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SNM of Drone4Agro

Applying Schot and Geels‘ theory about strategic niche management on the situation of Drone4Agro.

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Management Summary

The Task given by the director of Drone4Agro, Mr Rijssenbeek, was to apply the strategic niche management (SNM) theory introduced by Schot and Geels. The theory consists of two parts: The policy dilemmas and the multi-level perspective (MLP). The policy dilemmas need to be balance to place the company and its products successful on the market. The MLP determines how they can be placed on the market.

The policy dilemmas are adequately balanced, but the MLP shows that the policy regime dimension in form of restrictions set by institutions and agencies permit the usage of Drone4Agro's agricultural drone. This struggle can be handled by making advantage of a combination of a mixture of a proactive and a top-down window of opportunity (WO). The regime actors are willing to adapt the novelty proactively. But the policy dimension of the regime permits this.

The following actions are recommended to fight these struggles:

- Contact Mr Jan Hesserbarth (vice-president of BUVUS, see contact card) in order to team up with a network that forces the government to change the policies,
- Finish the development of the drone, and
- Take a look at the restrictions for drones on other continents to see if the usage of the agricultural drone might be possible there. If so, consider moving the distribution there.

Contact card: Mr Hesselbarth, vice-presedent of BUVUS, association of unmanned Systems.

These are the most promising actions that put Drone4Agro in a better position to step into the regime.

Remember, that Schot and Geels' SNM theory is not including financial aspects! Financial aspects should actually have a big weight in this decision making.

Content

Introduction

The agricultural sector is an important part of the modern industry. It produces a high amount of food, raw materials, biofuel and fibres[1]. The surface used for production crops worldwide in relation to the total land area on earth was in 1961 36.1% and only increased to 38.9% in 1990. Since then it stayed steady at a level of about 38% the last decade[2]. In the same time period, world population more than doubled from 3,093,909 inhabitants in 1961 to 6,895,889 inhabitants in 2010 and will even grow to approximately over 9 billion inhabitants in 2050[3]. These figures show the importance of an efficient agriculture.

In order to improve the efficiency of agriculture, novelties and innovations are required. One highly promising novelty is the usage of unmanned aerial vehicles (UAVs) – also known as drones. These remotely piloted aircraft systems are already used to gather information about the status of the crops[4]. The company Drone4Agro sees even more potential. "Its goal is to have a fully certified drone of 150 kg for use in precision agriculture and more general tasks in this area like crop sampling, herds watering, etc."[5]

The task for this bachelor assignment is to use Schot and Geels' theory about strategic niche management (SNM) supporting Drone4Agro to bring its product onto the market. Based on Schot and Geels (2007), it can be concluded that Drone4Agro will start in a niche outside of the actual regime. New innovations "are initially unstable sociotechnical configurations with low performance. Hence, niches act as 'incubation rooms' protecting novelties against mainstream market selection" (Geels/Schot 2007: 400; Rip/Schot 2002). This bachelor thesis aims to help Mr Winfried Rijssenbeek, director of Drone4Agro, to make the right decisions in order to place their agricultural drone on the regime in the most beneficial manner. Another common tool that handles this subject is the SWOT analysis[6]. SWOT analysis is a tool that helps managers to build an appropriate strategy based on the company's strengths,

[1] Safety and health in agriculture. International Labour Organization, 1999, pp. 77ff.
[2] *Anteil der landwirtschaftlichen Nutzfläche an der Gesamtfläche weltweit in den Jahren 1961 bis 2013.* http://de.statista.com/statistik/daten/studie/159816/umfrage/anteil-landwirtschaftlich-genutzter-flaeche-an-weltweiter-gesamtflaeche-seit-1990/
[3] *Population of the entire world, yearly, 1950 – 2100.* http://www.geohive.com/earth/his_history3.aspx
[4] E.g. eBee by SenseFly https://www.sensefly.com/applications/agriculture.html
[5] *Drone4Agro* http://drone4agro.com/
[6] *SWOT Analysis* https://www.mindtools.com/pages/article/newTMC_05.htm

weaknesses, opportunities and threats. In Chapter 3.4. will these two theories be compared and explained why Schot and Geels' SNM theory suits better for this task.

The company Drone4Agro and their agricultural drone will be introduced in Chapter 1 of this report. Based on Schot and Geels, Chapter 2 contains the challenge the company faces when placing the product on the market. SNM is a theory that will be explained in Chapter 3. It is a theory about why such challenges occur[7]. Part of the strategic niche management (SNM) is the multi-level perspective (MLP) that describes niches, regimes, landscapes and their relations in general. These terms will be explained in Chapter 3 as well. Based on that, it can be determined in what manner a novelty is able to step out of the niche and into the regime[8]. During this process the decision maker needs to find the right balance between two extremes of the policy dilemmas[9]. Why these are important will be explained by using the example of Google Glass and its struggles. In Chapter 4, the SNM will be applied on the issue of Drone4Agro. Which decisions need to be made? What facts need to be considered and what is already known? The things that are not known need to be figured out in order to enable the company to take the right decisions.

1. Drone4Agro

Drone4Agro is a start-up initiated and coordinated by Rijssenbeek. The goal is to develop a certified drone for the agricultural applications. It will be able to carry 100 kg of payload and have a flight duration of 20 minutes (extendable to 1,5 hours with a range extender)[10]. "It is the flying horse for precision agriculture"[11]. The applications for such 100 kg pay load capacity drones are[12]:

- Seeding,
- Micro nutrients granulate dispersing,
- Spraying with biological (neem, tobacco) insecticides,

[7] Schot, J., and F.W. Geels, 2007: *Niches in evolutionary theories of technical change*. Journal of Evolutionary, Economics 17, no. 5, p. 605 - 622
[8] Geels, F.W., 2002: *Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study*. Research Policy 31, no. 8/9, p. 1257 - 1274
[9] Schot, J., and F.W. Geels, 2008: *Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy.* Routledge, Technology Analysis & Strategic Management 20, no. 5, p 547
[10] *The Start-up* http://drone4agro.com/about/
[11] *Drone4Agro* http://drone4agro.com/
[12] v.d.Wal, T. and J. Verschooren, 2016: *Kansen en Toepassingen von Agro-Drones: Marktverkenning.* AgroVision BV, p. 10f

- Sample taking of foliage,
- Harvesting by plucking,
- Herds guidance, and
- Herds protection and rescue.

The advantages of using agricultural drones in general for these tasks are[13]:

- Overcoming obstacles by air (no crossing waterways, bad roads, wet fields),
- Small landing area required,
- Zero ground pressure or compaction,
- High manoeuvrability in flight as compared to spray helicopters,
- High redundancy in control systems and safety systems, and
- Relatively low cost compared to helicopters and autogyros.

The advantages of the Drone4Agro that might separate itself form other agricultural drones and tractors are:

- Combination of high precision of any application with other field points in routing,
- Highly compact craft 2 by 3 meters,
- Easy transport by trailer,
- No pollution, can be driven by solar energy, and
- Fully remote controlled and completely planned routing, no operators required.

But an agricultural drone has some disadvantages as well that should be mentioned at this point:

- A tractor is still needed to gather the products,
- Drone control is based on software and – as every IT specialist is aware of – computer programs sometimes tend to run errors, and
- While Tractors can be repaired by everyone with car repairing skills, a service specialist may be required for drone repair.

[13] v.d.Wal, T. and J. Verschooren, 2016: *Kansen en Toepassingen von Agro-Drones: Marktverkenning.* AgroVision BV, p. 66ff

2. The Problem

The agricultural drone developed by Drone4Agro is a new innovation which is very different to the technologies used for the named applications nowadays. Today, drones in the agriculture are used to gather information about the crops and the ground. For all other tasks mentioned in Chapter 1 either tractors or man power is required. The problem Drone4Agro is now facing is that it needs to find a way to place itself on the overall market. To do so, the task giver and director of Drone4Agro, Mr Rijssenbeek, sets to use Schot and Geels' strategic niche management theory.

The task of this approach is to apply Schot and Geels' SNM theory on to the situation of Drone4Agro. The task giver and director of Drone4Agro, Mr Rijssenbeek, chose this theory because in his point of view, it is the most suitable. If the theory really is the most suitable will be discussed in Chapter 3.4 by comparing it with another analysis method after the SNM theory itself was explained in Chapter 3. Nevertheless, will Schot and Geels' theory be the tool that is used for this approach.

According to the SNM theory introduced by Schot and Geels, a novelty being placed on the market will struggle to be successful in the market. Novelties are forced to stay in a niche outside of the general perception and are carried by a small number of individual, collective or cooperative shareholders[14]. "If such niches were constructed appropriately, they would act as building blocks for broader societal changes towards sustainable development."[15] It can be concluded that a niche should not be seen as a sort of prison that needs to be left as fast as possible, but as opportunity to improve[16]. As soon as the improvement is done (including prototyping and networking), the stakeholders seek for a possibility to leave the niche and to place their product on the mainstream market. This is the challenge Drone4Agro faces at the moment.

The action problem targeted with this bachelor project is that Drone4Agro is inside a niche and wants to get into the regime (Terms like niche and regime will be explained in Chapter 3.1). Schot and Geels' SNM theory does not give indicators how to measure if a company got

[14] Scharpe, J.-F.: *Kurze Einführung in die Multi-Level Perspektive.* University of Stuttgart, 2014, p. 1
[15] Schot, J., and F.W. Geels, 2008: *Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy.* Routledge, Technology Analysis & Strategic Management 20, no. 5, p 537
[16] Schot, J., and F.W. Geels, 2008: *Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy.* Routledge, Technology Analysis & Strategic Management 20, no. 5, p 539

into the regime or not. But for this approach it will be supposed that the following items are important:

- Achieving a stable market share,
- Winning a certain base of customers, and
- The brand needs to be known by a certain number of target customers.

None of these indicators are adequately fulfilled. Drone4Agro is not yet present in the market. Till now, the base of customers is only a couple of early adaptors. The brand is known by the broad network of Drone4Agro and early adaptors who are interested in novelties on the upcoming market. It is evident that Drone4Agro is not inside the regime today.

3. Strategic niche management (SNM)

The SNM by Schot and Geels is a theory based on empirical findings, explaining why novelties are not directly adopted by the market and how this should by handled. It often even takes decades from the invention to general establishment (examples in table 1).

Invention	Invention date	General establishment	Duration
Telephone	1876 (first application)	Ca. 1945 (USA); early 1970s (Europe)	70 – 90 years
Television	1926 (full-electronic program)	1954/55 (USA) early 1960s (Europe)	30 years
Mobile telephone	1973 (first prototype)	2002 (USA), 1999/2000 (Europe)	26 – 30 years
World Wide Web	1989 (project proposal)	Early 2000s	12 – 14 years
Mobile Web	1996 (commercial offer)	2011 (USA) 2013/14 (Europe)	15 – 18 years

Table 1: Examples for duration from innovation to general establishment for media technologies (adapted from Scharpe, 2014, 5)

"[…] most inventions are relatively crude and inefficient at the date when they are first recognised as constituting a new invention. They are, of necessity, badly adapted to many of the ultimate uses to which they will eventually be put"[17]. That means that the novelties are not able to compete on the existing market. They are forced to improve inside a niche. A niche is a sort of "proto-market", where the invention can be tested and improved. A small number of individual stakeholders aim to build a network of people that support the project and help

[17] Rosenberg, N., 1976: *Perspectives on technology.* Cambridge, Cambridge University Press., p. 195

to develop it. This phase is so important that even governments build such niches to make it easier for developers to improve their inventions[18].

Three processes were distinguished for a successful development of a niche (by Elza, Hoogma, and Schot[19] and Kemp, Schot and Hoogma[20]):

- The articulation of expectations and visions. Expectations are considered crucial for niche development because they provide direction to learning processes, attract attention, and legitimate (continuing) protection and nurturing.
- The building of social networks. This process is important to create a constituency behind the new technology, facilitate interactions between relevant stakeholders, and provide the necessary resources (money, people, expertise).
- Learning processes at multiple dimensions:
    - Technical aspects and design specifications,
    - Market and user preferences,
    - Cultural and symbolic meaning,
    - Infrastructure and maintenance networks,
    - Industry and production networks,
    - Regulations and government policy, and
    - Societal and environmental effects.

After developing an appropriate niche and improving the product as well as the network, the stakeholders search for a window of opportunity to step into the regime.

3.1. Multi-level perspective (MLP)

The multi-level perspective (MLP) is part of SNM. After looking at the explanation of the different levels of MLP. Afterwards an example will make the definition more comprehensible.

[18] Schot, J., and F.W. Geels, 2008: *Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy.* Routledge, Technology Analysis & Strategic Management 20, no. 5, p 538
[19] Elzen, B., R. Hoogma, and J. Schot. 1996: *Mobiliteit met Toekomst; Naar een vraaggericht technologiebeleid [Mobility with a future. Towards a demand-oriented technology policy].* Report to the Ministry of Traffic and Transport (in Dutch), Adviesdienst Verkeer en Vervoer, Rijkswaterstaat, Rotterdam
[20] Kemp, R., J. Schot, and R. Hoogma. 1998: *Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management*. Technology Analysis and Strategic Management 10, no. 2, 175 – 196

The MLP explains the structure of the three different levels inside the overall market[21]. This is important for inventors to understand if they want to place a novelty on the market. It helps to understand what needs to happen to step up of the niche onto the mainstream market.

The MLP introduced by Geels (2002) describes three different levels (Figure 1):

- *Niche.* The niche is where the novelty is placed first and where it can be improved and tested over and over. This level can be structured by the inventors themselves. What is needed to develop the niche successful is already explained in the previous chapter.
- *Regime*. This is where the inventors want to go with their product. It represents the mainstream market. The regime is based on six dimensions: Science, culture, technology, policy, industry, and markets including user preference. These dimensions determine which product is bought by the mainstream customers.
- *Landscape.* The landscape describes all dynamics that cannot be directly influenced by the niche actors, i.e. general trends like globalization or customization as well as natural phenomenon like global warming[22]. Changes in the landscape cause radical changes of the dimension of the regime underneath it.

The example of the niche of electric cars is a good way to explain the multi-level perspective (MLP). Electric cars are bought by a relative low number of people in comparison with the number of people buying a fuel-engine car. Engineers are working hard on improving electric cars and installing the needed loading stations for the infrastructure. The regime is the overall and mainstream market. It is ruled by fuel-engine cars. But the landscape forces this regime to change in several ways:

- Fuel-engine cars produce a high amount of pollution. Avoiding global warming becomes more important to potential customers;
- The amount of petrol is limited and will at a certain point of time become short. The outcome of this is that fuel gets more and more expensive.

[21] Geels, F.W. 2002.: *Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study*. Research Policy 31, no. 8/9, p. 1257 – 1274
[22] Scharpe, J.-F.: *Kurze Einführung in die Multi-Level Perspective.* University of Stuttgart, 2014, p. 1

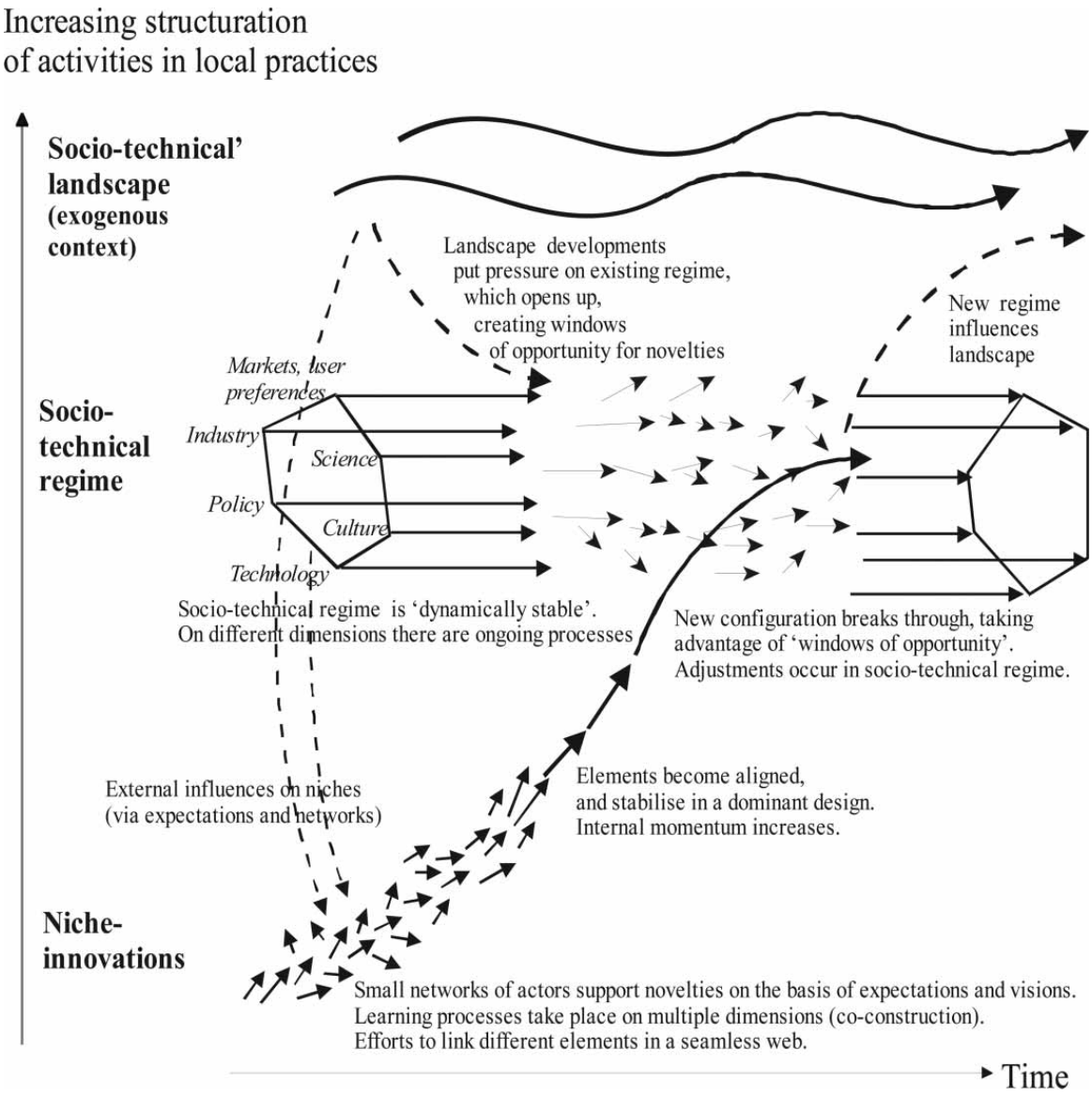

Figure 1: "Multi-level perspective on transitions" (adapted from Geels 2002, 1263)

The electric car as well as other novelties seek for windows of opportunities to step out of their niches and into a regime.

3.2. Stepping into the regime

A window of opportunity (WO) is the possibility for a novelty to make the step out of the niche and into a regime. There are three possible manners for the novelty to use a WO and to step out of the niche into a regime (Rotmans/Loorbach 2010[23]; Geels/Schot 2007):

[23] Rotmans, J., D. Loorbach, 2010: *Towards a better understanding of transitions and their governance*. A systemic and reflexive approach. In: Grin, J., J. Rotmans, J. Schot: *Transitions to sustainable development*. New directions in the study of long term transformation change. New York: Routledge, p. 105ff

- *Bottom-up.* The niche could become that big that it replaces the existing regime and become the new regime.
    - An example for this is the website Wikipedia.org. Before Wikipedia.org was the dictionary the most important knowledge database. It was the common product of the regime of getting information for decades. But several advantages of Wikipedia.org (multilingual, open source, up-to-date, fast and intuitive use, etc.) made it to the new regime.
- *Top-down.* The landscape causes such a pressure that the existing regime is forced to change. This makes it instable and the novelty is able to get into the regime.
    - The sector where the landscape has a huge factor is the weapon industry. Under legal terms the weapon industry is not able to cause a war. In war the demand on new technology is highly increased and depends on the technology and power of the enemy. The factor "war" is part of the landscape because neither developer nor regime actors are able to influence it.
- *Proactive.* The existing regime includes the novelty by deciding to integrate it. This happens when the regime actors chose to integrate the novelty on basis of search- and development processes.
    - The market leaders of the car industry are General Motors, Volkswagen, Toyota and a couple more[24]. The regime is based on the technology of fuel-engine cars. But the market leaders tend to implement electric cars more and more in their product range.

Now is understood what the strategic niche management (SNM) and the multi-level perspective (MLP) is about. Next, will be explained that the decision maker (Mr Rijssenbeek), who wants to place his novelty (Drone4Agro) in a regime successfully, needs to keep an eye on the policy dilemmas. The more adequately the policy dilemmas are determined, the better the niche development is performing. If the policy dilemmas are not adequately balanced, the regime can still be reached by the novelty by a WO that was discovered by analysing the MLP. But the performance is very limited. An example what happens when the MLP was analysed

[24] *These 14 giant corporations dominate the global auto industry*. http://www.businessinsider.com/car-companies-of-the-world-2015-2?IR=T

and a WO was found but the policy dilemmas ignored is the Google Glass published by Google. The reason for Google Glass not performing in the market will be taken as an example after a more detailed explanation of the policy dilemmas, captured in Chapter 3.3.

3.3. Policy dilemmas

The policy dilemmas listed by Schot and Geels (2008, 549) concluded from their theory help to guide the decision maker during the SNM process. Each policy dilemma has a left hand extreme and a right hand extreme (Table 2). The decision maker needs to find the right balance between those two in order to reach the goal in an efficient and suitable manner. The theory only lists the policy dilemmas as shown below. There is nothing said about how they concluded them neither what needs to be known to find the right balance.

Discipline	Left hand extreme	Right hand extreme
Expectations, visions	Be flexible, engage in iterative visioning exercises; adjust visions to circumstances and take advantage of windows of opportunity.	Be persistent, stick to the vision, persist when the going gets tough.
Learning	Create variety to facilitate broad learning.	Too much variety dilutes precious resources and prevents accumulation. It also creates uncertainty and may delay choices/commitments (by consumers, policy makers).
Learning	Upscaling through bricolage strategy and stepwise learning. Disadvantages: (1) slow, (2) incremental steps.	Upscaling through breakthrough strategy and big leaps to achieve success rapidly. Disadvantages: (1) danger of failure, (2) misalignment with selection environment.
Network	Work with incumbent actors, who have many resources, competence and 'mass' try to change their agenda, visions.	For radical innovations, it is better to work with outsiders, who think 'out of the box' and have new ideas. Incumbents have too many vested interests and will try to hinder or encapsulate radical innovations.
Protection	Protection is needed to enable nurturing of niche-innovations.	Do not protect too long and too much. This might lead to limited exposure to selection pressures (and the danger of creating white elephants).
Niche-regime interaction	Wait for 'cracks' in the regime, and then vigorously stimulate niche-innovations. Until such windows of opportunity arise, niches should be nurtured to facilitate stabilisation.	Use niche experiences to influence perceptions of regime actors and actively create cracks in the regime.

Table 2: "Policy dilemmas for niche development" (adapted from Schot and Geels 2008, 549)

Now that the policy dilemmas are listed, the example of Google Glass will be used to clarify what happens when they are not adequately balanced. There is no official linking between the failure of Google Glass and Schot and Geels' policy dilemmas. But if it the policy dilemmas are better understood by using this example, the example fulfils its duty.

Google Glass is an optical, head-mounted display[25] published by Google in April 2014. Google was able to place its product on the market because of knowing their environment, the multi-level perspective (MLP). But the niche development was not done. The product, services, networks and/or company was not ready for being inside a regime. By looking though several media[26], it can be concluded for the policy dilemmas:

- *Expectations, vision:* The company kept sticking to its vision of the product. There was no room for adjusting product strategy or customizability of the product. This policy dilemma was very right handed.
- *Learning 1:* Saving resources during development had the highest priority. No money was spent to create variety. There were no comparable products on the market and the developers thought being fast was more important than to be market user orientated.
- *Learning 2:* Google was going for a breakthrough strategy. They wanted to publish their innovative product on the market as fast as possible. Being a world-wide company known for its innovative novelties helped with that, but it failed because of various reasons. If Google would have chosen to go more left sided of this policy dilemma a lot of these mistakes could have been prevented.
- *Network:* Google kept its Network as narrow as possible because there are many other companies who are very interested in copying the novelties of the company. What looked first like a smart approach failed because of lack of manpower, leading to missing innovative ideas. This policy dilemma should have been a bit more right handed.
- *Protection:* For every novelty, critics are not far away. Google got the most critics for the expedience, voice control and design of their product. It is unknown why the

[25] *Optical head-mounted display*, https://en.wikipedia.org/wiki/Optical_head-mounted_display#cite_note-89
[26] Men's Journal, 8th Aug 2016; KQED, 8th Aug 2016; Columbus Dispatch, 4th Jan 2016; etc.

company did not listen to these critics. Nevertheless, they did not listen to them and kept their original concept. Based on the public information available, it can be concluded that in this case Google was too left-handed.

- *Niche-regime interaction:* They made it to enter the regime. Even if it was too early, it can be said that Google achieved to manage this policy dilemma.

3.4. Theory review

The theory of strategic niche management (SNM) by Schot and Geels (2007) is about the environment of novelties when they are placed on the market. The multi-level perspective (MLP) helps to understand the structure of the market. It consists of three different levels: niche, regime and landscape. The novelty starts inside a niche where it runs through further developments and becomes supported by various people inside a network. The stakeholders aim to enter the regime with the novelty. The regime is the mainstream market including the current market leaders. The landscape represents everything that influences the regime and is independent form actors of the regime and the niche. The novelty is able to step into a regime by using one or a combination of up to three different types of windows of opportunity (WOs). Based on this theory were the policy dilemmas introduced. The policy dilemmas help to guide the decision maker of the novelty to implement it in the regime.

It is conspicuous that till now nothing is said about money. There are certain conflicts a decision maker needs to take into account while building a start-up company. The most important decisions include investment, financing and dividends[27]. These are factors that investors might be interested in. They are important for networking during the niche development. A company needs to generate shareholder's wealth and add value[28]. It is also important for the product to be financially beneficial for potential customers. Why should the customers leave the product they know and adapt a novelty?

Mr Rijssenbeek wants to keep the financial aspect out of this approach. It is assumed that the finance part of the company is well structured and attractive enough for investors and potential customers. It is not recommended to take out the financial aspects, but the task

[27] Saritha Pujari: *Finance Manager: Tree Major Decisions which Every Finance Manger Has to Take* http://www.yourarticlelibrary.com/management/finance-manager-three-major-decisions-which-every-finance-manager-has-to-take/8746/
[28] Hill, R. H., 2008: *Strategic Financial Management*. Bookboon.com, p. 102f

giver is convinced that the financial aspects do not need to be included and to stick to the given theory.

Another possibility to analyse the situation of a project or start-up company is the SWOT analysis[29]. "A SWOT helps a company to understand what the dynamics of everything related to the situation being contemplated are"[30]. This analytic method focuses on the strengths, weaknesses, opportunities and threats according to a project of a company. These factors help the decision maker help to "determine whether a new project is worth pursuing or not"[31]. It is often used while building up a strategy. Because of this, it is important to carry out a SWOT analysis at the beginning of a niche development.

The SWOT analysis is already done for Dron4Agro[32]. For this approach, it is agreed with Mr Rijssenbeek to focus on the SNM Theory of Schot and Geels. This theory focuses on the possibilities of entering a regime and designing an appropriate niche until stepping over.

[29] Pestle analysis contributor, 2013: *What is SWOT Analysis – A Simplified Definition.* http://pestleanalysis.com/what-is-swot-analysis/
[30] *What is SWOT Analysis for Organizations.* http://pestleanalysis.com/what-is-swot-analysis/
[31] *What is SWOT Analysis for Organizations.* http://pestleanalysis.com/what-is-swot-analysis/
[32] v.d.Wal, T. and J. Verschooren, 2016: *Kansen en Toepassingen von Agro-Drones: Marktverkenning.* AgroVision BV, p. 28ff

4. Decisions making

Drone4Agro is already heading the end of the development and improvement inside the niche. Business plan[33] and marketing plan[34] are already existing in Dutch and a network of stakeholders is built[35]. This chapter will explain the facts to be considered by the decision maker Mr Rijssenbeek in order to enable the agricultural drone to step up from the niche into the regime based on SNM.

4.1. Knowledge problem

A knowledge problem is a question asking for knowledge that helps to solve a given problem[36]. The Problem that needs to be solved is to place Drone4Agro on the regime. Moving from the niche to the regime can only be done as soon as niche development is done. The stage of the niche development can be found by analysing the policy dilemmas. If the policy dilemmas are surely balanced by the decision maker, the time inside the niche development is heading its end. This follows that it needs to be known the state of the policy dilemmas. One knowledge problem will be:

"Is the balance of the policy dilemmas chosen and if not, how shell they be balanced?"

If the policy dilemmas are not properly surely balanced, there exists a lack of information for the decision maker. The decision maker needs that information to decide the appropriate balance for the policy dilemmas.

Once the policy dilemmas are surely balanced, it still needs to be identified how to step into the regime to finally solve the problem. To identify a suitable window of opportunity, it needs to be known how the environment of Drone4Agro looks like. The environment is best described with the MLP. Therefore, the second knowledge problem is:

"What does the multi-level perspective for Drone4Agro look like?"

This question can be answered by splitting it into the three different levels. There is no clear application manual how to do it, because "So far, SNM has been used primarily for ex-post

[33] *Business plan Project Drone 4 Agro.* Drone4Agro, 2015, v2.0
[34] v.d.Wal, T. and J. Verschooren, 2016: *Kansen en Toepassingen von Agro-Drones: Marktverkenning.* AgroVision BV
[35] *The Start-up* http://drone4agro.com/about/
[36] Heerkens, H., 2012: *Geen Prbleem: Een aanpak voor alle bedrijfskundige vragen en mysteries.* Business School Nederland, p. 26

evaluations of case studies. It has not been applied prescriptively in ongoing processes"[37]. The analysis of possible windows of opportunity, niche, regime, and landscape will therefore be self-constructed.

4.1.1. Windows of opportunity (WOs)

As already mentioned in Chapter 3.2., there are three kinds of WOs that differ in a possible manner of the novelty to step over into the regime. Now will they be applied to the situation of Drone4Agro:

- Bottom-up WOs give Drone4Agro the opportunity to build up such a big niche, that the niche becomes the new regime. This requires good knowledge about how to extend the niche.
- Top-down WOs occur when the landscape puts such a big pressure on the existing regime that it is forced to change. On that point the novelty is able to step over into the regime. But it is important to understand how the regime will change in order to develop the novelty in the direction that it will fit into the newly changed regime.
- Proactive WOs open even if the regime does not change. This happens when the actors of the regime simply recognize that the novelty fits better to the given dimensions than the current market leading technology. This sort of WO can be created by adjusting the novelty in a way the actors of the regime want them to. This needs time and a good understanding of the targeted regime.

There is no need in targeting just one sort of WO. It is even possible to combine different types to one, but it is more efficient to focus on one of them: While opening a bottom-up WO requires high assertiveness and pertinacity, a proactive WO asks for high flexibility and adaptability.

4.1.2. Niche

Drone4Agro is already in a niche. It needs to be known how well the niche is developed including network, business plan, market strategy, innovation development, etc. In total this means that the current state of the niche needs to be overviewed.

[37] Schot, J., and F.W. Geels, 2008: *Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy.* Routledge, Technology Analysis & Strategic Management 20, no. 5, p 548

4.1.3. Regime

The decision maker is free to choose the regime he wants to focus on. Each regime is based on the six dimensions that set the demand of a specific market. As long as the current market leading technology suits to these dimensions better than the novelty, no window of opportunity will open. So it is important to know the state of the six dimensions, in order to know what needs to be changed (improvement of the novelty or by penetrating the six dimensions), and what the current market leading technology is.

One example for that is already done by Drone4Agro. A regulation done by the European Aviation Safety Agency (EASA) divides drones into different categories based on their weight. Drones over 150 kg have stricter limitations than drones under 150 kg. Therefore, Drone4Agro designed their agricultural drone so that it weights under 150 kg.

Based on the understanding of the regime, the company can decide in what manner the novelty could step into a regime (bottom-up, top-down, or proactive).

4.1.4. Landscape

The landscape is very difficult to influence. The landscape is determined by the general interests and opinions of humanity. It sets pressure on the regimes and form the dimensions dynamically. When the landscape and its trends that influence the target regime are understood is it possible to predict future changes of the regime. This helps to improve the novelty in a way that it fits to the future regime.

The subject drone is very new in various markets. This new technology is facing a lot of discussions all over the globe. This follows, that the landscape – especially the laws – fluctuate. The opinion people have about drones may change rapidly. On the one side is it difficult to plan with such a landscape, but on the other side is it a lot easier to influence and to shape the landscape.

4.2. Research planning

The first step to answer the research questions is to determine what is already known and what needs to be known. A lot of information about niche, regime and landscape can be found in the business plan of Drone4Agro. Furthermore, will an interview with Rijssenbeek give the possibility to get a deeper insight in general as well as in specific issues.

In the next step needs to be determined what is not already known by Drone4Agro but still important to know for the policy dilemmas and the MLP. Research method will depend on the information that need to be gathered.

4.2.1. Interview questions

The following questions will be addressed to Mr Rijssenbeek. Some of these questions can also be answered by the business plan, but are still necessary. It might occur that new aspects and opinions will emerge. Being in a niche is a fast changing state of a novelty. Each of the following main questions is linked to a policy dilemma and/or asks for information for the multi-level perspective (MLP). The secondary questions give the subject more detail.

- How flexible is the vision of Drone4Agro?
    - Is there a type of window of opportunity (WO) that is focused on? Which?
        - It is important to know possible WOs, because the vision can be adjusted to aim at a specific type of WO.
    - What parts of the vision won't be changed in spite of everything?
        - This question determines the parts of the vision that are the most persistent. They are the backup when it gets tough.
- How do you learn to do things right?
    - Do you create variety to facilitate broad learning?
        - A high variation is important to find out the best possible manner for certain subjects.
    - Where do you draw the line in variety?
        - Too much variety dilutes precious resources and prevents accumulation. It also creates uncertainty and may delay decision making.
- How did you come to your business strategy?
    - Did you built the strategy by stepwise learning or big leaps to achieve success rapidly?
        - This policy dilemma actually needs to be handled much earlier. But it is still important to know in order to adjust the strategy in the future.
- How would you describe the network of Drone4Agro?

- Who are the most important actors? With whom do you want to work in the future?
  - The people inside a network can highly influence the development of Drone4Agro. That is why it is important to know with whom the company is working together.

- Do you see any dangers for the novelty?
  - Are there people who highly criticize the agricultural drone? Why do they do that?
    - The novelty needs to be defended and protected against critics. By listening to the critics the novelty can be improved.
  - How do you permit seeing white elephants?
    - A possibility to prevent seeing danger where actually no danger is makes the development process more efficient. Each WO comes with a sort of risk. If the decision maker is too careful, he might miss a WO.
  - What benefits do you see from staying inside a niche?
    - The niche is where the novelty is improved. But it should be known what still needs to be improved or if the time has come to seek for a WO.

- In what manner are you trying to affect the regime to open it for the novelty?
  - How does the regime look like that you are targeting?
    - The regime can be influenced in an efficient manner only if the target regime is known.

4.8.2 Analysis of the answers

This step analyses the information that are given based on the answers of the interview questions. It is important to understand the given information to get to know what is not known to be able to proceed to the application of the theory about strategic niche management and multi-level perspective. For the analysis the information will be sorted by the different disciplines of SNM and MLP. For example, the answers that proved information for the policy dilemmas will be separated from the rest of the information and linked to the policy dilemmas.

If the interview provides sufficient information, this chapter will already answer the knowledge questions.

4.8.3. Additional research

This step needs to be done if the interview did not provide sufficient information. If the information is sufficient, Mr Rijssenbeek knew the complete answer to every question and the questionnaire was adequately designed that the 'Analysis of the answers' needs no additional information to answer the knowledge problems. If not, additional research is necessary. It can also happen that Mr Rijssenbeek tells by himself to take a closer look on a certain issue. But if that happens, is it important to predict if the requested information is actually required for the further research. If not, that issue will slow down the whole process and may waste resources.

The further research will be designed in an efficient way to gather the information required. If no further information is needed, the project proceeds to the next step of the research, 'Applying the theory'.

4.8.3. Applying the theory

Schot and Geels' theory about strategic niche management was never applied or tested on a running project. They only analysed the processes afterwards. That is the reason why there is no ideal manner given to apply the SNM and MLP theory on a running project.

The application will be tailored to Drone4Agro. The different parts of the application are SNM including policy dilemmas on the one hand and the MLP on the other. The SNM afterwards tells what to do about the niche development and the MLP how to get into the regime. These are the final information that are the goal of this bachelor assignment. Applying the theory will tell the decision maker what needs to be done to perform well and to solve the problem.

5. Research

The research is performed like described in the previous chapter. It starts with the summary of the answers of the interview. Afterwards the information of these answers are sorted. The next step is an additional research to gather needed information that could not be gathered by the interviewing Mr Rijssenbeek. This additional information will be integrated in the sorted data from the previous step. The sorted data are needed to apply Schot and Geels' theory about strategic niche management and the multi-level perspective.

5.1. Answers of the interview

This chapter provides the answers of the interview. Mr Rijssenbeek had an answer to every question. Most of these questions could be answered by Drone4Agro's business plan[38] and/or marketing plan[39] as well. But speaking to Mr Rijssenbeek will provide the most updated information and if he is not sure on a specific question, there might be a leak of information. The leak of information is an indicator that more research needs to be done.

- How flexible is the vision of Drone4Agro?
    - The vision is highly flexible and freely optimistic. The drones are customizable as long as the customization is doable with the given budget.
  - Is there a type of window of opportunity (WO) that is focused on? Which?
    - The biggest challenge is the policy dimension of the regime. The restrictions given by institutions and agencies (see 'How would you describe the network of Drone4Agro?') permit the Drone4Agro to be used. These policies need to change. Drone4Agro already asked for that but got rejected. Now Drone4Agro will contact other drone intercessors as well and will penetrate the institutions and agencies to force them to change the policies.
  - What parts of the vision won't be changed in spite of everything?
    - The basic version of the drone is a nine-engine spraying drone will not be changed in spite of everything.
- How do you learn to do things right?
    - The learning technique is to learn with others, to listen to the customers and to compare the possibilities.
  - Do you create variety to facilitate broad learning?
    - Drone4Agro is trying to improve their agricultural drone. It is very important to get to know the best possible manner. But there always should be an eye on the resources are used up, there won't be anything left to improve with.

[38] Drone4Agro, 2015: *Business plan: Project Drone4Agro.* v2.0
[39] v.d.Wal, T. and J. Verschooren, 2016: *Kansen en Toepassingen von Agro-Drones: Marktverkenning.* AgroVision BV

- Where do you draw the line in variety?
  - Developing the drone is far more important than giving the company a high amount of prestige. Drone4Agro wants to let the product speak for itself and not to build up a high prestige. They want to keep up with the important issues. The line is where prestige is highly more important than actually improving the product.

- How did you come to your business strategy?
  - The business strategy is designed focus on the product. The hole strategy is built to provide a well-performing product.
- Did you built the strategy by stepwise learning or big leaps to achieve success rapidly?
  - Drone4Agro takes the time that it needs. Even if other companies are following, it is more important to perform well then being the very first. Mr. Rijssenbeek is the opinion that a stepwise learning is a better way of building a strategy than with big leaps.

- How would you describe the network of Drone4Agro?
  - The network consists of different kinds of partners. They are divided in institutions, agencies, universities and business partners. The institutions and agencies (NLR, EASA and CTB) put up the conditions under which drones may be used. These conditions are at the moment still too strict to have a permission to use the Drone4Agro. The universities help the company to improve the drone. Various courses of studies from a universities and universities of applied science work on various subjects to improve the propeller, the doc-in station and marketing. The business partners are mainly suppliers. For each part of the drone is a supplier chosen that is bonded to a contract. The contract guaranties an amount of quality. If the contract does not meet the conditions, Drone4Agro may recall the contract immediately.
- Who are the most important actors? With whom do you want to work in the future?

        - The most important factors influencing the project are the institutions and agencies. They make the laws under which a drone may fly. At the moment Drone4Agro's agricultural drone is not allowed to fly. The institutions and agencies need to change their policy before Drone4Agro may sell their drones.
        - The business partner Boessenkool will be an investor and partner for Drone4Agro.

- Do you see any dangers for the novelty?
    - Are there people who highly criticize the agricultural drone? Why do they do that?
        - There are many reasons why people think that Drone4Agro will not succeed. The regulations are too strict, the drone is too dangerous and people are too afraid of drones. But in fact drones are nothing else than model aircrafts. Model aircrafts are remotely piloted aircraft systems as well and they are around since decades. Trucks are far more dangerous than drones. They have much more mass on a higher speed and people aren't afraid of them anymore. Drone4Agro provides demonstration flights and guidance held by trained personal. People only need some time to get used to drones.
    - How do you permit seeing white elephants?
        - The niche is developed and everything is heading its way. Drone4Agro will soon be ready to step into the regime once the guidelines for drones are changed. But in the past seeing white elephants wasn't a bad thing. They made it possible to argue. When keeping an eye on every contra argument, the agencies and institutions will soon not be able to abnegate Drone4Agro.
    - What benefits do you see from staying inside a niche?
        - The niche helps to build up a suitable network and to reach the first pioneers adapting the product. After the pioneers, early adaptors and soon commercial customers will follow.
- In what manner are you trying to affect the regime to open it for the novelty?

- Drone4Agro works together with other drone intercessors to penetrate the agencies to change the laws. The technology that the laws are based on is out-dated and there is more secure and more efficient technology that could help to update these restrictions that the Drone4Agro will be able to be used. Today drones up to 150 kg like Drone4Agro need a flight permission for every single flight. Getting a flight permission needs up to a couple of months, because the requested flight route needs to be checked. If there is already another flight object crossing at the same time, the request will be rejected. This is a problem because Drone4Agro is a system that plans its flight routes by getting the temporary information of the crops. Mr Rijssenbeek sees the flight planning as an outdated system, because existing communication technologies are able to predict the trajectory during the flight. The system is able to determine possible collusions and tell the pilot or autonomous steering system to correct its trajectory a little bit. The collusion is therefore prevented dynamically on the flight.
- Drone4Agro provides demonstration flights and guidance held by trained personal in order to make people used to drones and to show their benefits.

o How does the regime look like that you are targeting?

- At the moment tractors and helicopters are the market leading products on the market. But they are far less efficient than the Drone4Agro.
- There are two different spraying possibilities – chemical and non-chemical. Drone4Agro has decided to focus on chemical spraying after doing research on the market.

Mr Rijssenbeek answered all questions based on research and decision making. The questions were designed to answer the knowledge problem. From this follows that no further research is needed. But the analysis of the answers that is handled in the following chapter might uncover a leak of information. If there is still information missing, additional research needs to be done.

5.2. Analysis of the Answers

The gathered information will be sorted for policy dilemmas and multi-level perspective.

The policy dilemma consists of six disciplines that each have a left and a right hand side. It is meant to determine the balance between these two. The policy dilemmas are mainly important in the niche development face. If Drone4Agro is really that far in its development that it is heading to the end of the time in its niche, the policy dilemmas shall be pretty secure in its values. The highest security is not met when left hand, right hand nor a 50-50 balance are adapted to every policy dilemma. But when the argumentation underlines the balance of the policy dilemma. If for example the decision maker is not sure if he designed the vision flexible or not, he might be still right at the beginning of the niche development.

The MLP is to understand the environment of the novelty including niche, regime and landscape.

5.2.1. Policy dilemmas

This chapter will give answer to the research question: “Is the balance of the policy dilemmas chosen and if not, how shell they be balanced?” (see ‘4.1. Knowledge problem’), if there is enough information**.** Again, there is nothing said about how to apply the policy dilemmas onto a temporary situation of a company**.** The balance of the policy dilemmas can be found in figure 2. Each policy dilemma can lead to max. 100% to the left hand side or 100% to the right hand side. The bars in the middle of the figure show the orientations of Drone4Agro to each policy dilemma. The darker the bar is, the surer is the decision maker with this policy dilemma. Mr Rijssenbeek was in all is answers very secure and that is why all policy dilemmas appear in a dark blue.

1. *Expectations, vision:* The first policy dilemma is about expectations and the vision. It must be known what may be changed and what shell not. To be able decide that is an overview of cost and customer interests needed. Mr Rijssenbeek mentioned that the vision is highly flexible but still has issues that will not change in spite of everything. hat will not change is the size of the basic drone. He decided this based on market research and evaluating customizability costs. Drone4Agro is more heading to the left hand side of policy dilemmas in this discipline.

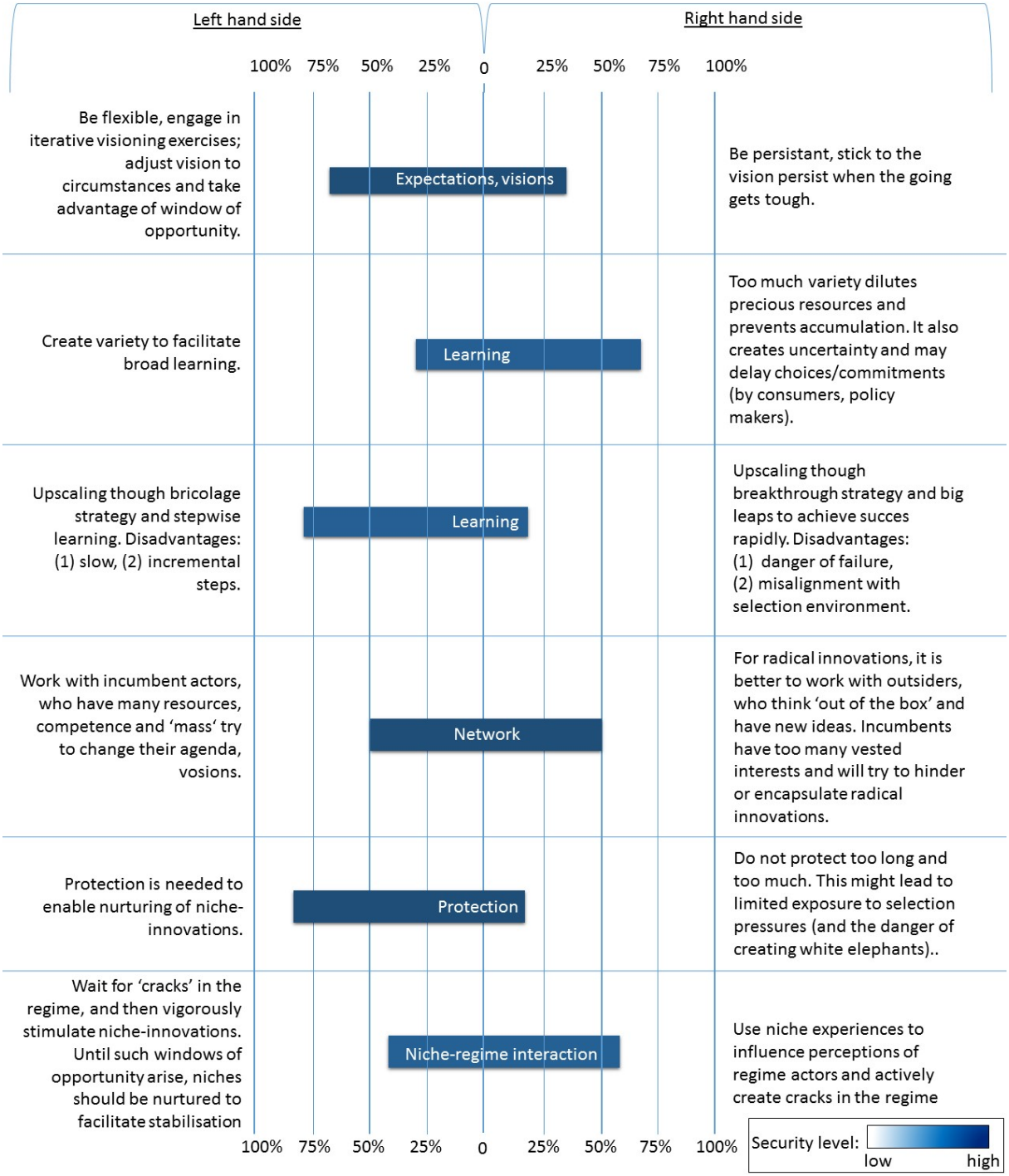

Figure 2: Balance of policy dilemmas of Drone4Agro based on the interview. (adapted from Schot and Geels 2008, 549)

2. *Learning 1:* To determine the right balance for the first learning policy dilemma is an overview needed about how much the decision maker will learn by experimenting and testing as well as how much the development steps cost. Even if Mr Rijssenbeek is the opinion that variety is an important tool to learn, he takes financial aspects into account. He really focuses on improving the product. He works close together with other actors inside the niche and listens carefully to his customers. All in all, does he

know the danger of variety and of the loss of short resources that he does not want to waste. Based in this, he is more orientated to the right hand side of this policy dilemma.

3. *Learning 2:* The other discipline about learning is more orientated to a bricolage strategy and stepwise learning. It is important to know the consequences and the risk of performing badly. Building a strategy by big leaps is cheaper but is also riskier. Drone4Agro is an unknown start-up brand that is entering a market that didn't have such a big novelty for decades. The consequence of performing badly would be devastating. Mr. Rijssenbeek decided that a stepwise learning is a better way of building a strategy than with big leaps and therefore raises the chance of performing well.
4. *Network:* All possible partners and actors as well as their influence towards the project must be known to evaluate the best balance for the network policy dilemma. The network of Drone4Agro consists of a lot of different people including companies that are incumbent actor, who have many resources, and universities that are more 'out of the box thinker'. Because of this is Drone4Agro 50-50 balanced in for the network policy dilemma.
5. *Protection:* For the protection policy dilemma is an objective point of view towards the company needed. Mr Rijssenbeek needs to know advantages, disadvantages and the opinion of relevant people about Drone4Agro. He is very convinced of Drone4Agro. But he also says that other people have many reasons not to believe in the product. He understands their opinion but is convinced that people only need to get used to drones. Till then the novelty needs to be protected. Because of this the protection policy dilemma is strongly orientated to the left hand side.
6. *Niche-regime interaction:* To find the right balance for the niche-regime interaction policy dilemma it is necessary to know the MLP (Chapter 5.2.2. Multi-Level Perspective) as well as how far the project is. If the project is absolutely not ready to be sold this policy dilemma should spend more time in the niche and should stay passive. If the company is settled and ready to go including the product, network and internal structure, the decision maker should decide to penetrate the market more. Mr Rijssenbeek sees the biggest problem for entering the regime in the restrictions given by institutions and agencies. This is part of the dimensions of the regime and can

usually only be changed by the landscape. His plan is to penetrate the institutions and agencies together with other drone intercessors to make them change the restrictions. This means that he brings the attention of a part of the landscape to this certain issue. On the other hand, he is convinced that the restrictions will change any way and it is only a matter of time. The technology for more efficient communication between flight objects is already available. It only needs to be adopted into the restrictions.

All in all, the policy dilemmas show that they are all a settled and hardly to move anymore. This is an indicator that the time of the niche development comes to an end and that Drone4Agro will soon be ready to step into the regime.

5.2.2. Multi-Level Perspective

This chapter will give answer to the research question: "How does the multi-level perspective for Drone4Agro look like?" (see '4.1. Knowledge problem'), if there is enough information. But the main problem - stepping into the regime - will be handled in the Chapter '5.4. Applying the theory'. The multi-level perspective (MLP) introduced by Schot and Geels (2008) is about the structure of the environment of the novelty. It consists of niche, regime and landscape (see Chapter '3.1. Multi-Level Perspective'). This chapter is about sorting the information to its place in the landscape. Here for will be taken advantage of the figure 1 on page 8. The figure will now be extended that each level is described in detail. The result is figure 3 and the following explanations.

1. The niche development is running to an end. The network is widely planned and settled with contracts. The product is primarily designed. Some components like doc-in station and propellers will be further developed by university partners. Once this is done, Drone4Agro is ready to step into the regime.
2. The regime consists of actors (sellers and customers) and products of the chemical spraying industry. This include spraying tractors and helicopters.

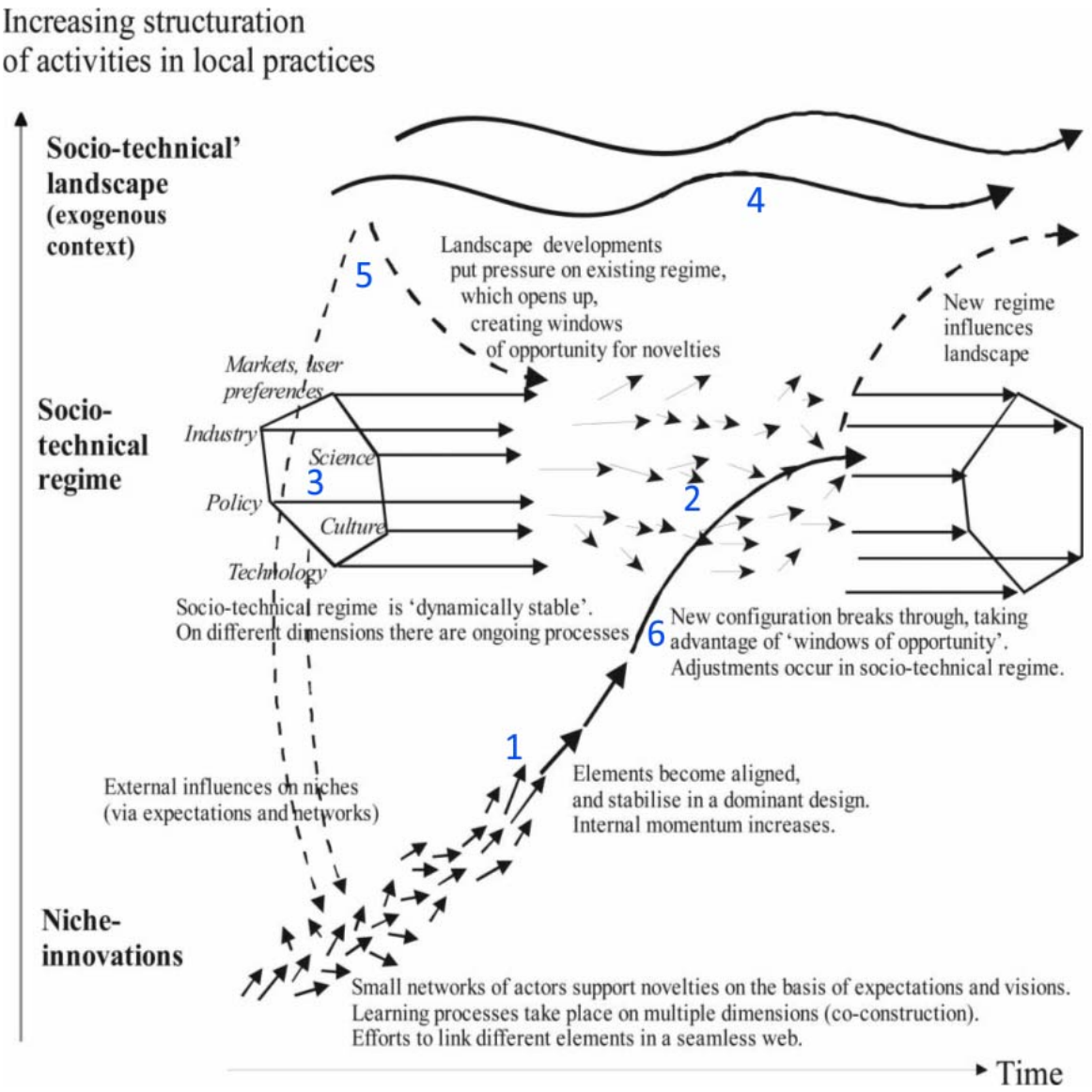

Figure 3: "Multi-level perspective on transitions" (adapted from Geels 2002, 1263) extended to explain the MLP for Drone4Agro.

3. The regime is based on six dimensions: science, culture, technology, policy, industry and market/user preference. The scientific and technological needs to implement Drone4Agro is already given after the development at the Universities will be done.

   The cultural aspect keeps the emotional and religious aspects of people in mind. Till now people are a bit conspicuous about drones. But this is just a matter of time until they recognize the benefits. This happened many times in the past. The policy made by institutions and agencies (like NLR) permit the usage of the agricultural drone of Drone4Agro as it meant to be used. The industry and market/user preference endorse Drone4Agro because of its high efficiency and autonomy in comparison to today's technologies.

4. The landscape is everything that is able to influence the market of tractors and helicopters as spraying technics. That does not directly have to be linked to the drones. Landscape factors may be worldwide demand on sprayed vegetables, novelties in permitting vermin or an increase in petrol prices.
5. The most important regime dimension that needs to be influenced by the landscape in order to place Drone4Agro in the regime is the policy dimension. If the policy does not change, Drone4Agro has no chance to get into the regime.
6. Once Drone4Agro is done with niche development and the landscape or the actors of the regime forced the regime to change, Drone4Agro will be able to step out of the niche and into the regime. The kind of window of opportunity is top-down and proactive. How that can be identified is described in Chapter '5.4 Applying the theory'.

The multi-level perspective of Drone4Agro is well described. The knowledge question is answered accurately. There is no need for additional research to describe the MLP for Drone4Agro.

5.3. Additional research

In case an interview shows lack of information, additional research would be required. Mr Rijssenbeek answered all questions with a no leak of information. He knew the answer to every subject based on research and decision making. The questions were designed to give sufficient information to apply Schot and Geels' theory about strategic niche management and multi-level perspective.

After analysing the information, the policy dilemmas and MLP are well described. This shows that the questionnaire of the interview was well designed and that all needed information were gathered.

There is no need in additional research, because the knowledge problems could already be answered.

5.4. Applying the Theory

In this chapter, the SNM theory introduced by Schot and Geels (2007) will be applied on the situation of Drone4Agro. The gathered and sorted information will be taken as basis. As

already mentioned, “it has not been applied prescriptively in ongoing processes”[40]. Because of this, the application process is self-made and carried out. This step is used in order to find a solution for the problem described in Chapter 2 (see page 4). The problem is that Drone4Agro is currently sitting inside the niche and wants to step into the regime.

After analysing the information gathered during the interview, it is now known that Drone4Agro is nearly done with the niche development. The decision maker decided how the balance for each policy dilemma has to be based on research and experience. This shows that Drone4Agro is heading its way to the end of the niche development and will soon be ready to step into the regime. In order to do the step into the regime, it needs to be defined how that can be done. The “how” is linked to a window of opportunity (WO). There are three different kinds of WO (see Chapter 3.2 on page 8). Each WO requires a different set of conditions inside the multi-level perspective (MLP) that describes the environment of the novelty. The MLP of Drone4Agro is described in Chapter 5.2.2. on page 25.

A regime is formed by its six dimensions. If these dimensions suit the novelty more than the current system, the actors of the regime will switch to the novelty. There are three possibilities how the novelty could fit better to the out-dated regime then the current system.

- The novelty creates its own regime and gets more popular than the outdated regime (bottom-up WO). This WO is suitable if the regime of the novelty highly differs from the current regime (e.g. Netflix abo and buying DVDs). In the case of Drone4Agro, the current regime does not differ that much from the regime of the novelty. There are still crops that are sprayed on the field. The only factor that changes is the machine itself. Therefore, the bottom-up WO is no appropriate WO for Drone4Agro.
- The regime dimensions change because the landscape forces them to. They can change in such a manner, that the novelty suits better to the regime than the current product (top-down WO). According to Schot and Geels, the regime dimension can only be influenced by the landscape[41]. One of the two dimensions that permits Drone4Agro to step into the regime is the cultural dimension. People are still having drones in mind

[40] Schot, J., and F.W. Geels, 2008: *Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy.* Routledge, Technology Analysis & Strategic Management 20, no. 5, p 548
[41] Schot, J., and F.W. Geels, 2008: *Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy.* Routledge, Technology Analysis & Strategic Management 20, no. 5, p 545

as threat being dangerous and scary because of its autonomy and spying machines. But Mr Rijssenbeek is convinced that this issue will change rapidly. The second regime dimension that prevents Drone4Agro to step into the regime is the policy dimension. The current restrictions given by institutions and agencies permit the agricultural drone to be used the way it is planned by Drone4Agro. All other dimensions support the novelty Drone4Agro.

- The novelty is already better than the current product and the novelty only needs to be recognized by the actors of the regime and they need to decide to take it into account (proactive WO). As soon as that happens the novelty will step into the regime. This WO is not appropriate for Drone4Agro, because the regime dimensions permit Drone4Agro to be used in the way it is planned by its inventors.

By taking a look at these possibilities, it becomes obvious that only the top-down WO seems to be suitable for Drone4Agro. Therefor the company has to wait until the landscape changes the policy dimension.

The agencies and institutions are a set of people who set the rules, restrictions and guidelines for drones. The opinion of people can be influenced. This is what Drone4Agro needs to do (figure 4). Drone4Argro forms a network with people that support drones (step 1, figure 4). This network can comprise customers that are seeking for more efficiency as well as other drone intercessors or the ministry of agriculture, being interested in enforcement of competitiveness of regional farming industry. This set of people then penetrates the institutions and agencies that set the restrictions for drones (step 2, figure 4). Once the legislators have enough pressure, they will take action and change the restrictions (step 3, figure 4). What follows is a crack in the regime that opens a window of opportunity for Drone4Agro (step 4, figure 4).

The described WO is a mixture of proactive and top-down. The regime actors are willing to adapt the novelty proactively. But the policy dimension of the regime permits this. The regime dimensions can only be changed by the landscape. The landscape cannot be influenced by the niche actors[42]. Because of this, the regime actors need to force the landscape to change the

[42] Geels, F.W. 2002.: *Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study*. Research Policy 31, no. 8/9, p. 1257 – 1274

regime dimensions. When the landscape changes the policy dimension, a top-down WO will open and will be even wider because of the proactivity of the regime actors.

The conclusion of applying Schot and Geels' strategic niche management theory on the situation of Drone4Agro is that Drone4Agro should put more effort in actively creating a crack. The niche development is heading its end and it is only up to the policy regime dimension if Drone4Agro may enter the regime. If the policy regime dimension does not change, Drone4Agro won't be able to sell its product. Based on this, it is advisable to set the niche-regime interaction policy dilemma from a balance of 40% : 60% to 20% : 80%.

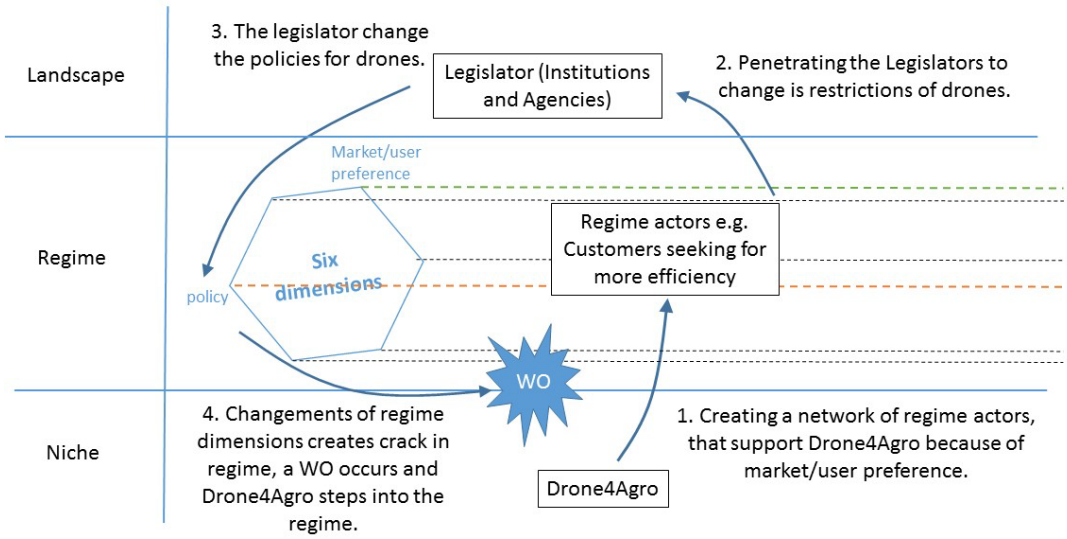

Figure 4: How to open a suitable window of opportunity for Drone4Agro.

The following actions provide the opportunity to change the balance of the niche-regime interaction policy dilemma, influence the policy dimension and therefore may open a window of opportunity.

- Contact other drone intercessors e.g. other companies or drone hobbyists that are interested in placing comparable drones on the market. This network of drone intercessors need to penetrate the institutions and agencies. This makes them to think about the given restriction continuously and might final make them change the policies.
- The given restrictions are only linked to the Europe. The restrictions of other continents might differ and allow the customers of Drone4Agro to use their

agricultural drone. Drone4Agro needs to take a look on the restrictions and guidelines on other continents. If they differ in deed, Drone4Agro should move its distribution and start its selling there.

- The restrictions of agencies and institutions are based on the overall opinion of people about drones. This opinion can be influenced by a huge marketing campaign. If Drone4Agro achieves to win the trust of the public people, they will make pressure on the agencies and institutions and force them to change their policies.

Schot and Geels' strategic niche management theory does not take financial aspects into account (see Chapter '3.4. Theory review'). But financial aspects are a huge factor that should have a high weight during the decision making process. The financial aspects were not taken into account in this thesis, because of the clear statement of the task giver. Nevertheless, it is advisable to keep an eye on certain financial hurdle during the decision process:

- Huge marketing campaigns are very expansive especially to small start-up companies.
- Going abroad generates high costs based on moving the location of distribution. The hole supply chain as well as marketing needs to be suited to other countries.
- The time Drone4Agro is not selling any products, it makes loss. It costs money to keep a company living (e.g. rent, wages and material for development). As long as it does not generate revenue, it is not generating profits. Just waiting for a WO could take some time and therefore costs a lot of money.

It is obvious that the most promising action including the financial aspect would be to build up a network with other drone intercessors. Via penetrant petitions towards the government can the policies be changed. BUVUS[43] ("Bundesverband für Unbemannte Systeme" – association for unmanned systems in Germany) is an association that is building such a community of drone intercessors. It is covering all kinds of unmanned systems regardless of its usage on land, water or in the air. One of the main tasks of BUVUS is to represent its members on front of the government. Additionally, it offers a platform where all kinds of drone intercessors can come together and provides workshops for start-ups.

[43] www.buvus.de

To get more information about how BUVUS could help Drone4Agro Mr Jan Hesselbarth, vice-president of BUVUS, has been interviewed. He said that Drone4Agro has a very interesting project and even if Drone4Agro is a Dutch company, they are willing to help them with their huddles. Drone4Agro is precisely the kind of company BUVUS is targeting and is able to support them with their international network of associations abroad. BUVUS is not only helping manufacturers and developers of unmanned, further more it advises all kinds of companies how they can improve themselves with unmanned systems.

Following the application of Schot and Geels' SNM theory, it is indispensable to contact BUVUS.

6. Summary

The bachelor assignment was to apply the strategic niche management (SNM) theory introduced by Schot and Geels (2007) on Drone4Agro. Drone4Agro is a company that is developing an agricultural drone. The problem is that the novelty is currently inside a niche but wants to step over into the regime. In order to do so, was the theory described and that policy dilemmas and multi-level perspective (MLP) have a certain role in applying the theory.

After understanding what the theory is about was clear that the balance of the policy dilemmas and the MLP of Drone4Agro needs to be known. These two components were each part of the knowledge problem. Based on the policy dilemmas could be determined how far Drone4Agro is with its niche development. By knowing the MLP can be predicted in what manner Drone4Agro could step into the regime once it is ready.

The research that helped to find the answers to the knowledge problems were designed in an efficient way. First the decision maker Mr Rijssenbeek was interviewed. If the interview let questions unanswered, an additional research needed to be done. All questions were answered and the analysis of the gathered information showed that no further research needed to be done. The policy dilemmas and the MLP are sufficient described in order to find a suitable window of opportunity (WO) when applying Schot and Geels' SNM theory.

The WO that suits Drone4Agro best is a mixture of a proactive and a top-down WO. The policy dimension permits stepping into the regime. But because of the efficiency and autonomy of the agricultural drone is the market/user preference dimension of the regime hardly

supporting Drone4Agro. This can be used to form a network of intercessors inside the regime that forces the landscape to change the policy dimension. When the landscape changes the regime dimension, a top-down WO occurs that is even wider because of the proactivity of the regime.

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