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# Toward Impactful Scientific Research: Guidelines for the Dissemination of Research Findings

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## **Preface**

Participating in this study program has been a very fruitful learning experience for me, who have spent most of my time studying biosciences and carrying out research in the field of molecular biology. Through an inspiring series of lectures, the Industrial Management program, has provided me with a great opportunity to learn about corporate culture, the challenges faced by companies and how companies cope with these challenges through different approaches, such as better services. We were informed in the very beginning that the program is designed to be completed in one year, but is as demanding as a two-year Master's program, and as such, it would be very challenging. I, of course, did not realize the extent of this until I got fully engaged in it.

Special thanks to my instructor Dr. James Collins for his guidance and motivation during the completion process of this Thesis. Undoubtedly, I have enjoyed our informal meetings at Johto Café where we not only discussed studies but also other interesting topics.

Thanks are also due to Dr. Satu Teerikangas and Dr. Marjatta Huuhta (current and former head of the Industrial Management Program, respectively), as well as Zinaida Grabovskaia for their encouragement, feedback and thoughtful suggestions throughout the studies and for making this program very interesting.

Last but not least, I would like to thank my wife Saara and children Samara and Saad because without your extensive support, it would not have been possible to complete this study.

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<p>Today, universities and research institutes generate novel information and develop new technologies more rapidly than ever. Nevertheless, these organizations face major funding cuts, particularly in small countries such as Finland. One reason may be the ineffective dissemination of research outcomes to industrial audiences.</p> <p>Research dissemination refers to the creation, interpretation and transfer of knowledge between research institutes and an appropriate audience, which is extremely important for both parties. Successful dissemination may help leverage extra funds, and collaborative projects between research institutes and the industry may improve the quality of research.</p> <p>This study aims at examining the current dissemination activities in the field of agriculture. The collected data reveal difficulties in the process.</p> <p>The outcome of this study is a framework. The recommendations proposed in it aim at promoting fruitful relationships between research institutes and the industry. In addition, it may help them to adopt new methods and approaches to disseminating their findings effectively.</p>	
Keywords	Research, Research Dissemination, University-Industry Relationships

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## 1 Introduction

Resources in research laboratories are often limited, and researchers have to make contacts with private customers who can provide them. Generally these resources mean extra funds, but sometimes, especially when large companies are involved, they may include technical tools and materials or even human resources. To complete their public funding, researchers thus build relationships with the industry. Usually, the research themes studied during these academia-industry relationships are co-determined, but sometimes they are shaped according to the demands of the private partner. In health, researchers have adopted several approaches to build successful long-term relationships with the industry. In biological fields, such as agriculture, however, such relationships are either nonexistent or extremely limited. There is, then, a need in these fields to develop a framework so that laboratories, research centers and universities may be able to develop relations with industrial partners in the most satisfying and agreeable way.

In biological fields, such as Agricultural Sciences, the outcome of the research done by research institutions is often poorly communicated to industrial customers, even in cases where the new information might benefit the industry. These government-run institutions are generally not particularly customer- or service-oriented and their focus is typically on the research only. After publishing the results of one project, the institutions shift their focus onto the next project, provided that enough resources are available. This means that industries do not get to benefit from the research as much as they could. In other words, the commercial services that research institutes provide industrial customers with are insufficient. The direct funding from government authorities has been reduced significantly in recent years and research resources are becoming limited. However, these resources can be increased through the successful dissemination of research results to the industrial customers.

This thesis examines current research dissemination activities in the field of agriculture. In addition, it provides recommendations for the researchers and research institutes aimed at improving the dissemination of their research findings, especially to private customers and industry in a way that may help to generate extra funds.

## 1.1 Key Concepts

*Dissemination of research*, in the context of this thesis, refers to the transference of scientific findings to the appropriate audience. According to Wilson et al. (2010, p. 2), dissemination is a planned process during which research findings are delivered to a target audience via communication and active interactions. In literature, the phenomenon has been given several names, e.g. research dissemination, knowledge transfer, research into practice, and diffusion. Regardless of the differences in terminology, however, the idea remains the same. In this thesis, the term 'dissemination' has been chosen.

The *research institute* plays a vital role in the dissemination activity as new knowledge and information is generated there. It is also responsible for the proper dissemination of the new knowledge.

*Research*, in simple words, is a process of generating new knowledge. Even if the research theme is novel and the research carried out is outstanding, if the results are not disseminated properly, the research becomes worthless.

The *relationships between a research institute and industry* ensure that research findings are getting into practice. Trustful long-term collaborations between academia and industry ensure that research is disseminated properly and effectively. In fact, interactions between research organizations and industries have increased in recent years. One of the main aims of these collaborations is the transfer of new knowledge. As a by-product, the research institute may receive extra funds and be able to create new jobs and the industry may get new products.

## 1.2 Background

In recent years, university research funding has changed in many countries, including Finland. After the privatization of Finnish universities, funds from the government have gradually decreased, and universities have to depend on external, including industrial, funding to carry out their research activities. Furthermore, the government funds have not only been reduced, but are also allocated on the basis of performance.

Since the 20th century, decisions in Finnish universities have been made in a democratic manner, with an equal representation of students, teachers and professors alike. As a result of the privatization reform of 2009, Finnish universities are becoming more like

corporations. The idea behind privatization of Finnish universities is not only to compete in the newly emerging open market of human capital but also to generate income to run their operations.

In Finland, like many other countries, the academic worth of a university is measured in dissemination activities by the Ministry of Education. Research dissemination can be considered a basic function of the university, achieved in large part by presenting research outcomes in top level research journals and international conferences. Indeed, it is a classic way to rank a country's academic and research institutes. However, in university-industry relationships, it is becoming important for the industrial partners as well.

Another reason to focus on collaborations between research organizations and industry is enhancing competitiveness. A collaboration may provide the industry with an opportunity to benefit from an advanced technology combined with greater in-depth knowledge on up-to-date research. In addition, the research that cannot be carried out on the industry premises can be taken care of with minimum risk and at a low cost by universities. On the other hand, depending on the collaboration agreement, the university may be able to generate some money for itself through patents and technology transfer activities.

The concept of university-industry collaborations is not new. In 1980, the United States government passed the Bayh-Dole Act that enables universities, small businesses and not-for-profit organizations to control their intellectual property rights. This has encouraged research organizations to get extra funds by the active development and transfer of advanced technologies to private partners. The effect of the Act can be seen in an increase from 250 to over 2,000 of annual patents in government-funded research institutes. Since this piece of legislation, research institutes around the world have followed in the footsteps of the United States. To transfer knowledge, many countries have built their own technology transfer offices, the responsibilities of which include the commercialization and transfer of advanced knowledge, new ideas, concepts and techniques, and exciting innovations to various stakeholders (Gardner et al. 2010, p. 318). The efficient use of technology transfer activities can help universities to attract new private partners.

### 1.3 Research Objective and Outcome

Dissemination of the research findings is a key component of whole research process. However, currently there are several barriers in effective dissemination, particularly in



Agricultural Sciences. The current situation requires for a critical analysis of the factors which can influence the dissemination activity including successful academia-industry relationships.

The objective of this Thesis is, thus, to construct, based on the findings of this study, an overall best practice based operating model to help industries to benefit from academic research. The study aims at providing recommendations of key steps of improving academia-industry networks. The outcome of this Thesis is to come up with a proposal for a model for improving the dissemination of research results.

This Thesis consists of 7 sections. Section 1 outlines the study and introduces the problem, objective and outcome of this Thesis. Section 2 describes the research methodology used in this study and discusses the validity and reliability plan of this Thesis. Section 3 presents the current state analysis of the dissemination activity in agricultural sciences as well as in business research. Section 4 provides an overview of the findings from literature related to research dissemination, difficulties in dissemination activity and possible solutions to enhance the dissemination process. Section 5 presents the initial proposal for improving the dissemination activity in agricultural departments. Section 6 deals with the validation and improvement of the proposal built in section 5. Section 7 describes the findings this study and provides the summary of the Thesis.

## 2 Method and Material

This section explains the materials and methods used in this study and describes how data were collected and processed.

### 2.1 Research Approach

This study utilized a qualitative approach based on the literature review and data from the interviews performed.

The literature review not only provides an overview of past studies but also keep updated with current developments in the field of the study. Such a review can help a researcher in broadening his/her viewpoint because personal experiences, regardless of being valuable assets, do not form a sufficient basis for research work. It can help not only by providing new ideas and shaping a research hypothesis in the field of interest, but also in finding the areas where more research is needed. At the end of research, on the other hand, a literature review may provide tools for assessing the impact of the current study and help to develop new ideas for further research (Blaxter 2006: 100-101).

In this era of information technology, the amount of research information available is overwhelming and getting acquainted with all of it would require an ample amount of time. Hence, it is of extreme importance to focus on desirable readings from proper sources. Academic databases, such as EBSCO, and certain free search engines, such as Google scholar, are good tools for finding reliable information of interest.

Depending on availability and possibility, more than one method should be used to validate research results. The results of the current study are solely based on interviews conducted with several individuals from different fields.

An interview generally consists of pre-formulated questions. Adhering strictly to these questions is known as a structured interview. Showing flexibility during an interview, however, may help in coming up with new questions depending upon the replies of the interviewee. Such interviews are called semi-structured interviews. The interview can be recorded in different ways. The ideal way of saving the answers from an interview for later analysis is to record the interview as well as to take notes. Of course, the possibility of a voice recording depends on the interviewee's preference. Furthermore, depending on

the preference and availability of the interviewee, questions can sometimes be answered via email or phone, but interviews conducted face-to-face can often prove to be more fruitful (Blaxter 2006: 172-175).

## 2.2 Research Design

This study aims to formulate an organizing framework to promote research dissemination. A detailed research design of this study is presented in Figure 1. The figure shows the different steps with possible outcomes taken to complete this study as well as the different data collection stages.

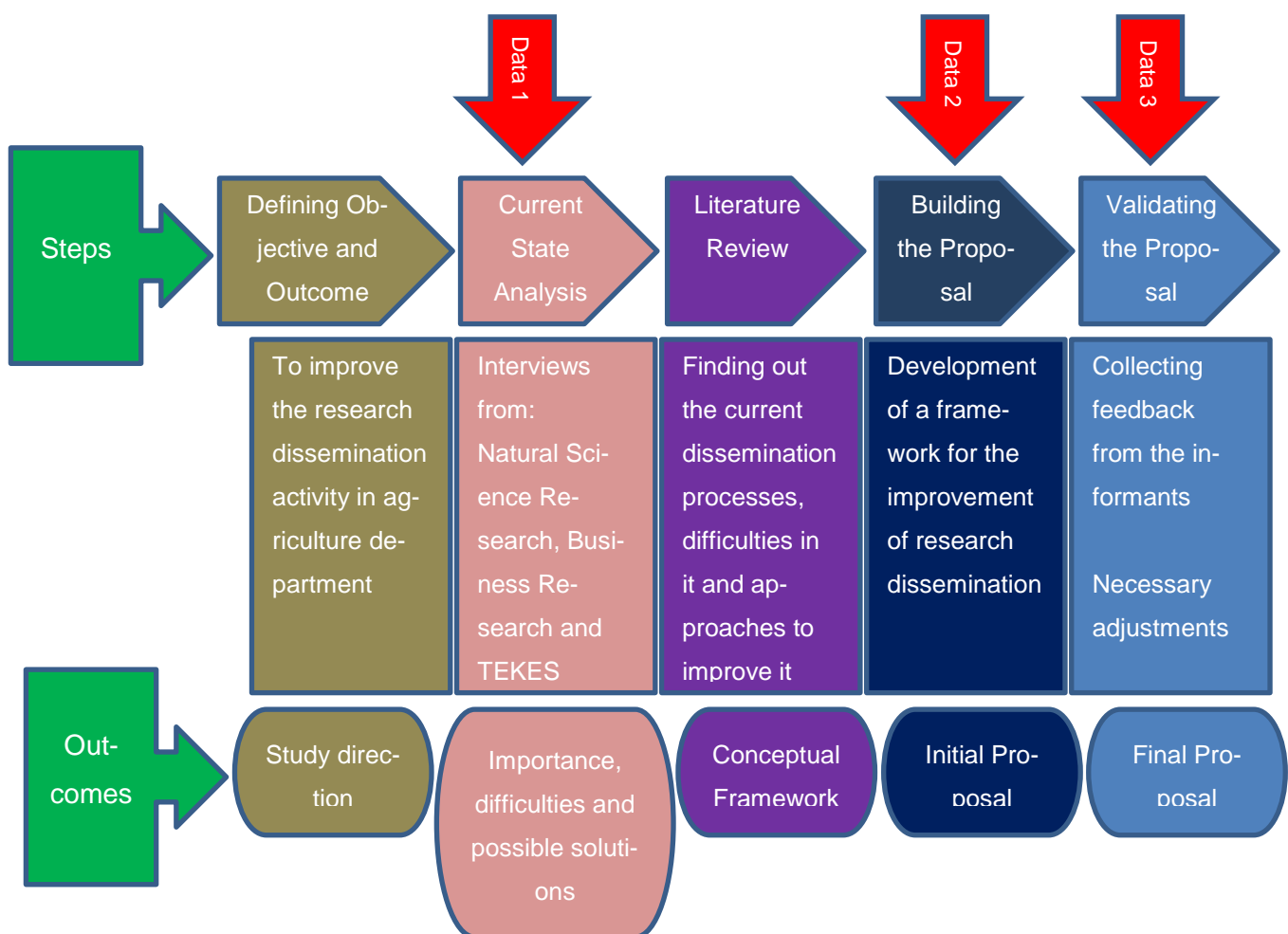


Figure 1. Research design for this Thesis

The first step of the design defines the objective of the current study. The next stage focuses on the exploration of current concepts, difficulties and possible solutions of successful research dissemination activity. This step will lead to the planning of a conceptual framework developed to highlight factors which can help to improve research dissemination. Then, data is collected through interviews. This is followed by the proposal building step, in which knowledge from literature and recommendations from the interviewees lay a foundation on to which a framework is developed. The last stage of the research design deals with the validation of the framework which is carried out through the feedback of the interviewees.

### 2.3 Data Collection and Analysis

This study is carried out in the academia hence the data collection is slightly different as compared to the data collection rounds carried out in a company. Due to this fact, in this Thesis, there are two rounds of data collections i.e., data on the current state and data for the validation of the proposal.

#### 2.3.1 Data collection 1, for the Current State Analysis

In this study, data was collected through interviews. The semi-structured interviews were conducted with four selected interviewees. Three of them work at Helsinki, Turku and Aalto universities, while one works at TEKES, (Teknologian kehittämiskeskus-Finnish Technology Agency) a funding agency. The details of the interviews and interviewees can be seen in Table 1.

Table 1. Data collection for current state analysis and building the proposal

Participant	Affiliation	Mode of interview	Date
Professor	Helsinki University	Face-to-Face meeting	August 24, 2015 60 minutes
Adjunct Professor	Turku University	email	March 07, 2016
Senior Business Advisor	TEKES	Face-to-Face meeting	April 05, 2016 30 minutes
Professor	Aalto University	Skype	May 14, 2016 45 minutes

Table 2. Questionnaire for data collection 1

Main Themes	Questions
Importance and difficulties in the research dissemination	<p>1. Is it important to disseminate the research findings? Why?</p> <p>2: Is the dissemination of research findings very difficult? Or How difficult it is to disseminate the research findings?</p> <p>3. Why is it so difficult?</p>
Current situation	<p>1. What is the current situation in your laboratory/unit and department?</p> <p>2. How do you evaluate the impact of your research?</p> <p>3. How do you rate your current research dissemination activities?</p> <p>4. Have you ever tried or planned dissemination related activities?</p> <p>5. What is the appropriate time or stage (of research) to disseminate the research findings?</p>
Improvement in the current situation	<p>1. How current situation can be improved?</p> <p>2. What do you think who needs to know about the research findings and/or who is most likely to be influenced or will influence others?</p> <p>3. What methods do you think will be useful to disseminate research findings? (Academic journals, Report to funders, Academic conferences, Workshops , Face to face meetings, Networking , Media interviews, Others)</p> <p>4. Should it be the part of the strategy of unit/department?</p>

Two of these interviews were conducted in one-to-one meetings, one was done through Skype while one was done via email. During the one-to-one interviews, answers were not only audio recorded but short notes were also taken by the interviewer. The field notes were transcribed from the recording source. The results of the interviews are interpreted and discussed in Section 3 and Section 5.

The questions were formulated in agreement with the objectives and aims of the current study. The interviews were analyzed to get an in-depth understanding of the current state of research dissemination. The outcome of the data collection is to map (a) the importance of and the difficulties in the dissemination activities, (b) the current research dissemination activity and (c) the possible ways to improve the current dissemination activities. Table 2 below shows the questions asked in data collection 1.

### 2.3.2 Data collection 3, for proposal validation

A second round of interviews was conducted for the validation of the proposal. Instead of asking specific questions, these interviews were more conversation-like. Table 3 shows the details of the experts who participated in the validation and improvement of the proposal.

Table 3. Data collection for validating the proposal

Participant (s)	Affiliation	Mode of interview	Date
Professor	Lappeenranta University	Skype	October 03, 2016 30 minutes
Chief Innovation Activist and Research Manager + two assistants	Aalto University	Face-to-Face meeting	October 11, 2016 45 minutes

Both of the interviewees mentioned in table 3 have extensive experience in research dissemination to private customers. Their valuable input was incorporated into the initial proposal which then leads to the final proposal.

## 2.4 Validity and Reliability Plan

For a qualitative study such as this Thesis, validity and reliability play a significant role in the clear understanding of a research approach.

According to Quinton and Smallbone (2006, 126-129), validity can be sub-categorized into internal and external validity.

It is the *internal validity* which assesses the credibility of qualitative research as it relates to extensive data collection methods (Quinton and Smallbone 2006, p. 128). Data triangulation by utilizing multiple sources of data collection can increase the internal validity (Yin 2003, p. 99). In a qualitative study, when the research sample is small, the *external validity* aspect is not a key element in assessing validity (Quinton and Smallbone 2006, p. 129).

The validity testing for this Thesis will be carried out by defining the research problem, objective and outcome at the start of the study. The Data in this study is mainly collected through interviews. The questionnaire is formulated to assess an overall situation of the current dissemination activity. The interviews are conducted in English and the data collected are presented in the same language. To enhance the validity, the interviews are audio recorded and carefully transcribed into field notes whenever it is possible. For the reason that this study used more than one data source (interviews, discussions, own observations), data triangulation is utilized.

To improve the validation of the results, the initial proposal is drafted by utilizing both current state analysis and existing knowledge. The proposed framework is sent back to all interviewees, and the framework is then updated according to the recommendations of the interviewees as, according to Huhta (2014, p. 9), having data checked by interviewees can enhance validity.

Reliability refers to the trustfulness, authenticity and productivity of the research when it is repeated by the same or different researchers. Whereas a solid research connection to existing knowledge can increase reliability, data triangulation can enhance the trustfulness of research (Huhta 2014, pp. 10-13; Golafshani 2003, p. 598). Likewise, the reliability of this study will be increased not only by utilizing different data sources (interviews, discussions, own observations) but also by connecting the current study to existing knowledge.

A repetition of the same questionnaire with new interviewees may be carried out to further validate current results. In the meantime, this study may pave the way for future research in the field of dissemination.



### 3 Current State Analysis

This section presents the answers of the four interviewees working in R & D departments in different institutes, each of whom has been involved in research dissemination at some stage during his or her professional career. The questions asked during the interview are listed in Table 2. The answers are divided into three sections: the importance of and the difficulties related to research dissemination, the current situation in the unit regarding research dissemination, and possibilities for improvement.

#### 3.1 Importance

All the interviewees agreed that it is very important to disseminate research outcomes because it is one form of providing the justification of the work which is done. Yet, according to them, it is generally rather difficult to succeed in the disseminating process as it requires high-level results as well as high-quality writing and interpretation of the research outcomes. Indeed, it requires a lot of work, time and resources, particularly funds, which are always limited. According to interviewees from the natural science department, due to time pressure, it is often very difficult for researchers to maintain a balance between writing popular articles and producing quality research publications, and it follows that it is a tough task to work on the dissemination of research results to private customers.

In natural sciences, interviewees explained that the possibilities for dissemination also depend on the kind of research carried out and its target audience. Some research topics are better suited for dissemination than others. E.g. a study about how a virus interacts with plants may be more applicable to dissemination whereas a study about developing resistant varieties against a virus might not have enough information to disseminate. In other words, in agriculture, the final outcome or end product might be more applicable to dissemination than the research process utilized in the data generation.

As compared to the Helsinki University, the Aalto University School of Business (the interviews were conducted from the researchers of these two universities) is smaller, yet it produces better quality research papers. Naturally, the Aalto University School of Business is different from the natural sciences departments. It follows different dissemination

criteria, such as managerial relevance. Managerial relevance means that academic researchers in the business field benefit from communicating effectively with managers if they wish to become successful marketing practitioners or consultants. Through this communicative process, they passively participate in dissemination activities other than publishing in peer reviewed journals. Table 3 presents a question related to the importance of and the difficulties in dissemination and the answers provided in the interviews.

Question	“Why it is important to disseminate research findings and what are the difficulties in it?”
<b>Importance</b>	<p>“Yes but it depends how and to whom.”(I1)</p> <p>“The work is done to be disseminated.”(I2)</p> <p>“Yes, of course but somehow it is not happening actively.”(I3)</p> <p>“It is an objective requirement to disseminate your findings.”(I4)</p>
<b>Difficulties</b>	<p>“It is difficult for the high quality of work that is required--doing high quality results requires a lot of time and work--i.e. funding.”(I1)</p> <p>“Lack of involvement from non-scientific community.”(I2)</p> <p>“It is quite tough task being a researcher to have some kind of balance between writing popular articles and producing quality research publications.”(I3)</p> <p>“Researchers from the university and people from the industry are living in separate kind of blocks and not coming close to each other.”(I4)</p>

Table 4. Interviewees’ views on the importance of and difficulties in research dissemination. I1, I2, I3 and I4 stand for Interviewees 1, 2, 3 and 4 respectively as mentioned in the material and method section.

As seen in the Table 4, one big problem in the dissemination of research results to private customers is the lack of interaction between the two parties, as if researchers from the

academia and the industry representatives are living in separate silos. In agricultural sciences, it is often very difficult to convey a message to farmers, for instance, or to convince them of new research outcomes if they have not been involved since an early stage of the project. In technical or business research fields, on the other hand, it is quite common and practical for researchers to build their own startup company after having conceived a nice idea through research instead of opting for the dissemination of the results.

### 3.2 The Current Situation

From the answers of the interviewees, it seems that currently, dissemination activities in natural sciences are less productive than at the Aalto University School of Business. The main reason given by the informants from the field of natural sciences was the insufficient quantity of funding. In addition, dissemination, according to the natural science researchers, tends to consist in publishing in high-impact journals, whereas at the business school, other approaches are used as well. Indeed, publishing in high-impact peer-reviewed journals requires high-quality research, which can only be done with sufficient resources. In business schools, on the other hand, there tends to be no laboratory work requiring large amounts of funds in order to be successfully carried out. Furthermore, business schools tend to be more in touch with industries, which may make it easier for them to arrange dissemination activities. According to the interviewee, in the Aalto University School of Business, dissemination plays a vital role in career progress. The school utilizes many different ways to enhance the dissemination activity: the number of media hits reveals how many times you and your work were visible on the radio, on television, in the newspapers etc.; a performance management system includes counting the number of days which faculty members spend in executive education; Professors of practice are PhDs with strong managerial experience that translate business knowledge into easily disseminatable knowledge or research information into managerial language. The school then publishes this information in the form of books or small booklets. On the other hand, there are tendencies that pull in other directions as well: assistant professors are often advised to publish only in peer-reviewed journals because they may not get 10 years' tenure that would allow them enough to get their research published in the form of a book or a chapter in a book.

<b>Question</b>	<b>“What is the current research dissemination situation?”</b>
<b>Current Situation</b>	<p>“In my own group, we did maintain a fairly steady rate of annual publishing of 2 good papers per year as long as the funding was running. Now we are having quite slim years – and struggling to finish up some papers that are still in the pipeline.” (I2)</p> <p>“Very active dissemination through different pathways.” (I4)</p>
<b>Dissemination-related Activities</b>	<p>“Publishing in local journals and newspapers.” (I1)</p> <p>“Networking and different new (Social) media for the educational project.” (I2)</p> <p>“Fairs” (I3)</p> <p>“Performance Management System, media hits, professors of practice.” (I4)</p>
<b>Suitable Time for Dissemination</b>	<p>“It depends on the kind of information.” (I1)</p> <p>“As soon as possible.” (I2)</p> <p>“If you wait for too long, it may lead to wastage of resources.” (I3)</p> <p>“Disseminate during the research.” (I4)</p>

Table 5. Interviewees’ answers on current dissemination activities. I1, I2, I3 and I4 stand for Interviewees 1, 2, 3 and 4 respectively as mentioned in the material and method section.

As shown in Table 5, the different units represented by the four interviewees utilize different means for disseminating their research outputs. The informants agree that research results should be disseminated, but it appears that the right time may depend upon the information to be disseminated. Some technologies or end products, for instance, may require patenting before information can be released to the public. Deciding a suitable time may, then, prove to be challenging. If the research is at a very early stage, it may be hard for the researchers to provide concrete information, while after publication,

it may already be too late as the information has already become public property. Additionally, patents only last a maximum of 20 years, after which the information within then becomes free for anyone to use.

Researchers from the agriculture department may have fear of losing their research if they disseminate too early. According to one interviewee, companies are always willing to have and ready to pay if there is something novel and then sign a confidentially agreement with them. It should be very easy to sign such kind of confidentially agreement as companies are doing it all the time. According to the interviewee from the business side, industries like to be updated with current information. Companies also seem to expect quicker delivery during the research process as compared to the standard academic publishing activity, and if the research unit waits too long or until the project completes to share information with the industry, it is quite plausible that the industry will not be interested anymore. The whole process may, then, have become a waste of resources as industries would like to gain access to the information early enough to have ample time to adjust to the new information and ideas. Similarly to the industrial opinion, according to the interviewees from the business field, dissemination should occur throughout the project through meetings and seminars. To this effect, funding agencies may ask from the funding applicants to provide a communication plan and plans for research dissemination from the conception of the research idea or proposal. This process of constant dissemination is sometimes called co-production of research because it entails researchers providing information at every stage of the project. It is important to note that in this process, research result are not only disseminated to show one's progress, but also because it may help to obtain extra funds for further research.

### 3.3 Improvement to Current Dissemination Activities

According to the answers given by the interviewees, it seems that it is very difficult to change the status quo if you are part of a small group. One way to improve dissemination, suggested by one interviewee, maybe to spread research findings to key persons and to the important authorities in each field and of course to all colleagues working with the same topic. The interviewees suggested that long-term relationships between universities and private customers can help in active dissemination. In the beginning of relationships, it is usually very hard to build trust. Farmers and horticulturists have their routine seminars. According to one interviewee, the researchers who are interested in

building the relationships with farmers, for instance, can go and attend these seminars. During these seminars, personal relationships and trust can be built between attendants. Moreover, these meetings contain very useful information about the current situation of the work and future needs. A better understanding of the needs of the farming community can help researchers to deliver their message in a better way. After having built trust in each other, it may be easier to present a potential threat or problem to the farmers and the companies, which may encourage them to try to acquire money from the government together with the researchers in order to defeat the issue.

Another important tool used to spread information today is social media. It allows information to be shared very rapidly. Furthermore, private customers can be engaged more actively. Social media is, then, a platform from which researchers and research institutes might benefit, and having a well-thought-of social media strategy could be an important first step.

All the informants agreed that all possible methods e.g. academic journals, conferences, workshops, one-to-one meetings, networking, fairs, media interviews, alumni events, should be utilized to disseminate research findings.

After the 2009 Universities Act, the situation has changed drastically and after the act, according to one interviewee, there has been a huge change as to how information is shared with the internet, social media in particular, having become an essential part of information sharing. As mentioned by the interviewee from the Helsinki university, Agricultural knowledge is spread by e.g. Luonnontieteilijä, but this information is usually rather general and not necessarily based on up-to-date research. According to this interview, university researchers, however, are always happy and pleased to work for the popularity of the university and one way of doing this is through disseminating the research outcome that could be achieved through quality publications.

<b>Question</b>	<b>“How to improve the current situation?”</b>
<b>Methods</b>	“Depending on the situation.” (I1, I2, I3, I4)
<b>Part of strategy</b>	<p>“Yes” (I1)</p> <p>“It should be part of the strategy of the unit to spend some time in this direction.” (I2)</p> <p>“Can be” (I3)</p> <p>“Depending on the school.” (I4)</p>

Table 6. Interviewees' answers on improving dissemination activities. I1, I2, I3 and I4 stand for Interviewees 1, 2, 3 and 4 respectively as mentioned in the material and method section.

The interviewee from the Aalto University School of Business mentioned that Business schools are usually very active in helping to build new companies. This way, research findings can move into the practical realm. If other universities, too, encouraged the founding of new companies, they might be able to utilize this channel to improve their dissemination activities. Moreover, by having built-in into career systems a requirement of managerial relevance, people will take it more serious. In addition to other ways of forming ties with the industry, the Aalto University School of Business invests a lot of efforts in alumni working in companies. They are often asked to appear as guest lecturers at the School. Furthermore, they are encouraged to take Master's students as trainees in a win-win scenario: the company gets work done by the student, the student gets paid by the company, and the program gets funding as its student graduates (University departments in Finland usually get funded based on the number of graduates, not attendees). In addition, the alumni are part of steering groups of Master's students, which means that they come back physically as well. This way, people working in the field do not need research journals since Master's students can keep them updated on academic research.

The interviewees from natural sciences agreed that dissemination activities should be part of the strategy (Table 6) of the department and that researchers should spend some time in this direction e.g. by writing articles in newspapers or local popular journals. In reality, however, small research groups are often poorly supported by the departments, and there is usually no dissemination strategy. Furthermore, according to interviewees from TEKES and agricultural sciences, it seems that there is currently a gap between universities and industries which, according to these interviewees, might be closed through informal meetings. However, this may not be easy. Natural sciences do differ from the economic sciences, especially when it comes to building relationships between the industry and a research institute. In business schools like the Aalto University School of Business the collaboration and interaction between universities and companies is encouraged and well received.

In technical and business fields, it is possible to attract the industry by presenting a novel or practical idea. In that case, an industrial partner or even group of industrial partners might be willing to pay some money toward carrying out the research. In the field of agriculture, according to one interviewee, however, it is close to impossible to “sell” an idea as it is usually very difficult to convince a private customer of the business potential of a research idea. E.g. a farmer deals with his/her problems on daily basis, and may need a solution against a certain problem today. Even a good research proposal or idea, on the other hand, usually takes 3-5 years to become a solution, and by then, it is usually too late for the private customer or for the industry. Moreover, there is also a possibility that a solution may never be found, or that one is found that is not practically feasible. All this makes it difficult, or close to impossible, to “sell an idea” in agriculture.



## 4 Existing Knowledge

This section examines different aspects of research dissemination. The chapter covers themes of research dissemination (the difficulties in it and the impact of it on research organizations, university-industry relationships, and the role of these interactions in research innovation). Towards the end, this chapter also covers the current public funding scenario. Additionally, a conceptual framework detailing the elements involved is constructed.

### 4.1 Research Dissemination

For any university, research is the key. The worth of an academic institution is often measured by the number of masters and doctors graduated and the amount of research produced and then disseminated through published articles and work presented in international conferences. A high scientific worth can not only provide a position among the world's most esteemed academic institutes but also give a university scientific backup when looking for a collaboration with industry (Karvonen et al. 2012, p. 169).

Generally, dissemination is perceived as the spread and distribution of new research findings and ideas to the public via the publishing of these findings in scientific journals, with the belief that the new research and recommendations will reach the potential user, e.g. industry. However, research findings will not have a real impact on practical use by merely being published in a journal, and the lack of suitable dissemination practices is the main reason behind the lack of industry–university collaborations.

#### ***New Definition of dissemination***

According to Scullion (2002, p. 70), “dissemination is therefore seen as a process that aims to ensure that key messages are conveyed to specified groups via a wide range of methods such that it results in some reaction, some impact or implementation.” With a little modification, it could be said that research dissemination is often a process that aims to ensure that key messages are conveyed to specified groups especially to private customers to generate extra funds, via a wide range of methods such that it results in some reaction, some impact or implementation.

Anderson et al (1999, p. 1012-1015) argue that dissemination activity involves awareness, communication and interaction. All these three processes are interconnected, and

a researcher or research institute should pay attention to the industry needs and preferences while planning a project. Likewise, the interpretation of the research results and the mode of delivering the information are very important for proper dissemination. Long presentations, either oral or written, with too many technical details may appear boring to the industry representatives, so the proper amount and level of information, presented in an exciting and colorful mode, may enhance the dissemination process. In addition, sometimes the venue where the information is delivered (industry vs. research organization) can play a vital role in dissemination activities.

It is not uncommon for researchers to be unaware of the importance of dissemination. As a result, we often lack the skills and knowledge needed to properly disseminate our research. As researchers, we are often confined to the research lab and lack information about the target industry and its needs. Furthermore, there is pressure to publish findings in high-impact journals in as little time as possible, which often leaves researchers with little time to spread their research findings to the industry. It is important to transform research findings into simple messages, highlighting the advantages and recommendations that match the industry demands and focused on practical application and acceptance. Researchers who are trained with dissemination techniques and skills are able to present their research findings in a deliverable message form. Moreover, researchers with good communication skills can convey their message in a better way. Of course, while focusing on dissemination activities, we cannot forego the quality of research, which is another important aspect for a company looking for the right partner.

When presenting a proposal to an industrial partner, research institute can avoid highly technical research language as not everyone in the industry has the same research background. Moreover, universities and research institutes should reserve a part of their budget for dissemination. Currently, research institutes do not seem to have separate funds for activities other than publishing in scientific journals.

Researchers may find several possible dissemination methods and can choose among those which are more suitable for the industry with which they hope to collaborate. Furthermore, using multiple methods as compared to focusing on only one method can help in creating better dissemination. However, the selection of an appropriate method can be a challenging task. Sometimes a poster presentation is preferred over a conference paper, while other times a conference paper presented in a local conference or fair is more acknowledged as compared to a short review or report of the research findings

presented to private customer. In addition, the same information may require different methods of dissemination depending on the receiver, since sometimes industry personnel may require a technical report on research findings while the policy makers may require a report written according to a prescribed style. Generally, however, presenting a short summary highlighting the main points in addition to meeting people informally in a local conference may help not only in delivering the message but also in making collaborations.

There are many elements which can enhance dissemination activity. Some of these are discussed below.

#### 4.1.1 Factors promoting dissemination

There are four elements that can play an important role in dissemination activity (Anderson et al. 1999, p. 1012-1015; Majdzadeh et al. 2008, p. 272-275; Scullion 2002, p. 68-75).

The first of these four elements is the research institute because it is quite possible that source of the message sometimes may become more significant than the message itself. It is understandable that an industry will pay more attention to information that is provided by a trustworthy and well-known research institute. Likewise, if representatives of an industrial partner have been part of a university or research institute in the past, they may have more trust in that institute than in others. In addition, a professional affiliation with a more prestigious institution may make an institution appear more trustworthy, which in turn may help in the dissemination of its research results.

The second element that can help in promoting the dissemination is the research. The response of different industries toward the same research may vary as each industry will look for things which will best suit their objective. By focusing the research in directions which may appeal an industry, a research institute can facilitate collaborations. Indeed, thorough information regarding current research available in and an assessment of future research needs of an industry will lay the path for focused research. Generally, industrial partner seem to prefer research institutes where research is broad but very focused, specific and action-oriented with immediate application. Of course, it is not always a prerequisite for an industrial partner that the institute carry out specific research, as sometimes broader research can be compatible with its demands and expectations.

Nevertheless, it is important to note that the quality or focus of research alone is not enough for wide dissemination to take place. No matter how novel or groundbreaking, information may go unnoticed or be misinterpreted by those outside the research world if it is not presented in the right way.

Thirdly, the target group also plays a vital role in dissemination activity. In this era of information technology, any industry can easily access many kinds of information and can focus on finding high quality research information in accordance to their objectives. Understanding what kind of information an industry is looking for and for what purpose can help research institutes in delivering their research-based information to the industry. Most industrial partners will have made ties with research institutes in the past, and knowing about this history can help research institutes in developing networks with private partners. It may be especially important to pay attention to the companies that have never collaborated with research organizations before as it may indicate that they are skeptical of the use of academic research and may be hard to work with later on. After all, the background knowledge and enthusiasm of the industry personnel can have huge impact on the industry–university relationship. Thus, it is of extreme importance to have thorough information regarding potential industrial partners, such as the size of the industry, their research activities, their past involvement in research dissemination activities, their expectations of the research institute and the background of the persons involved in the collaboration. It is only after this that you begin to formulate the research agenda in a way that it suits the potential industrial partner.

The last important factor in promoting the dissemination activity is the relationships between a research institute and an industry. Good relationships between a research institute and the industry are very important. One crucial factor involved in these relationships is the trust between the two partners. It takes time to build trust in each other, but by continuously working together, the relationship can be strengthened. Moreover, involving industrial partners at a very early stage of the research project, preferably in the form of frequent, face-to-face contact, can facilitate the building of trust, as can discussing and agreeing upon the expected research outcomes. In addition, contact from an early stage can help both the research institute and the industrial partner to assign responsibilities and resources in the best way possible.

From the universities' point of view, there is often a lack of appropriate interactions between universities and industries. By enhancing the motivation for researchers to be in active interaction with the industry while conducting their research can help in building good relationships.

#### 4.1.2 The Impact of Effective Dissemination

Using dissemination activity effectively, academia can attract new private partners. According to Gardner et al. (2010, p. 23-26), the effectiveness of knowledge transfer can be measured by six different factors: input and output, quality and quantity, and subjectivity and objectivity.

Input, according to the authors (Gardner et al. 2010), refers to activities, such as inventions. Output, on the other hand, evaluates the technology transfer offices effort. The authors suggest it is thus more important to measure output than input.

According to Gardner et al. (2010), it is currently difficult to differentiate between quality and quantity. Public research organizations with a large amount of financial as well as human resources are able to produce a large number of results and disseminate them widely. This often means that they are considered more successful as compared to small spin offs, despite the fact these spin offs may generate high-quality benefits for the society.

The measurement of objectivity can play an important role in the effectiveness of knowledge transfer. It can provide technology transfer offices an opportunity to compare their results from year to year as well with those of competing organizations.

#### 4.1.3 The Societal Impacts of Public Research Organizations

The societal impact refers to the actions of different organizations on the surrounding community or society (Woodson, 2013). Assessment of the societal impacts of public research organizations (PRO), such as universities, research centers etc., can help PROs to identify strengths and weaknesses in their performance. In addition, it can help them to focus on their key competences.

Lähteenmäki-Smith et al. (2006, p. 69-74) have studied the societal impact of public research organizations. They name three perspectives that, in their view, can have an impact on the societal impact of a PRO: *objectives*, *indicators* and *learning*. Each of these factors can enhance organizational performance.

From an organizational perspective, the identification of objectives in impact assessment is important because it not only helps an organization to discover its customer needs, which may, in turn, lead the organization to identify future policy options but also enables PROs to make the right strategic choices by utilizing the core of their expertise. Likewise it helps PROs in meeting their research goals and engages them in identifying the right innovation processes as well as it allows PROs to identify their main customers and to build close relationships with them. (Lähteenmäki-Smith et al. 2006, p. 70-71.)

Indicators are mainly related to innovation processes. Their assessment allows PROs to select the indicators that have the impacts most desired by their customers. Carefully selected indicators enable the PROs to choose projects that are of particular interest to key customers and the society in general and to discontinue projects which are unrealistic and irrelevant or whose goals are impossible to achieve. These indicators help in transparent distribution of research and development (R & D) resources and in developing relationships with other public bodies, such as financing organizations and Ministries. (Lähteenmäki-Smith et al. 2006, p. 72-73.)

Learning, from a PRO's perspective, means motivation for both internal and external learning. A societal assessment supports learning within the PROs. It helps them, e.g. in conducting transparent operations inside the organization and the implementation of an assessment system for the whole organization – not just the management, thus helping the organization to develop its expertise and to increase competence.

Learning not only helps in assigning roles to different actors such as PROs and ministries but also helps in developing the cooperation between these actors. Likewise it enables in getting expert knowledge based on the cumulative information of individual organizations from Ministries and policy organizations, which in turn can help an organization in decision-making and policy development. (Lähteenmäki-Smith et al. 2006, p. 73-74.)

To attract a larger number of private customers, according to Lähteenmäki-Smith et al. (2006, p. 69-70) PROs may need to improve their strategic competence and methodological practice. If the situation is assessed and focus is then given to improving the areas that have been identified as lacking, the process may help PROs in developing long-term relationships with customers. Of course, there are challenges, too, in such impact assessment studies. For instance, it may be difficult for a PRO to maintain a balance between academic and customer orientation.

PROs can generate positive impacts through networks with different partners. They can, for instance, play a very important role in developing policy initiatives. Having clear objectives can allow PROs to work better with actors involved in devising policies. Moreover, by having a fair assessment of the strengths and weaknesses of the organization and a focus on key competences, PROs can attract more customers and stakeholders. Likewise, through the right indicators, PROs can develop good relationships with Ministries and other key actors in the sector. Because PROs are a source of continuous knowledge creation, they can play a vital role in boosting future innovation (Lähteenmäki-Smith et al. 2006, p. 70-74.). This all can lead to generate more funds.

Any research process starts with idea generation which then leads to a project theme to answer the specific research challenges. In university-industry relationships, the basic idea can come from the research institute or the industry (Karvonen et al. 2012, p. 169) and can sometimes lead to important innovations in the field.

Researchers are well aware of the importance of research dissemination, yet the dissemination process is usually not very active. There can be several possible reasons behind this low activity, e.g. researchers may not have enough dissemination skills or may lack the suitable methodology to do it. However, it is not only researchers who are involved in and can enhance the dissemination activity. Departments and universities are also important players in the dissemination of research results. Universities would benefit from realizing their impact on dissemination. The path to innovations is mostly laid by suitable interactions and dissemination activities from the academia to the industry.

## 4.2 Academia and Industrial Innovation

The role of Universities in industrial innovation is important as they are a source of scientific and technological knowledge. Thus, links between PROs and industrial organizations are crucial to generating innovations. Factors such as legislative environments, public–industry research partnerships, initiatives offered by governments to promote research and pressure on universities to improve national economic competitiveness have also encouraged universities to collaborate with industries. In turn, such collaborations have helped universities to generate new resources e.g. by getting a considerable amount of funds from the industry or by generating revenues from licensing and patents (Perkmann and Walsh 2007, p. 60.).

Research organizations not only can play important role in providing information and knowledge but can also help in building good networkers. Traditionally, research organizations have been involved in solving individual problems, emerging from the needs of their individual customers. But recently the research organizations have become more proactive and try to improve the innovation processes as a whole as well as different phases within these processes (Lähteenmäki-Smith et al. 2006, p. 72-73).

### 4.2.1 The Role of University–Industry Relationships in Innovation

Relationships between academia and industry are widespread and of great value for both the industrial and the academic participants. Studies suggests that collaborations between industry and life sciences or other disciplines are extremely common. It is noteworthy, however, that the commercial sector generally gets a bigger reward – in the form of innovations – through these relationships than universities do, although PROs can sometimes be benefited through activities such as intellectual property transfer (e.g. licensing) (Perkmann and Walsh 2007, p. 271).

According to Perkmann and Walsh (2007, p. 272), although there is no detailed information available on the industry's relationships, such as research partnerships or research services, with universities, evidence suggests that companies consider these relationships to be of importance throughout the entire innovation process. Furthermore, industrial partners often expect to gain further learning and capacity building rather than just tangible outcomes through these collaborative activities, and are usually less interested in 'ready-made,' university-generated technology.



Several research papers have been published covering different aspects of university–industry interactions, including the impact of expenses justifying this collaborative academic research (Karvonen et al. 2012, p. 165). One of these studies, namely Leydesdorff and Etzkowitz, 1996, presents the Triple Helix Model.

#### 4.2.2 The Triple Helix model

The Triple Helix (TH) model was given by Leydesdorff and Etzkowitz (1996). It was created by combining two theories given by Etzkowitz (1994) and Leydesdorff (1995). Etzkowitz had written about university–industry relationship, while Leydesdorff had been more interested in communication networks. Since its emergence, the TH model has been adopted in many countries (Leydesdorff 2012).

The model is based on the assumption that in a knowledge-based society, it is hard to mark the gray area between the public and the private sectors, science and technology, and university and industry interactions. For example, according to Etzkowitz and Leydesdorff (1996), patents provide legal protection for intellectual property rights. However, they also serve as output indicators for science and technology, and, on the other hand, as input indicators for the economy. It follows that different elements, such as patents, can move in a three dimensional pathway of industry, government and academia. This three dimensional interaction is important for the possible economic, political and social change. Nevertheless, most universities are not very well equipped for patenting, especially patenting in order to gain profit.

From the perspective of research dissemination, the TH model suggests that universities can play a critical part in creating innovations in knowledge-based societies. In order to play their part, however, researchers need to take their scientific outputs to the industry, while at the same time researchers working in industry need to be up-date with scientific developments (Etzkowitz and Leydesdorff 2000, p. 111-112; 118-119).

The impact of successful university–industry collaborations on innovations is of a great deal. One way to enable research institutions to focus their efforts on the right areas is a good practice model, which should include all the important factors which can have a significant impact on the success of collaborative projects.

### 4.3 University-Industry Relationships

Since the beginning of the 21<sup>st</sup> century, the development of university–industry relationships and processes involved in these relationships has been area of interest for researchers. Currently, these collaborations are seen as part of the innovation system. According to Metcalfe (1987), an innovation system is “a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies”.

Despite the fact that many industries may regard universities as a mere source of basic knowledge and highly trained students, they are still valuable to the industry as the industrial partners often lack the expertise, knowledge and resources which the academic partner is able to provide. Following a university–industry relationships, fresh graduates who have been part of the collaboration have a good chance of being hired by the industry. Not only they can be valuable assets to the industry due to their research, training and prior university experience and the fact that the industrial partner has learned to trust them, but they can also be helpful in facilitating university–industry relationships in the future. Such continuous relationships between the industry and a university can help companies in generating new technologies, products and processes as well as more patents and licenses (Santoro and Betts 2002, p. 42).

The relationships between research organizations and the industry depend on mutual benefits. They are based on the exchange of specialized skills: the industry looks for research organizations with specific skills that will benefit it the most. It is, then, my view that research units should adopt a specialized research theme and have a number of researchers work on it. It not only helps in getting their findings published in peer reviewed journals but also in building strong relationships with private partners. On the contrary, when a research organization does not have an explicit theme, it may get diverse problems to solve. Its contracts with private partners, in this situation, may be short-term, bringing in less funding regardless of the huge effort researchers have to make to get the answers. In addition, these short-term contracts may make it difficult for the research organization to focus on a specific problem, and instead, they may end up studying a variety of topics. Furthermore, the researchers may not have enough time to publish their findings, and even if they manage to do it, the publications may cover a variety of themes. This may result in a situation where the PRO might not be able to

attain a specialized recognition, which is essential for good industry partnerships (Joly and Mangematin 1996, p. 908-910).

#### 4.3.1 Forms of Research University–Industry Relationships

University–industry relationships can be built either as research partnerships or as research services. It is noteworthy that the two types of collaborative relationship are often practiced simultaneously. It should also be noted, however, that different institutions may classify the same collaborative interactions in different ways.

Research partnerships, also known as sponsored research, are designed for collaborative research activities. In such relationships, researchers expect to get high quality research outcomes leading to high quality academic publications. The industrial partner, on the other hand, expects to get hands on some advanced technology.

These collaborative research arrangements can range from small-scale to large-scale strategic partnerships with hundreds of industrial members. Generally, however, the projects initiated through these partnerships are rather small and managed by individual university researchers or research groups. The level of industrial involvement in these projects can also vary, from funding and guiding research to bench-level co-operative work (Perkmann and Walsh 2007, p. 268-270.).

In research services, the industrial clients pay to the researcher or research groups to complete a specific assignment or service with little academic freedom as compared to research partnerships. In contrast with research partnerships, research services are, then, usually more controlled by industrial partners. During research service, although, it is usually less likely that research findings are published in academic journals. However, universities may be benefited by gaining access to technological advancements made within the company.

Research services include contract research and academic consulting. The boundaries between contract research and consulting are generally inseparable. Consulting exploits existing expertise available to the academic partner, while in contract research, the private partner demands the academic researcher to work on a specific, previously un-researched problem. (Perkmann and Walsh 2007, p. 270-271.).

Santoro and Betts (2002, p. 42) explain that in the past, the relationships between the industry and a university consisted in sponsoring instead of real interactions. In these sponsored relationships, the industrial partner would get solutions to specific problems by providing funds and other resources required to find the answers. In recent years, however, a shift in university–industry relationships has been observed. Now, these relationships tend to be relationships of two partners, rather than a sponsor and a sponsored party.

#### 4.3.2 Role of Laboratory Type and University–Industry Relationships

Different research institutes and research laboratories have a particular scientific and technological production. Based on its specificity, a research laboratory prefers a specific relationship between the research institute and the industry and follow a certain logic in choosing a partner.

Research laboratories can be categorized into types according to the way they operate. Based on their findings from the plant breeding industry and the biochemical sector industry, Joly and Mangematin (1996, p. 910-913) have divided laboratories into three categories: research centers for the profession, designers of generic tools and methods and basic and specialized laboratories.

Research centers for the profession are laboratories with multilateral contracts that work with small and medium-sized industries. These research centers have weak independence when it comes to the research themes because these are determined according to the needs of the industry. Generally, a researcher or a small team of researchers work on a specific problem. The private partner's contribution for the funds is not very high, and research centers largely get their funds from state and regional and sometimes EU subsidies. The researchers working in this kind of research centers are not very keen on publishing their work in peer reviewed journals. Instead, they prefer to publish their work, usually based on applied research, in technical journals (Joly and Mangematin 1996, p. 912).

Designers of generic tools and methods consists of larger research centers. They are focused on fundamental research. The researchers working at these research centers create value by developing generic tools for the industry and by publishing their work in peer reviewed journals (Joly and Mangematin 1996, p. 912).

Basic and specialized laboratories are generally focused on fundamental research and make bilateral contracts. The researchers are grouped into teams and work on well-defined research themes. Their work is valued through publishing peer-reviewed articles. The laboratories usually focus on just one or two themes, becoming specialized in that topic. The industry may, then, benefit from this expertise in order to solve a specific problem. Relationships between these laboratories and the industry are generally long term. Sometimes, however, they are also affected by conflicts related to the publishing of research findings, as there may be disagreement between the industry and the researchers as to who owns the rights to the work performed by the researchers and funded by the industry. In addition, the financial stability of these centers depends heavily on external funding from the industry, and research work can often be affected by interruptions in the funding (Joly and Mangematin 1996, p. 912-13).

According to Joly and Mangematin (1996, p. 908-910), production of basic research knowledge has a strong tendency to form contracts with private industry, and private funding (excluding salaries) can represent as much as 50 % of total research funds available. Of course, the amount of private funding received often depends on the recognition and reputation of the public research organization. In other words, a PRO which is well recognized in the scientific community through published scientific work may have more negotiating power as compared to PROs with a less high reputation.

#### 4.3.3 The Management of University–Industry Relationships

Based on their multi-case research findings, Barnes et al. (2002) have proposed a practice model which can help in managing successful collaborations between a university and the industry. The model consists of six major themes or key areas presented below: A good model should include a method to evaluate the new partner. The partner evaluation can not only help to find out if partners understand the research direction and are committed to achieving the common research goal by providing adequate resources but also can help a project manager in managing an effective and successful new collaboration. It is useful to acquire information regarding a new partner's collaborative experiences, way of operating and their perception of their role in a collaboration. The evaluation may also provide an insight into the intended contributions from the new industrial partner (Barnes et al. 2002, p. 276-77).

Careful planning of a project and monitoring the progress of this project plays very important role in managing university-industry relationships. Due to competitive commercial environments, industries tend to face time pressures and establish deadlines on projects. In research institutes, on the other hand, sound and correct conclusions are ideally drawn after thorough research regardless of time scales. Because of this, industrial partners may consider academic institutions to be slow movers. This kind of perception may lead to the failure of a collaboration. Through better management practices, such as the setting of objectives and the regular monitoring of progress, this misperception may be avoided. In addition, effective communication plays an important role in avoiding misunderstandings. Of course, high quality project managers should be hired to run the collaboration because without an effective senior management, the lower level of management may not provide the required commitment for a collaborative project (Barnes et al. 2002, p. 277).

Trust can be regarded as one of the most important factors in successful university-industry collaborations. Factors such as prior experience of working together play an important role in building trust. To encourage trust among new partners, Barnes et al (2002) recommend that university-industry collaborations start with smaller projects that not only are easy to manage but also pose fewer risks. Moreover, they provide opportunities for one-to-one contacts which further encourage trust building by treating all partners equally, through friendly communication and by fulfilling commitments (Barnes et al. 2002, p. 279).

The management processes can affect the relationships as well. External factors, such as corporate changes, including mergers and acquisitions, and changes in project strategy, can affect a collaboration. To overcome any drastic effects resulting from such changes, managerial activities, e.g. project planning, should be flexible enough to adapt to the changes (Barnes et al. 2002, p. 279-80; 82).

Commitment is, of course, needed to form lasting partnerships. To keep industrial partners committed and interested, academia should provide the realistic tangible outcomes as early as possible (Barnes et al. 2002, p. 280; 82).

Good university-industry collaborations require an appropriate balance between academic and industrial objectives. This is why a good model should represent the

importance of finding mutual benefits for both university and industry (Barnes et al. 2002, p. 281-82).

Despite the fact that university policies regarding Intellectual Property Rights (IPR), patent ownership and licensing can pose a major obstacle to university–industry relationships, many industries still develop collaborations that satisfy both partners. Nevertheless, a company needs to know the current position of the university with which it is planning to collaborate regarding IPR, patent ownership and licensing as it relates to timing and revenue sharing. Based on this knowledge, the industrial partner can decide about accepting each position without affecting its own unique circumstances (Santoro and Betts, 2002, p. 44-45).

Collaboration between research organizations and the industry can not only enhance the competitiveness of an industrial partner but also give the universities a possibility to receive more funding. Depending on the university–industry relationship agreement, the university may, for instance, be able to generate funds through patents and technology transfer activities. On the other hand, collaborations may provide the industry with an opportunity to have access to advanced technology and vast up-to-date research knowledge. Furthermore, research that could not be done in industry facilities can often be carried out with minimum risk and at a low cost in universities. It could, then, be beneficial for both parties to give greater focus to these collaborations. However, it should be kept in mind that in order to make university–industry collaborations successful and the most beneficial that they can be, a great deal of management efforts is needed.

To carry out competitive research, a researcher or a university may need access to several funding agencies and organizations, some of which are discussed below.

#### 4.4 Sources of Research Funding

A university's research funds can be based on internal or external funding. In general, funds from the government and the university's own assets can be considered internal funds. On the other hand, external funding can consist of public and private research funding. It can be provided by either public funding agencies, such as the Academy of Finland and TEKES (the Finnish Funding Agency for Technology and Innovation) in Finland, or by a private industry, such as the KONE Foundation, or both. The fact that a major part of research funds is provided by the government and public agencies means



that they can affect the research orientation of a university. On the other hand, external funding from an industry can provide an opportunity to extend research activities (Auranen and Nieminen 2010, p. 825-827; Loikkanen et al. 2011, p. 87).

According to Auranen and Nieminen (2010), the Nordic countries invest more in university research than many other countries. In Finland, for instance, the expenditure on research and development increased during 1981-2001 as compared to other countries, regardless of the fact that during this time period, the funding environment in Finland, as well as other countries such as the UK, became very competitive. A big portion of this investment in research in the Nordic countries, Sweden and Finland in particular, comes from external funding. In Finland, the reason for the relatively high portion of external funding are comprehensive networks and relationships between universities and public research institutes. Of course, research funding agencies, such as the Academy of Finland, play a significant role in providing external funding (Auranen and Nieminen 2010, p. 827-828).

Traditionally, in Finland, research institutes have received their funds from the state budget funds, but the situation is altering. There are huge adjustments in the funding structures and PROs are facing national as well as international challenges in Finland.

#### 4.4.1 Changes in the Funding Structures of PROs in Finland

A significant share of the funding in Finland comes from the State budget. This is also known as 'budget funding.' Another part of funding is generated by providing services to private customers, which can be referred to as 'the market.' The third main source consists of domestic and external research markets which includes, for instance, European research and technology organizations (RTOs). According to statistics, in Finland, a total of EUR 1.8 billion were allocated to R & D in 2008, 4.4 % of total government expenditure. Out of the 1.8 billion, 9.7 % (EUR 586.2 million) was given to PROs. Although there was an increase of EUR 68 million for R & D funding from 2007 to 2008, the amount reserved for the PROs remained practically the same (Loikkanen et al. 2011, p. 85).

This direct budget funding was distributed between 21 different research institutes, with a big portion allocated to three research institutes and two policy sectors. The three research institutes, namely VTT (Valtion teeknillinen tutkimuslaitos) Technical Research Centre of Finland, the Forest Research Institute and the Agrifood Research Finland, received 54 % of the total budget (Loikkanen et al. 2011, p. 85).



Traditionally, in Finland, research institutes have received their funds from the state budget funds, but the situation is changing. Since 2000, the direct funding budget for research organizations has decreased. To compensate, the PROs have found more external funding. The external sources of funding can be divided into commissioned research and co-financed research. In commissioned research, customers pay all of the costs of a project and get the reward by having Intellectual Property Rights (IPRs) over the project results. On the other hand, co-financed projects consist of both external funding and the research organization's own budget. The research results from co-financed projects, like the budget funding, are public (Loikkanen et al. 2011, p. 86).

This external funding can make up a large portion of total funding: in VTT, for instance, external funding represents approximately 70 % of total funding. It seems that the proportion of external funding is increasing, although not at a very significant pace. E.g. in 2008, research institutes received about EUR 227 million in external research funding, representing nearly 45 % of their total funding — but only 1 % more than in the previous year (Loikkanen et al. 2011, p. 87).

#### 4.4.2 Internal and National Challenges Faced by Research Organizations in Finland

One of the main challenges for PROs is increasing their impact on the economy and the society. The main indicators of the impacts of PROs on the commercial level are developed through technology or knowledge transfer and spin-off companies. However, in Finland, the number of PROs involved in commercial activities such as patenting, licensing or ventures is very low. This may be because inventors often do not benefit monetarily from collaborations with institutes (Loikkanen et al. 2011, p. 89).

Finland is currently trying to streamline the national innovation system and the public innovation environment by developing national institutional research strategies. PROs play an important role in the national innovation system and the national innovation policy and thus form a key part of the research infrastructure. Moreover, Finnish PROs are in a transition phase both internally and externally. They are re-instating their organizational, managerial and funding structures and changing their strategies and policies in order to cope with the challenges brought on by internationalization. One of the changes is a move from the traditional institutional customers toward private customers, resulting

in a more diversified customer base and new sources of funding (Loikkanen et al. 2011, p. 93-94).

Another challenge faced by the PROs in Finland is the development of internationalization and international collaborations. Most of the Finnish PROs have developed international cooperation in recent years, which has led to an increase in international research funding. Nevertheless, PROs remain mainly national organizations following national policies. In fact, according to studies, the current governance system of Finnish PROs does not support their internationalization and, in some cases, may pose challenges for the internationalization process. This means that Finnish PROs could benefit from revisiting their international, especially European, strategies while keeping their national roles in mind (Loikkanen et al. 2011, p. 95).

European Research Council (ERC) is a very important source of external funding. In Finland, PROs can be benefited from ERC and can seek external research funding to support their research.

#### 4.4.3 European Research Council

The European Research Council (ERC), one of the main funding agencies in Europe, was established in 2007. The aim was to make European Union a knowledge-based economy by enhancing creative and innovative research in Europe and by strengthening the competitiveness of Europe considering that strong research capabilities play an important role in stable economic growth. (ERC 2015, p.1; ERC n.d. a).

The funding provided by the ERC is available to anyone willing to perform research in Europe, regardless of gender and nationality. The main selection criteria, according to the ERC, is “scientific excellence.” Since its creation, the ERC has evaluated more than 50,000 research proposals and granted about €9 billion for research activities to more than 5,000 researchers of different nationalities, working in over 600 research institutes all over Europe (ERC 2015, p. 1).

The ERC offers four different kinds of grant scheme:

- 1) Starting Grants, meant for researchers in the beginning of their research career,
- 2) Consolidator Grants for independent researchers,
- 3) Advanced Grants for well-established researchers, and

4) Proof of Concept Grants, the aim of which is to help researchers to commercialize their research. (ERC 2015, p. 2).

### ***Proof of Concept Grants***

The ERC Proof of Concept Grants are designed for ERC grantees whose research outcome can provide new opportunities for commercial and societal applications. The grant scheme was launched in 2011 and since then, about 300 grantees have succeeded in bringing their research results to the market. The grant allowed e.g. Prof. Eiliv Lund to commercialize an inexpensive and simple blood test which can help in diagnosing breast cancer. Likewise, it allowed Prof. Markus Aspelmeyer to build a first prototype which led him to establish a start-up company called Crystalline Mirror Solutions (CMS), which now manufactures high-performance mirrors used in different applications such as advanced navigation systems (ERC 2015, p. 13; ERC n.d. b).

The ERC encourages the building of networks between research and the industry and have set up a special unit to assure that research meet industry. Due to ERC efforts, the European Round Table of Industrialists (ERT) approved €80 billion for the Horizon 2020 program, the new EU Program for Research and Innovation, to support basic research in Europe. According to the ERT, this fund “will lay the foundations for growth in Europe”, as “discoveries and technological progress will produce new products, processes and services, and new industries will be created in their wake” (ERC 2015, p. 14).

Part of Horizon 2020, the ERC has a budget of €3.1 billion for the period 2014-2020, representing 17 % of the overall budget for Horizon 2020. Through the program, more than 10,000 doctoral students and approximately 16,000 postdoctoral researchers will be trained with advanced research by funding about 7,000 grantees (ERC n.d.a).

Due to the current economic situation, research resources, funds in particular, have become limited. However, there are several opportunities, as discussed above, to acquire funds to carry out competitive research.

Funding agencies could play a vital role in research dissemination by making dissemination a conditional part of the grant application. Grant applicants could be requested to submit a proposal of plans for dissemination. One way to achieve this could be for the applicant to provide a conceptual framework.

#### 4.5 Existing Frameworks in Research Dissemination

A conceptual framework is a tool or scheme explaining theoretically the key factors, assumptions, ideas or concepts and a connection between them, leading to a broad concept (Miles and Huberman 1994, p. 18).

A conceptual framework can be based on the persuasive communication matrix, the diffusion of innovations theory or the social marketing concept. Wilson et al (2010) have listed out several conceptual frameworks and their elements which can be used by researchers for their dissemination activities. Most of these frameworks are either fully or partially based on the McGuire Persuasive Communication Matrix (McGuire 2001, pp. 23).

The persuasive matrix is a communication model consisting of different phases. There are five inputs or variables that can affect persuasive communication. These five inputs consists of trustworthy and credible communication source, the kind of message to be distributed, channel through which the message is distributed, characteristics of audience, i.e. the beliefs, attitudes etc. of the receiver, and context meaning the circumstances (e.g. environmental factors, noise etc.) under which the message is received. (McGuire 2001.) Some of the frameworks, mentioned by Wilson et al (2010) are based on the diffusion of innovations theory.

The diffusion of innovations theory is one of the early social science theories. The theory was developed by Rogers (1962). The theory explains how an idea or product gains popularity and diffuses through a certain community or social system with the passage of time. As a consequence of this steady momentum and diffusion, people perceive an idea, innovation or product and adopt it (Rogers 1995, pp. 5-8). The frameworks based on this diffusion theory are focused on strategies to enhance the uptake of research based knowledge (Wilson et al. 2010, p. 9).

There are also frameworks which are based on the idea of social marketing (e.g. Kotler and Zaltman 1971). Research and evaluation together are the cornerstone of the social marketing process. The idea got its popularity from health communication field. Kotler and Zaltman (1971) realized that the successful marketing principles which commercial marketers used to sell products could be used to "sell" ideas. They define social marketing as follows

“social marketing is the design, implementation, and control of programs calculated to influence the acceptability of social ideas and involving considerations of product planning, pricing, communication, distribution, and marketing research” p.5.

One of the frameworks, listed by Wilson et al (2010) argues that social and commercial marketing principles can be used to promote research-based knowledge (Wilson et al. 2010, p. 5) while another framework from the same list discusses that the social marketing approach could play a vital role in the planning process resulting in “consumer” oriented research (Wilson et al. 2010, p. 7).

#### 4.6 A Conceptual Framework for Current Study

The gap between research and practice is very wide, especially in biological sciences. Because resources in research are always finite, researchers have to carefully consider the costs needed for the dissemination of their research outcomes and the benefits they may reap after the dissemination. To this end, a conceptual framework can be designed indicating the challenges in dissemination and describing some of the dissemination elements which researchers could use for their dissemination activities.

A good conceptual framework generally consists of several domains. In a similar fashion, a conceptual framework for research dissemination may include several elements, such as the location of research activities, the research itself, the target group (e.g. industry), researcher or research institute-industry relationships, and research dissemination strategies (Figure 2) (Anderson et al. 1999, p. 1012-1015; Majdzadeh et al. 2008, p. 272-275; Scullion 2002, p. 68-75). These elements can be divided into two groups, the dissemination activity and factors that can help the dissemination activity.

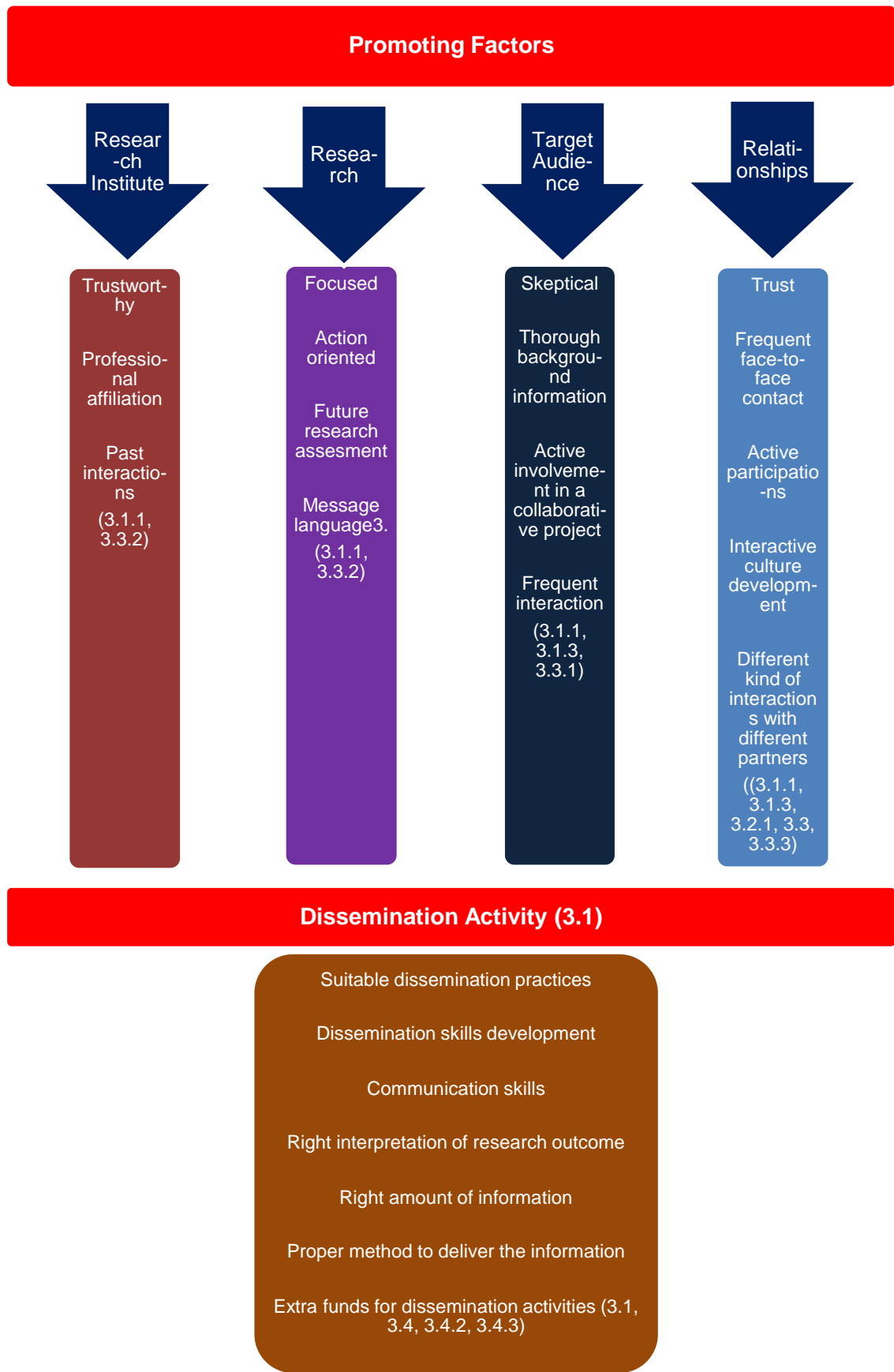


Figure 2. Conceptual framework for research dissemination

It is difficult to fit all the information into a conceptual framework. To make the framework more effective, it is wise to mention only the important and relevant information. The part regarding dissemination activity is drawn mainly from section 3.1, except for the funds-related element, for which the information is taken from sections 3.4, 3.4.2 and 3.4.3 as well. That information from these sections has factored in the framework does not mean that other sections from existing knowledge are not important, but that the output from these sections may not have a huge impact on this framework.

## 5 Development of an Organizing Framework for the Research Dissemination

This section will attempt to develop an organizing framework which researchers in agricultural sciences can utilize to enhance the dissemination activities. The framework is based on the ideas from the interviewees and is constructed by adjusting the conceptual framework mentioned in section 4 according to the needs in agricultural sciences.

### 5.1 Recommendations for the new framework

As described in Section 4.5, a conceptual framework for research dissemination can consist of the location of research activities, the research itself, the target group (e.g. industry), researcher or research institute–industry relationships, and research dissemination strategies. These domains are addressed in the new organizing framework.

Firstly, it is obvious that disseminating research findings is very important. Nevertheless, dissemination as it currently works is inefficient. This could be due to a lack of communication skills or a lack of dissemination skills in general. Departments can encourage researchers to develop their communication skills by arranging some communication courses. In addition, departments should help researchers to develop their dissemination skills. Researchers need to learn about maintaining a balance between research, peer-reviewed articles and other dissemination activities. Moreover, there should be extra funds allocated for dissemination.

Agriculture departments, too, can follow in the footsteps of the Aalto University School of Business. The dissemination activities in the Business School are diverse and multi-dimensional as approaches other than the simple publication of the data are employed. Furthermore, these approaches are used as criteria to move up in a professional career. One of these criteria is managerial relevance. In Agricultural sciences, this could mean how a researcher, as the project manager, can effectively communicate with the end user or practical user of the research findings.

Successful dissemination of research outcomes can be achieved by several channels, including peer-reviewed journals, local newspapers and society journals, workshops,



conferences and meetings. One very effective channel is social media, which it allows information to spread extremely quickly to an ever-widening audience.

As mentioned above, in the Aalto Business School, dissemination activities are common and diverse. In Agricultural sciences, it is possible to implement some of the same methods, e.g. media hits, meaning the visibility of one's work in the media, and the effective use of alumni. Agriculture departments can, for instance, invite alumni as guest lecturers, especially alumni who work in the industry, as well as placing them in a steering group of graduate students. This way, alumni can bring their knowledge from the industry in addition to being updated with the newest department research. Moreover, helping fresh graduates in building start-ups can be another route for the dissemination of information. The research itself can play a vital role in the dissemination activity. Industries tend to prefer focused and action-oriented research. By working on a specific research topic and by publishing it in a specific journal, researchers may be able to deliver their message more effectively as industry representatives do not generally read all the available published material. On the other hand, working on several dimensions and publishing in general scientific journals may reduce the chances of that work being noticed.

The form and recipient of a message are key elements in delivering information. In Agricultural sciences, however, focus has often been on the type of research as it may determine how practical disseminating research findings is at each stage of research. Nevertheless, dissemination can be enhanced by interpreting the scientific information according to the target audience, e.g. farmers, who may not be interested in all research details but may, nonetheless, be keen to hear the practical implications. In a similar fashion to the Business School's "professors of practice," Agriculture departments, too, can hire staff to translate research knowledge into disseminatable information.

The relationships between the academia and the industry also play a key role in the dissemination of research findings. Industry representatives tend to be skeptical and will only pay attention if they trust the source of information. Maintaining long-term relationships build trust. To start one, a researcher should attend seminars and workshops arranged by the target audience. There, current information as well as the future needs of the target audience can be learned. However, before going to the target audience, a researcher should have thorough background information regarding the target audience. Only then will a researcher be able to understand their future demands and to deliver

information in a better way. Moreover, proper communication and efficient explaining are crucial to building solid long-term relationships.

Trust is also more likely to appear in relationships where an industry representative is a former member of an institute's research team. This is why Agriculture departments should make it easier for students to do their Thesis in the industry. Through this pathway, students can work for the industry against a payment, while the department can disseminate the research findings. This may result in students working for the same industry in the future, which will further develop trust and relationships.

The time of dissemination is also very important. In Agriculture, it is sometimes hard to disseminate information until the end product, e.g. a resistant crop, is ready. Yet, on the other hand, waiting too long may make the information obsolete. If possible, then, it is better to disseminate the research findings as soon as possible. In the case of a collaborative project between a university and the industry, it is important to involve both partners at every stage of the project as this will allow for proper and timely dissemination. Furthermore, funding agencies can play a vital role in research dissemination by making dissemination a part of grant applications. Applicants could be requested to submit a proposal with plans for dissemination. To this effect, applicants could provide a conceptual framework.

Making dissemination activity part of the department strategy can promote research dissemination as well. This way, researchers may have to spend some time in this direction e.g. by writing articles for newspapers or local popular journals. In reality, however, small research groups are often poorly supported by the departments. It seems that there is currently a gap between universities and industries, with people from academia and the industry mostly working in their own silos. However, putting people from both sides together through informal meetings can break these silos. While it has generally been difficult to build relationships between the industry and research institutes dealing with natural sciences, the Business School proves that the situation could be different. It has a lot more collaboration and interaction with private partners, and companies tend to be very positive and open towards research. Moreover, there is a lot of willingness to share knowledge and to communicate across the worlds of academia and the business.

Funds are a limited resource in research, especially in agricultural sciences. The notion of "selling an idea," which may be common in a business or technology institute, does

not exist per se in agricultural sciences. Instead of “selling an idea,” a project or proposal can be drafted against an eminent threat such as a serious disease. In order to formulate such proposals, however, researchers need up-to-date information regarding potential threats in other parts of the world. After that, the next step is having solid background information about the problem. This makes it possible to convey a message about the research to all the stakeholders (other researchers, the industry, farmers etc.). Together with other stakeholders, then, a researcher can then propose a possible solution and apply for funds.

Instead of “selling an idea”, the interviewee from agriculture department of Helsinki University proposed another way of generating extra funds, which is to run a private laboratory in a government research institute such as Helsinki University. This may not require a great number of sophisticated tools. Usually, this could mean a kind of kitchen lab with basic machines to work on a specific problem e.g. if a gardener comes in with a berry bush for some diagnostics. In the USA, it is rather common to have such private laboratories, called Plant Clinics, dealing with farmers, horticulturists and gardeners owning vast piece of land. In addition to these land lords, many universities, too, have such clinics. In countries such as Finland, one may not be able to generate big money with such a clinic, but there is definitely a niche for it. However, there are a few possible reasons why such clinics have not been founded here. One reason could be that it would require the university to hire a permanent technical person for this job. In addition, it is hard to estimate the flow of people like number of people visiting on daily bases or weekly bases. Likewise, it may be difficult to accurately estimate how many and what kind of samples customers would bring. The interviewee from agriculture department believes that the USA being more business oriented country, it may be easier to set up things such as Plant Clinics.

## 5.2 A proposed framework for research dissemination

Based on the conceptual framework mentioned in section 4.6 and the recommendations made in section 5.1, the following framework (Figure 3) is proposed.

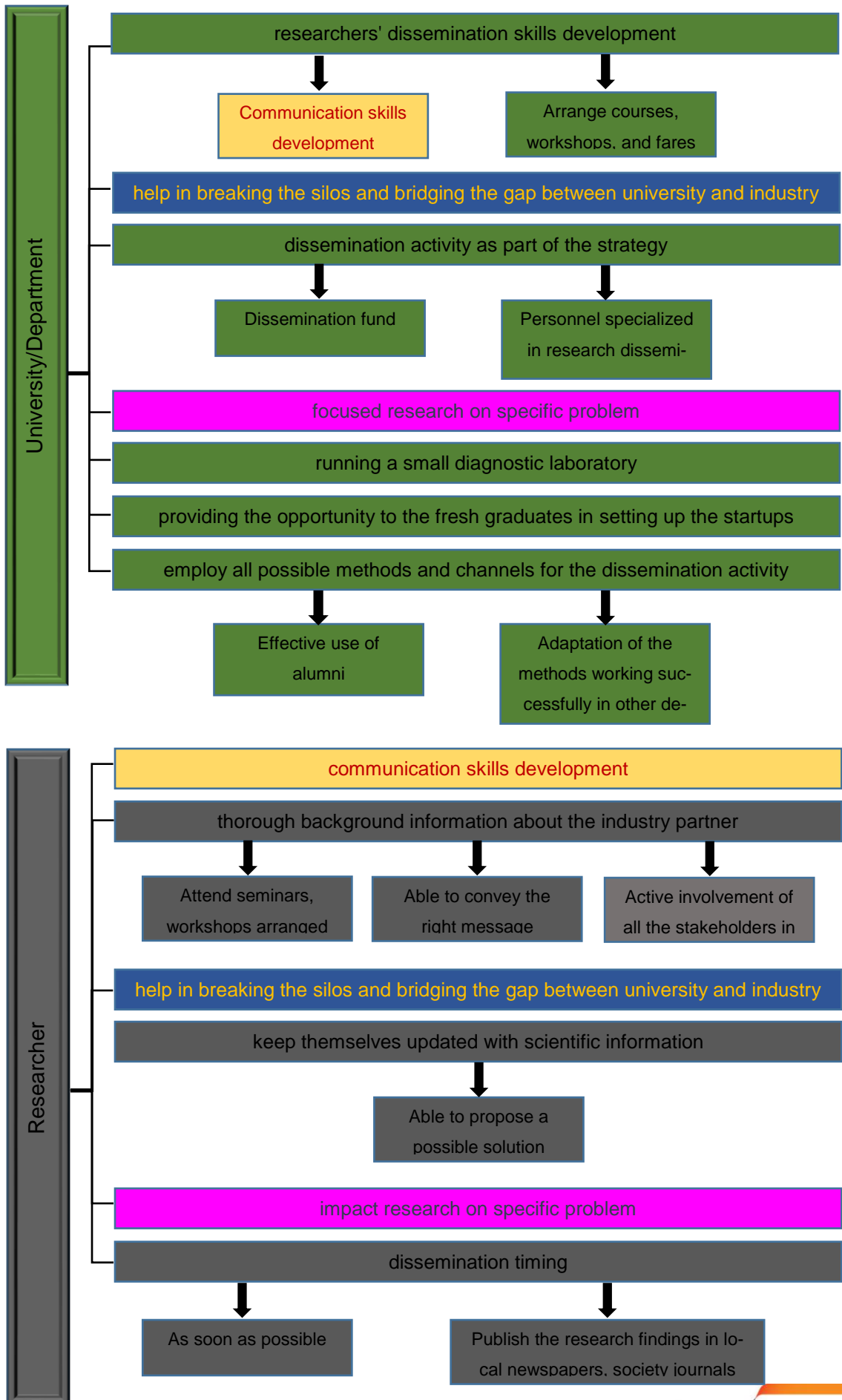
The framework proposed here consists of three parts. Part 1 deals with the role of a university in the enhancement of dissemination activity. Part 2 is based on the responsibilities of the researcher. Part 3 covers other small yet important factors that can help in the promotion of the dissemination.

By helping in the dissemination of research results, a university will not only encourage its researchers to carry out high level advanced research but will also help itself to acquire a place among the well-esteemed universities of the world. As illustrated in Figure 2, universities can add courses to their curriculum that teach attendants about the importance of dissemination as well as different methods of improving it. These courses can be at department, faculty or university level.

In addition, universities can arrange workshops for their researchers on dissemination. These workshops can help in spreading awareness of the importance of research dissemination. Likewise, universities can make departments responsible for some seminars arranged periodically for the same purpose. Besides workshops, universities can also arrange some academic fares, inviting delegates from the industries as well. Having academic researchers and industry representatives meet will help not only in building university–industry relationships but also in understanding each other's needs. In addition, these fares will help to break the silos and make communication better. If not very often, these fares could be arranged at least once a year. If possible, a university could hire personnel trained in the dissemination field. The presence of such personnel will help researchers by providing answers and solutions regarding dissemination.

Funds are one of the extremely limited resources. However, earmarking some funds for dissemination could have a remarkable effect on dissemination. In addition, universities can also make dissemination part of their strategy both at the department level and at the university level.

Universities and departments should show flexibility towards new dissemination methods in addition to traditional ones, such as only publishing in peer-reviewed journals. Particular attention should be paid to those methods which are successfully working in other universities or departments. A university can also be benefited by engaging the alumni.



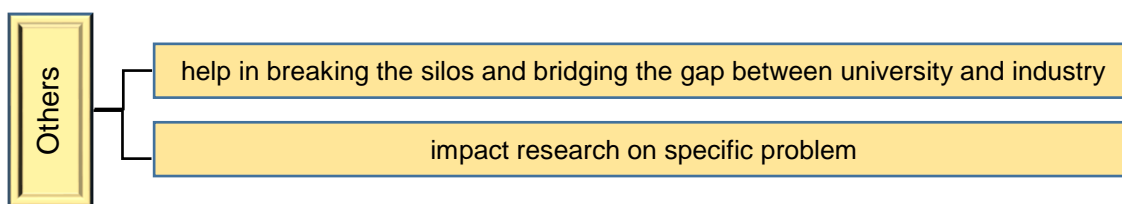


Figure 3. A proposed framework highlighting main roles of different key players in the research dissemination in agriculture department

Furthermore, having industry representatives graduated from the same university in the steering groups may help in building relationships between the university and the industry and in disseminating information on ongoing research. Moreover, providing opportunities for young researchers by, for instance, helping them in building start-ups or a plant clinic may further promote dissemination. In addition, providing incentives for dissemination or making dissemination activities an integral part of the career development ladder can also be used to better research dissemination.

At the department level, dissemination can be enhanced through focused research. Working on specific problems can make a department extremely specialized. The departments can also arrange regular seminars related to the promotion of dissemination in general and the dissemination plan regarding on-going research, as well as the current stage of research projects.

The researcher is the focal point around which all dissemination activity revolve. It is the researcher whose scientific achievements are disseminated and who is mainly benefited through dissemination, either by getting his/her published work in peer-reviewed journals or by receiving funding based on the research outcomes. However, researchers are generally extremely busy and so focused on their research that they tend to ignore dissemination activities. Nevertheless, if they wish to succeed in their research career, researchers may have to develop their dissemination skills. As illustrated in figure 3, one of the main skills which they need is communication skills. Generally, however, researchers from Agriculture departments are known to live in their own silos and not communicate well. They have to break these silos. They can, for instance, attend seminars arranged by farmers or the industry. By attending these seminars, they will learn how to communicate with production and industry representatives, become familiar with their problems and be able to spread information regarding their own research. In order to benefit fully

from the seminars, researchers should keep themselves up-to-date with advanced scientific information as this can make it easier for them to answer any questions, in addition to helping them later on in formulating a proposal to combat a problem.

Having solid background information regarding a future private partner may also help in sharing scientific information with them, which may, in turn, lead to a collaborative project. In addition, keeping all stakeholders involved at all stages of a project may also contribute to better dissemination, as well as build trust through the active participation of everyone involved.

Working on a specific problem, on the other hand, may make the research more visible and recognizable to specific clients. Furthermore, research can gain added visibility if it appears as a simple message in e.g. a local newspaper as opposed to specific peer-reviewed journals.

In addition to disseminating information to outsiders, information should be shared with colleagues within a department or university. This will enhance dissemination. One way of doing this is by arranging and attending department seminars routinely.

In addition to researchers and universities, there are other key players who can contribute to better dissemination. Funding agencies, for instance, can play an important role. In order to increase dissemination, they could require a dissemination plan to be attached with funding proposals. Moreover, they could ask a follow up report regarding the status of the ongoing research and its dissemination.

## 6 Validation of the Proposal

This section discusses the validation of the improved proposal. The first part of the section discusses the feedback from the two experts given on the initial proposal. Both of these experts mentioned in section 2.3.2 have extensive experience in disseminating research outcomes to private customers and in generating funds through this activity. The second part of the section presents the final proposal with the experts' feedback incorporated.

### 6.1 Findings of data collection 3

The initial proposal developed in the previous section was presented to the experts involved in research dissemination. The initial recommendations and framework were first sent to the experts via email, and the proposal was then discussed in a face to face meeting (expert 2) and via Skype (expert 1). All the discussions were audio recorded and later transcribed. The feedback from the experts is described below.

#### 6.1.1 Problem-driven research

According to the experts, research should have some direct impact and should be relevant to problem solving. However, it does not necessarily have to be industrially relevant, but it can be relevant e.g. socially or any other way which can help to make the research visible. This can enhance dissemination activity. Making press releases about the research work currently published in peer reviewed journals can help in the dissemination, particularly, if the topic is relevant and timely, then a press release can be very effective. Active dissemination, as mentioned in the initial recommendations, need several communication channels and forums to succeed. One of them is social media.

Social media can be effective. However, for a researcher, it has challenges as well. It is, of course, a highly dynamic environment, in which messages can be conveyed with little effort, but users have to realize that quite often, what social media encourage are opinions rather than scientifically proven results. This is, then, one of the challenges which a researcher may face on social media: in order to get more recognition, s/he may have to act differently and bring in his/her opinions. However, this is often one of the weaknesses of researchers: as scientists they are trained to say only what they are certain about, not what is uncertain. Nevertheless, if you want to make your research popular on social media, you have to take stands, express opinions, and offer interpretations, but same



time you have to be very explicit in saying that more studies have to be carried out and may find some funding if someone is interested in those results.

Another dissemination method which the experts stressed is the organizing of seminars. For proper dissemination, research needs to be seen by a wider audience. After all, experiments are not just vehicles for learning and doing new things, they are also resource attracting machines. Often, researchers only focus on writing. However, the best way to disseminate, according to the experts, is to organize workshops and seminars. In these meetings and seminars, most of the participants are only listening, and that may not have a strong impact. According to the experts, ideally the researchers should make a video recording of the research and display this in the seminars. Electronic media look very actively for news for today and tomorrow. If a researcher is conducting the research differently as compared to other researchers from the same field and displays this work through video, it may become a news story and may, then, be disseminated to a huge audience including the industry. It is generally hard to attract the industry to attend scientific workshops, especially if these workshops have only researchers give speeches on their content only. For better dissemination, it is suggested that company representatives are also asked to give speeches in the workshops after which researchers can discuss their own ideas with them.

### 6.1.2 Communication culture

Experts agree that it is important to develop the communication skills of researchers. However, this is not enough to improve the situation. It is not the task of individual researcher or team of researchers alone to make the research results popular. There should be a communication culture in the departments or on the university level to make research popular. In other words, what is needed is an overall culture and a structure supporting communication and dissemination. Most universities have communication personnel. Currently, the communication department e.g. in Lappeenranta university of technology is mainly involved in the recruitment of new students. They should spare some time for and play a more active role in the communication and dissemination of research. To make research more popular, the communication department should be well aware of published research, based on which it can then identify the relevant stakeholders. After this, it can target these stakeholders and disseminate the information to them.

According to the initial recommendations and framework presented in section 5, communications seem to be relatively one directional, from researcher to stakeholder. The experts suggested that universities should have some kind of model for engaging different stakeholders so that active researchers can engage themselves in relevant communities within their field of expertise. Nowadays, high-quality research is the result of good team work. This means that a researcher should not only join forces with his/her own research colleagues but also build good networks with other researchers. In addition to helping to better understand each other's interests, these networks can may lead to finding possible users of the research. Interactions can surely have a huge impact. Of course, it takes time, but researchers have to build these networks systemically. Currently, for a researcher to be successful, it is not enough for him/her to only sit and carry out research in the laboratory. In fact, it is a very critical part of a researcher's overall success to have information and knowledge not only in own field but also in the adjacent fields. An agricultural researcher, for example, should also engage himself in agricultural policies or in debates related to the agricultural policies.

#### 6.1.3 Theme oriented research

The experts suggested that research on a specific theme can help in the dissemination of results. This may, however, pose some challenges. For example, sometimes the state, particularly in small countries such as Finland, may bring forward certain themes which are in the state's interests rather than that of a researcher. In such a scenario, researchers may have to change or modify their research focus, since following the themed research may guarantee funding. In such a situation, a researcher can work on the government-specified theme, and at same time, spare some money to work on the topics of his/her own interest, which may, then, lead to future funding. Nevertheless, it is usually good, funding- and dissemination-wise, to carry out research on a certain theme.

#### 6.1.4 Research impact measurements

A university's worth is generally measured through published research. Currently, there are no practices at the university level to measure the impact of the research e.g. to the society. The experts, during the discussions, emphasized that universities should have measurements to evaluate the impact of the research. By doing this, universities can help in enhancing research dissemination.

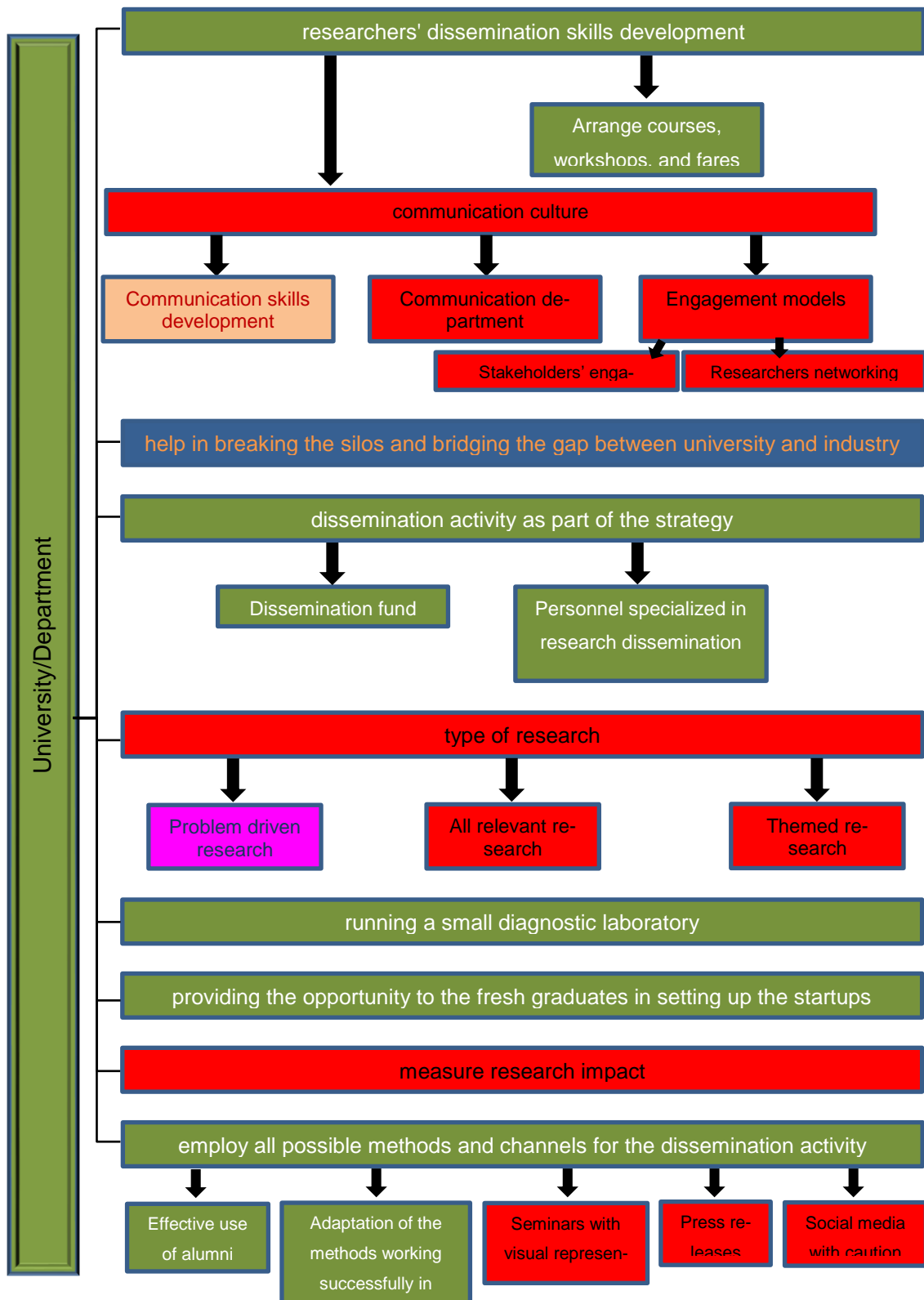
### 6.1.5 Micro units in research

As discussed earlier, a researcher is usually focused on writing out and publishing the research results in peer reviewed journals. Besides writing, however, a researcher should also think about taking the “research paper into practice.” While writing the paper, he/she should also think about some possible exercise which can be developed out of the paper and which the industry people can practice and rehearse. In addition, researcher should think about a possible workshop related to the published article so that the information can be disseminated. A researcher should have a clear agenda about attracting the industry representatives because with an agenda things start to work properly. A researcher needs to make channels with the business community and need to keep them open. In addition, a researcher needs to do several things to disseminate the information. Having one workshop or seminar in a year, for instance, would not have any impact and would not make the news, but doing several actions, e.g. workshops and seminars may result in some news, leading to the enhancement of the dissemination.

## 6.2 Final Proposal

The final proposal for the improvement of the research dissemination activity by agricultural departments was built from the initial recommendations, incorporating the existing knowledge on dissemination and feedback from the respondents`, who participated in building the initial proposal, as well as the feedback from the experts involved in successful dissemination activity. The main findings and suggested improvements for the final proposal are explained in Figure 4A and B. The Figure 4, collectively, thus presents a framework which may help in improving the dissemination process.

4 A



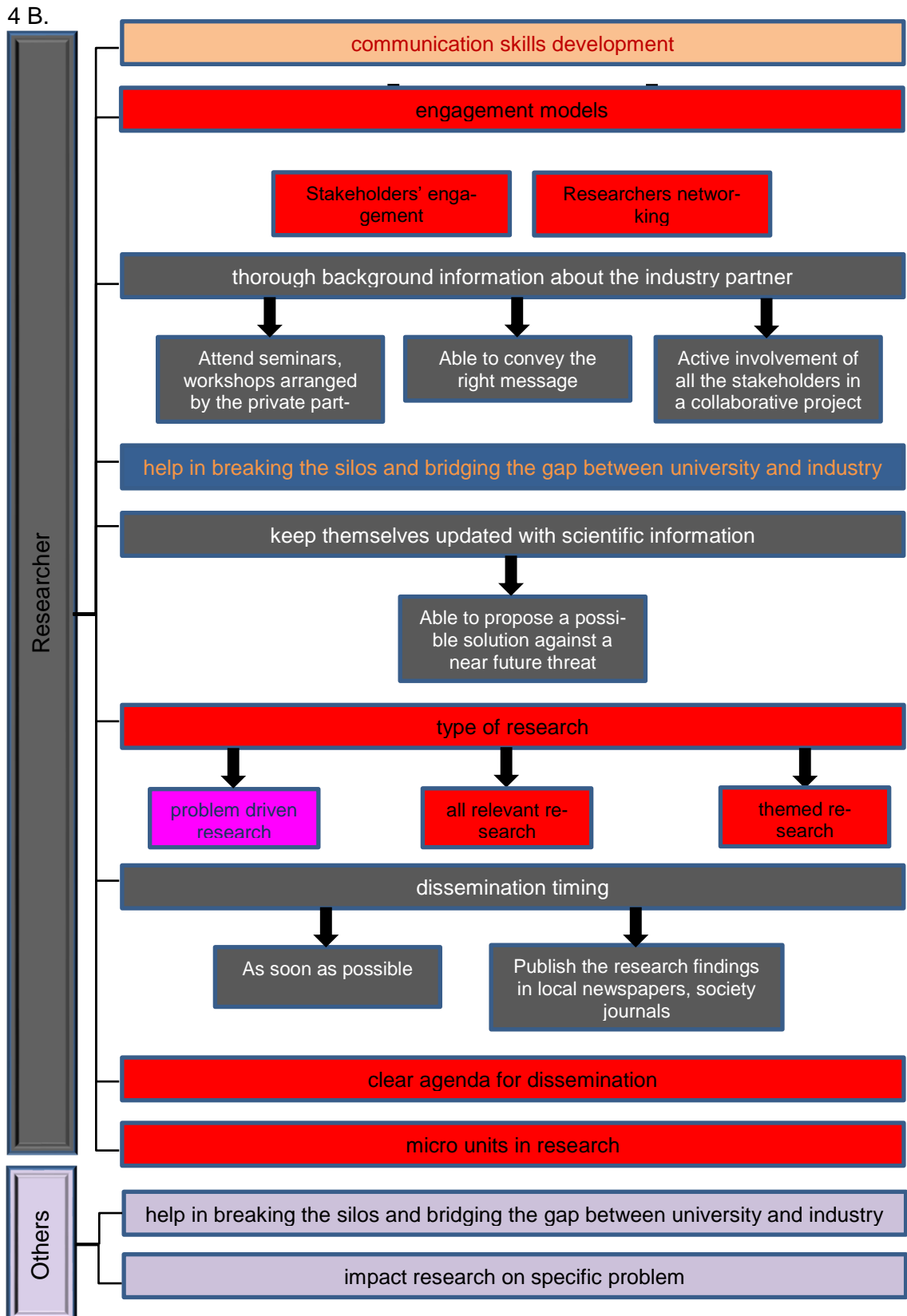


Figure 4. Improved framework highlighting the main roles of the university/department (4 A) and a researcher (4 B) in the research dissemination in agriculture departments. The boxes showing Input from the experts are marked with red.

## 7 Discussion and Conclusions

This section discusses the recommendations which I have made to improve research dissemination in Finnish public research organizations and the new framework I have developed for the research dissemination and concludes this Thesis.

### 7.1 Summary

Government-run research institutions generally focus only on research, carrying out research for research's sake. The research stays separate from the benefits that it could have if its results were disseminated and implemented properly. As a result, industries do not get to benefit from the research as much as they could. If dissemination services were better delivered, research institutes might get more industrial customers, which could lead to more funds. In addition, as a result of the Universities Act reform of 2009, Finnish universities have become more corporation-like. The idea behind the semi-privatization of Finnish universities is not only to compete in the open market of human capital but also to generate income for the universities to run their operations. This is where more successful dissemination could play an important part.

In this study, I have aimed to describe an organizing framework for the researchers or research institutes to help in the dissemination of their research findings, especially to private customers and industry, in order to generate extra funds.

The objective of this Thesis has been to examine the dissemination process in research institutions and the difficulties in it. Currently, the process occurs at a less than ideal level, especially in the field of Agriculture. Dissemination is only done at a late stage, after the research has been finished. Moreover, the main and, in many cases, only form of dissemination carried out by the researchers at public research organizations is publishing the research findings in peer-reviewed journals and sometimes as a conference paper. However, there is a huge number of scientific journals with an ever larger amount of peer-reviewed articles, which means that, without a robust dissemination strategy, research results may very easily go unnoticed by anyone other than researchers interested in the same line of research. This Thesis aims to contribute to solving this problem of inefficient research dissemination by developing an organizing framework and providing recommendations for key steps in the improvement of dissemination activity in Agriculture departments.

The new framework designed to improve dissemination lists the roles of the university, the department and the researchers and some other elements in the improvement of dissemination activity. It is based on an in-depth analysis of literature combined with research interviews conducted in different research institutes. The final proposal for the framework was formulated after feedback from the interviewees.

In this era of competitive research, the proper dissemination of research is very important. This study was conducted to discover some key elements that can influence the dissemination process. It indicated a number of factors that can affect the dissemination activity, such as university–industry relationships, the communication culture at the university and department level, the communication skills of researchers and the learning and implementation of different dissemination methods.

This study indicates that many researchers are well aware of the importance of dissemination, yet it is not carried out very efficiently, especially in natural sciences. Communication skills are perceived to be the most important element in spreading scientific information. Drastic measures are needed to improve the dissemination process. By following the recommendations and by implementing the framework proposed here, Agriculture departments can improve their dissemination process and its results.

On the other hand, universities have their own important role in the dissemination process. From the universities' point of view, there is often a lack of appropriate interaction between them and private partners, such as industries. Moreover, there may be differences of opinion as to if and when research findings should be published, which may not be thoroughly discussed. As a result, there is a strong need to develop a culture in the universities to facilitate interaction between the research community and the potential user of the research results. To this effect, this Thesis has emphasized the importance of trust and commitment between partners with an appropriate balance between research objectives and industry preferences. Indeed, all the stakeholders – not only universities – may have to play their part in order to improve the situation.

This study is an attempt to bring the discussion regarding dissemination process to the forefront. It raises number of important issues involved in an active dissemination process. Furthermore, it suggests that a good organizing framework or practice model would be a useful tool for the researchers in managing their research dissemination activities.

The proposed model may help researchers to discover the factors where they may need further training and expertise in order to have the most effective research dissemination process possible. Future studies on the topic may help to identify further factors not discussed here.

## 7.2 Managerial Implications

Good project management with well-chosen objectives, proper progress monitoring and effective communication among different stakeholders can play an important role in the success of a research project, including research dissemination. To make the proposed framework functional, this thesis provides a number of recommendations with managerial implications that can contribute to the improvement of dissemination. These recommendations can be divided into two groups: a) for the university/department to do and b) for the researchers.

For the university/department

1. The university should appoint one or two people who are experts in dissemination to guide researchers in disseminating their research findings.
2. The university or department should provide dissemination training to researchers.
3. The university should have measurements in place to measure the impact of research on society.

The researchers are the managers of their own projects hence they need to improve their managerial expertise.

For the researchers

1. The researchers should train their communication skills in order to communicate efficiently.
2. The researchers should actively participate in internal (arranged by the department) and external (arranged by the industry, farmers etc.) meetings and seminars to better understand the scientific problems, particularly those faced by the industry.
3. The researchers should specify the goals of a project at beginning of the project or as soon as possible.



4. The researchers should make sure that all members of the collaborative process are participating and keep them informed of any new developments and future directions.

5. The researchers should work as “micro units of research,” meaning that they should consider taking a research paper into practice as early in the research process as possible.

There may be other factors in addition to the ones mentioned above which may significantly influence dissemination. These include building and maintaining trustful relationships with the industry which can also be achieved through good management practices.

### 7.3 Validity and Reliability in This Study

This study was conducted to meet the objective of the Thesis, which was to examine the dissemination process currently taking place in research organizations and to construct an organizing framework to improve the current dissemination activities in Agriculture departments.

As discussed in section 2.4, the validity and reliability of this thesis were achieved through different measures. The primary data was gathered from interviews. To enhance the objectivity of the study, people from different disciplines involved in research and its dissemination at different stages in their career were selected for the interviews.

To guarantee that the observations are correct and accurate, the feedback was received from the interviewees on the recommendations proposed in the Thesis. To make sure that the objective of this Thesis was achieved, the outcome of the study was evaluated against the research objective. In addition, the author of this Thesis has worked several years in an Agriculture department and has a clear understanding of the problems in research dissemination, which may also increase reliability.

The reliability of this study was secured by formulating a framework. The framework was formulated after a comprehensive theory review and interviews with people familiar with the topic, thus linking the current state analysis with the existing knowledge in research dissemination. The initial proposal was then improved by presenting it to and discussing

it with people who have expertise in research dissemination. The input from these experts was then incorporated into the initial proposal which lead to the building of the final framework.

A conscious effort was make in order to not allow the author's personal views affect the recommendations made. However, the reliability of the Thesis could have been increased by conducting a larger number of interviews, particularly with industry representatives, and surveys in order to gather information from researchers at different stages in their career. In the future, the framework can be tested by implementing it in a research institute or in a university research department.

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