

AgroEcological Transitions

Changes and Breakthroughs in the Making

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ISBN: 978-94-6343-114-9

Published by Wageningen University & Research, Applied Arable and Vegetable Research
<https://www.wur.nl/en/Expertise-Services/Research-Institutes/plant-research/Applied-Arable-and-Vegetable-Research.htm>

Cover design by Françoise Maxime

Document available at DOI: <http://dx.doi.org/10.18174/407609>

Citing this document

Elzen, B., A. Augustyn, M. Barbier and B. van Mierlo, 2017. AgroEcological Transitions: Changes and Breakthroughs in the Making. DOI: <http://dx.doi.org/10.18174/407609>

Creating Niches by applying Reflexive Interactive Design

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Abstract

Reflexive Interactive Design (RIO) is an approach that aims to contribute to a transition towards more sustainable animal production systems. In this chapter three projects that use the RIO approach are evaluated: Pork Opportunities (pigs), Broilers with Taste (broilers) and New Livestock Husbandry (covering all sectors). In the evaluation, there is a specific focus on niche development and the interaction with the regime. The chapter shows the role of articulation of promises, building networks and learning in these projects, and in what way these led to shielding, nurturing and empowerment. All projects were successful in igniting and facilitating niche development, but to varying degrees and using different strategies. Until the time of writing (early 2015), no global niches were developed, but several local niches, that stem from these projects, are still in the process of shielding and nurturing. Although they are not powerful enough (yet) to compete with the regime, they slowly increase their potential to do so in the future. The analysis shows that the success of RIO can be equally attributed to its three essential aspects: design, interaction and reflexivity.

Keywords: system innovation, sustainable animal husbandry, redesign, structured design, co-creation, niche-development.

1 Introduction

Contemporary Dutch (and European) agriculture is in a threefold crisis (Van der Ploeg 2003; Swagemakers 2008):

- An economic crisis of stagnating revenues and increasing costs for farm households, putting their incomes under pressure.
- An ecological crisis of environmental pollution, deconstruction of natural habitats and loss of biodiversity.
- A social crisis of growing distrust in the food production system and an increasing demand for performance of more diversified functions in rural areas.

The agricultural sector, policy makers and scholars have been trying to tackle these problems since the 1980s. At some points, this has been successful, but most of the problems have exacerbated and new issues have emerged. The problems are embedded in the system, they have been institutionalized (Marsden 2003), and for the most part they are caused by modernization itself. Scholars have concluded that a transition in agriculture is needed. As a response the Dutch government started to promote a transition towards a sustainable agriculture in the 1990s (Slingerland & Rabbinge 2009).

Nowhere else is the crisis in agriculture more noticeable than in animal production chains. On top of the problems mentioned above, these systems are confronted with animal welfare issues, animal diseases, the risk of zoonosis, food scandals and (as a result) negative societal attention. Back in 2001, an appeal was made for a redesign of the animal husbandry sector (Commission Wijffels 2001).

One of the initiatives following this call was a series of projects, under the overarching programme title *Designs for System Innovation* (2001-2013), financed by the Dutch Ministry of Agriculture. Each project in

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this programme aimed for the interactive redesign of a specific animal production sector. In the course of this programme, a specific approach was developed called Reflexive Interactive Design (called RIO, in a Dutch acronym; Bos et al., 2011, Bos et al., 2009). This approach is characterized by a combination of system analysis, structured (co)design, stakeholder management and niche formation. The overall goal is to redesign husbandry systems, starting from a heterogeneous set of values and goals. These projects had the explicit ambition to contribute to a transition in animal husbandry, i.e. to ignite and facilitate 'system innovation'.

Very explicitly, RIO does not try to optimize the current system. Therefore, it starts with a critical reflection upon assumptions that are normally taken for granted in the current system. It follows the doctrine that, to tackle the problems that are institutionalized in the current system, actors have to break with existing routines. To do so, technical change is not enough. Therefore, RIO also focuses on cultural and institutional change. Furthermore, the projects make use of knowledge from multiple scientific disciplines, which is scrutinized and enriched with knowledge and experience from the field.

A central concept within the method is 'integral sustainability', meaning that an improvement on one sustainability aspect may not lead to a regression on other aspects. RIO strives for synthesis and congruency, instead of compromise (Bos 2008). To achieve this, an analysis is made of the needs and requirements of the most important actors involved in the production system: the animal, farmer, environment and consumer/citizen. These needs are summarized in so-called 'Briefs of Requirements', which form the basis for the actual redesign process.

The procedure for redesign is based on a structured design method, which is normally used to design machines and technical systems (Siers 2004; see also: Groot Koerkamp & Bos 2008; Bos & Groot Koerkamp 2009). In this approach, functions are identified to fulfill the needs that are determined in the Briefs of Requirements. Subsequently, existing and new solutions to serve these functions are generated, and combinations of selected solutions are used to design new systems. This is done in close interaction with stakeholders to stimulate implementation of the results, as a stepping stone towards igniting actual change.

One of the first projects in the *Designs for System Innovation* programme was *Houden van Hennen (Keeping and Loving Hens)*; addressing laying hen husbandry, 2002-2004). This project has been extensively studied and reported (Zwartkruis et al. 2010; Klerkx et al. 2010; Groot Koerkamp and Bos 2008; Bos 2008; Spoelstra et al., 2013). In the following years, over ten RIO projects have been executed within this programme, and various changes have been made regarding the operationalization of the general approach. The most essential changes are:

- A larger emphasis on integral sustainability. In earlier projects, the main focus was on farmer's income and animal welfare. In more recent projects, the environment gets equal attention and new issues like public health are addressed as well.
- The projects have become more interactive, especially in the design phase itself. Farmers and other stakeholders are participating in more phases of the projects while the group of participating stakeholders has become more heterogeneous.

Although the general response among participants and others appears to be very positive, thorough evaluation has been limited. In this chapter we want to focus on three of the more recent design projects, all of which used the RIO approach but with varying methodical set-ups and styles. These projects are *Pork Opportunities* (pigs: sows, piglets and fatteners), *Broilers with Taste* (chickens for meat production), and *New Livestock Husbandry* ('Het Nieuwe Veehouden', covering all livestock sectors).

We will use the multi-level perspective to carry out this evaluation, analysing to what extent and in what way niche development and niche-regime interaction has taken place. The analysis does not only lead to a better understanding of the three projects in terms of system innovation, but can also give some important clues for future redesign projects and other initiatives that try to stimulate transitions in the making.

2 Theoretical framework

RIO tries to tackle institutionalized problems by 'doing' reflexive modernization (Grin et al. 2004; Bos & Grin 2008; based on Beck 1997). This is based on the assumption that contemporary problems cannot be tackled by incremental changes within the system, because the problems are rooted in structural features of the system. For structural change, the whole system – which is normally taken for granted – has to be scrutinized, so that system failures can be addressed instead of treating the symptoms.

This kind of structural change can be understood by using the multi-level perspective (MLP) on socio-technical transitions. MLP distinguishes three analytical levels, namely (1) the socio-technical landscape of the external environment which is relatively static, (2) socio-technical regimes that comprise established practices which are produced and reproduced by a set of rules shaping and reshaping the current system, and (3) niches where novelties that break with the existing routines of the regime can develop (Geels 2002; 2005). The MLP clarifies how these levels interact with each other and how different transition pathways may develop, thus transforming or replacing an existing socio-technical regime (Geels & Schot 2007).

System innovation may result from the interaction between these three layers, and cannot be initiated or steered in a deliberate way because it stems from a complex interdependent whole of events and developments in which numerous actors are involved. One route to deliberately make a contribution to system innovation, is by niche development, i.e. creating protective spaces for path-breaking innovations (meaning innovations incompatible to and infringing with the regime). Another route is to make structural changes at the regime level, e.g. by new governmental regulations. RIO addresses the first route, taking niche development as an explicit goal (Bos et al. 2009), although (advise for) institutional interventions (like new regulations) are not ruled out.

A niche can be conceptualized at two levels that interact with each other (Geels & Schot 2010). First there are local niches: local projects or initiatives in which certain innovations are developed that challenge existing routines. These initiatives are supported by local actors, and their progress depends on local circumstances. The other level is that of global niches: the emergence of a community with shared rules as a counterpart of the regime. Local initiatives can be part of such a community. In the literature on transitions, a niche is usually understood as a global niche.

Niche development can be understood as combination of three processes that take place simultaneously (Smith & Raven 2012):

1. Shielding: creating protective space, so that the innovations are not directly evaluated (and rejected because of lock-ins and path dependency) against prevailing selection criteria. Shielding can take place by situating an innovation in a (geographical, social or economic) context that deviates from the mainstream selection criteria, or by introducing purposeful financial or regulatory arrangements.
2. Nurturing: shaping possibilities for the development of path-breaking innovations; building a novel innovation system by e.g. resource mobilization, knowledge development, market formation and creating positive externalities (Hekkert et al. 2007; Bergek et al. 2008).
3. Empowering: finding more enduring forms of institutionalization, so that 'shields' can be removed. Innovations can become competitive in an unchanged selection environment – without changing the rules of the game – labeled 'fit and conform'. Or the empowerment can take place by affecting the selection environment in ways that are favorable to path-breaking niche innovations: 'stretch and transform' (Hoogma 2000).

These processes can be stimulated by three kinds of activities (Kemp et al. 1998; Schot & Geels 2008):

1. Articulation of promises. Promises can attract the attention of a diversity of actors, it provides direction for further development and learning, it legitimates the protection provided, and it stimulates people to proceed.

2. Building networks. A variety of actors is needed to acquire the necessary knowledge, power and resources. The interaction between the actors increases the capacities of the total network.
3. Assisting learning processes. Niche development not only requires learning on how a technology functions in a technical way, but also how the technology relates to government policies, cultural and psychological meaning, functioning of markets and production chains, adequacy of infrastructure and the relation to society and environment.

All three kinds of activities are important for all three processes of niche development. Promises, for instance, are important to legitimize shielding, to keep the development going (nurturing), and by persuading influential actors to support the path-breaking innovation in its empowerment.

Smith & Raven (2012) emphasize that regime change does not come about by bottom-up processes only, or that it is simply the sum of niche developments (see also: Berkhout et al. 2004). Regime changes require interaction between niche and regime. This means that ongoing niche development – that is moving beyond local initiatives, and affecting the regime – requires outward orientation, focused on the changing interdependency of the niche and the wider social world.

On the basis of the above conceptualization, we derived the following four questions to analyse niche-development in the three projects mentioned above:

- How did the articulation of promises, building networks and learning take place in these projects?
- To what extent did (global) niche development take place?
- In what way did these activities lead to shielding, nurturing and empowerment?
- To what extent and how did the RIO approach contribute (or not) to these effects?

3 Methods

To examine the results of the projects in terms of niche development, in-depth interviews were carried out with people who participated in the projects. Per project three or four participants were interviewed. They were selected on the basis of their (expected) attempts to initiate change on their farm and on their (expected) knowledge of the progress of other participants. Most respondents were farmers, but also builders of housing systems and agricultural advisors who attended one of the workshops.

In the interviews, farmers were asked to explain the developments on their farm and plans for the future. The connection between the developments and plans, and their participation in the project was reviewed. The respondents were also asked to discuss the effects of their participation on their opinions, motivation and contacts.

After the interviews, a first analysis was made of the effects resulting from the projects, leading to a first overview of the differences in effects between the three projects. Subsequently, in-depth interviews were held with seven project team members. Most of them had been involved in more than one of the three projects in question and, therefore, were able to compare the projects with each other. In these interviews the results of the analysis of the first interviews were critically reviewed and checked. Furthermore the similarities and differences in effects between the projects were discussed, as well as the similarities and differences in the set-up and execution of the projects.

After these interviews a second analysis took place. This was done by scrutinizing the story lines of the various respondents leading to a meta-narrative of the projects: putting the events in chronological order, outlining different views and accompanying causalities, and identifying the most frequently mentioned similarities and differences between the projects. This meta-narrative was analysed, specifically focusing on articulation of promises, network building and learning, as well as shielding, nurturing and empowerment. Finally, we analysed to what extent the effects can be related to the RIO approach.

4 Results

4.1 Pork opportunities

Pork Opportunities was carried out from 2008-2010 with the aim to redesign the pig husbandry system. The project team was asked to come up with new ideas to 'produce pork in a way that is good for People, Planet, Profit and Pigs'. As most RIO projects, it started with a system analysis: the needs of the pig, pig farmers, environment and consumer/citizen were assessed. Furthermore, the key challenges in the current system were identified, as were the possibilities for change. After the system analysis and a trial design workshop for researchers only, two three-day-workshops for around twelve people were organized, with an ascending heterogeneity in group composition:

- In the first workshop, researchers and pig farmers participated. They worked together on three designs for a new way of keeping pigs.
- In the second workshop, researchers were only present to facilitate. The actual design process was carried out by participating pig farmers, builders of housing systems, agricultural advisors and civil servants. At the end of the third day, three designs were produced of radically different systems for pig husbandry.

In the workshops, design goals were formulated, key functions were identified and solutions to these functions were generated to fulfill the needs of all actors. We combined a selection of these solutions to render new designs of pig husbandry systems. After the two workshops, the project team made a wrap-up of all solutions and designs to construct three final designs which were published in an attractive brochure for a wide audience. Figure 1 shows one of the resulting designs.

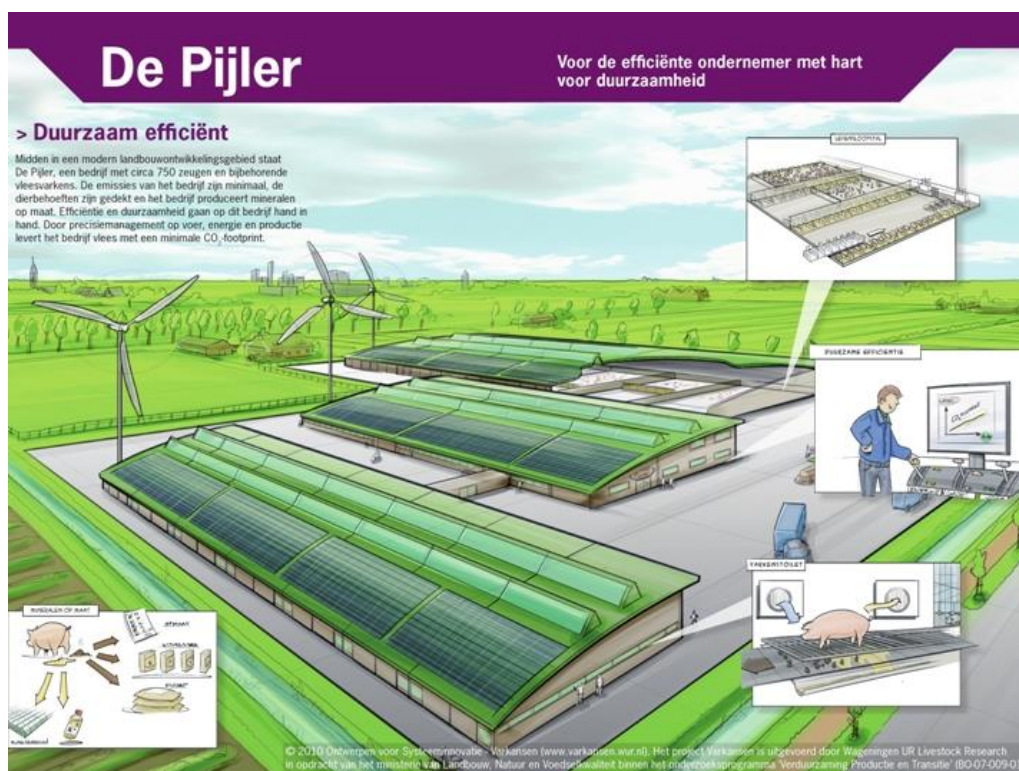


Figure 1: Resulting design from Pork Opportunities (The header reads: “The Pillar: For the efficient farmer with a drive for sustainability”)

As can be observed in Figure 1, various ‘partial solutions’ are highlighted by ‘zooming in’ on the overall design. This leaves room for pig farmers and others to tinker with the constituting elements themselves. The designs of Pork Opportunities are mainly meant as source of inspiration. Technically and economically, they have not been worked out in any detail. These designs express a strong focus on the level of the farm and the keeping of pigs, while attention for the wider production chain and market is limited.

4.1.1 Effects and their causes

The visible effects, that stem directly from Pork Opportunities, are limited to one initiative. After the second workshop one of the participating pig farmers immediately started with a realization process. She formed a consortium consisting of project participants and ‘outsiders’, and she was granted money from a Small Business Innovation Research (SBIR) tender (a national innovation stimulation fund). After three more years of further development and construction, a new type of farm (called ‘Vair Varkenshuis’, meaning ‘Fair Pig Home’) was realized, using several elements that were proposed in the Pork Opportunities project.

Next to this direct effect, the *indirect* influence of Pork Opportunities is far greater. According to the respondents, the project affected the pig husbandry sector as a whole. The intellectual legacy – in terms of ambitions, key solutions and changes of perspective communicated in brochures and presentations – has not only been adopted by a number of pig farmers, but also by other parties, including actors that can be considered representatives of the regime.

The legacy of Pork Opportunities has been especially appealing to the members of the steering group of the project. They represent the governmental Department of Agriculture, the Dutch Animal Protection Society and the Dutch farmers association. They have been involved during the whole project, and at the end of the project they decided to proceed with the existing steering group of the project, with the aim of further develop and spread the resulting ideas. Furthermore, these actors and other representatives of the regime changed the allocation of (applied) research funds, developed the tender structure for Small Business Innovation Research (that helped to realize the ‘Vair Varkenshuis’ above), and made a case for the adoption of elements of the Pork Opportunities method in other projects. Although these developments cannot be fully attributed to the project, Pork Opportunities did play a significant role.

Due to the initiatives mentioned above, this alternative view reached a lot of pig farmers and inspired a substantial number of them to implement minor or major changes on their farm that are related to or derived from Pork Opportunities. These include adaptations in existing pig pens, building new pens, changes in farm management and novel value chain development. These local initiatives illustrate that the regime is opening up to create more space for alternatives. However, this new space does not (yet) represent structural, institutional change. It mainly comprises add-ons to existing regulations, subsidies, research programmes and procedures.

A further analysis of these changes makes clear that part of the explanation for these further reaching effects lies in the interactive character of the RIO project, in which not only pig farmers actively participated, but also the earlier mentioned representatives of the regime. The project team discussed results of workshops and other activities with the steering group in detail, and this group also had some influence on the final designs. A result of this process was that they felt the (co-)owner of the resulting designs and became ambassadors for their further uptake.

Moreover Pork Opportunities resulted in a powerful story, decorated with appealing illustrations in an attractive brochure. But these results are not blueprints: the outcomes of Pork Opportunities offer quite some freedom. The essence is to be found in the ambitions and the changes in perspective, which respond to existing bottlenecks felt by many pigfarmers and upcoming societal needs. The resulting designs and solutions are not worked out in detail and mainly offer new directions to think about pig husbandry systems. As a result, the presented outcomes are neither compulsory, nor threatening for a variety of stakeholders in pig production. This makes it interesting for representatives of the regime, many of whom do feel that there are serious problems with current ways of doing things. It offers them space for their own interpretation and implementation of the outcomes. So it enables a lot of actors to relate to Pork Opportunities in their own way.

Arguably, the most influential factor for explaining the effects of Pork Opportunities is the (accidental) timing of the project. Respondents remark that ‘something’ was going on already in the pig husbandry sector. The status quo had been challenged for years, also from inside the regime, due to an outbreak of classical swine fever (1997), food and mouth disease (2001) and pressure from animal protection groups. In this situation, Pork Opportunities offered a welcome alternative: it showed that there are other possible ways to keep pigs and organise production.

4.2 Broilers with Taste

Broilers with Taste was carried out from 2010-2012 to redesign the broiler production system (broiler is the industry term for chickens raised for meat production). The project started with a system analysis, similar to the one of Pork Opportunities. After this first phase, two workshops were organised:

- The first was a three-day workshop with a heterogenous group (over 15 people), in which the whole production chain and some outsiders (e.g. NGOs) were represented. At the end of the third day, two alternative designs for broiler husbandry were realized, in terms of concreteness comparable to the designs made in Pork Opportunities
- The second was a seven-day workshop, stretched out over a period of several months. This design group was considerably smaller: a broiler keeper, a veterinarian, a builder of housing systems, an architect and two researchers. They started again from goals and functions, re-using results from the first workshop which they found useful. Two elaborate designs were made in architectural software, and subsequently converted to artist’s impressions by visual designers. A drawing of one of these (‘Windstreek’ in Dutch, meaning ‘Cardinal Point’) is presented in Figure 2 below.

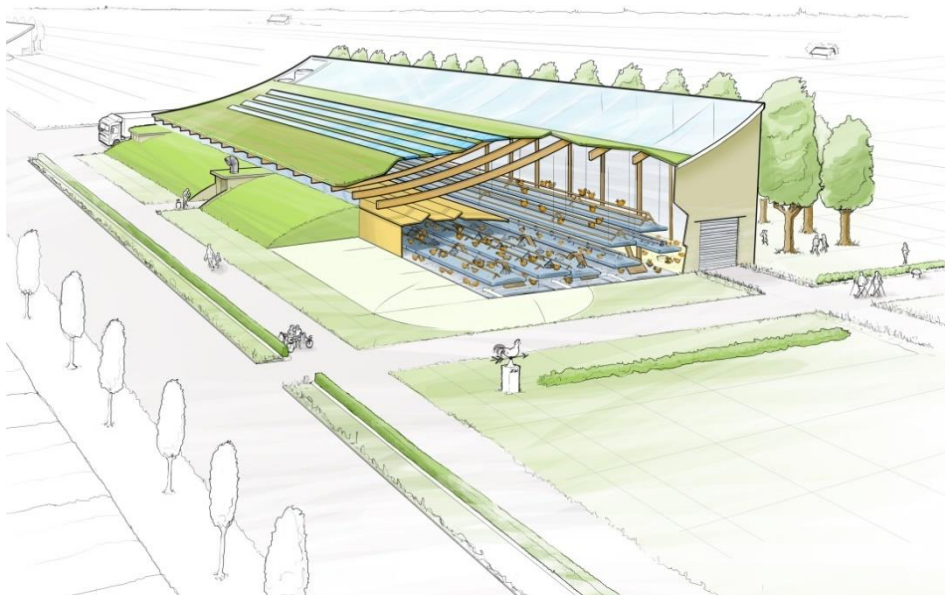


Figure 2. Windstreek (Cardinal Point) henhouse.

The final designs in Broilers with Taste are worked out in considerable detail (more than in Pork Opportunities): economic and technical calculations have been made, and the equipment of the system has been thought out more thoroughly. The designs of this project are not primarily meant as source of inspiration; they offer a complete and concrete interpretation of ‘what might be’. The designs are also set-up as a coherent big picture, not as a loose inspirational image to trigger the creativity of farmers or system builders. An important aspect of Broilers with Taste, which is not clear from the Figure above, is that the designs are broader than the farm. They cover various aspects of the whole production chain.

4.2.1 Effects and their causes

The effects of Broilers with Taste are limited to the activities in connection with *Windstreek*, one of the designs that form the output of the project. Broilers with Taste led to participants forming a consortium, consisting of a farmer, enterprises and a knowledge institute. Jointly, they develop *Windstreek* further, investing considerably in R&D of innovative key parts like the climate system and the 'mother clock' or 'brooder hood'. This consortium does so with the help of SBIR: the same tender arrangement that was used by the consortium that resulted from Pork Opportunities. At the time of writing (spring 2015), the first prototype of *Windstreek* is being built, aided by the support of a €460,000 sustainable innovation grant.

According to our interviewees, *Windstreek* has the potential to become competitive with the incumbent system. *Windstreek* tackles several sustainability issues while the consumer price of the meat will only be slightly higher than regular (no more than 20%). This potential is not only acknowledged by consortium partners, but also by outsiders. Various actors in the broiler husbandry sector are closely following developments in connection with *Windstreek*.

Representatives of the regime were involved in a steering group, although their involvement was more low-profile in comparison to Pork Opportunities, and they do not play an active role in the realisation of *Windstreek*. Here, the regime created space for further development mainly from a distance, most importantly by providing the SBIR grant, but also via some regulative support. The regime at large hardly seems to be affected.

The potential of Broilers with Taste lies mainly in the strength of the design of *Windstreek*. It was conceived in reaction to a regime with huge barriers for change, coming from the whole production chain and part of the periphery. The project offers the potential to tackle problems in a comprehensive and fundamental way, problems that cannot be tackled by individuals or single organisations. Solutions that were generated and applied were technically thought out in depth and underpinned by calculation. The technical aspects are relatively simple and foremost functional (for example the barn is equipped with a natural ventilation system). The design is elaborated in detail which makes it plausible that it can be built in the way presented. Compared to traditional housing systems, it is a radically different way of keeping broilers. For many actors this is very interesting and attractive, but for others it seems rather odd or even threatening.

The strength of *Windstreek* is also its weakness: for its realization larger parts of the production chain have to be mobilized and institutional changes may be required. Because of its radical character, *Windstreek* is 'hard to sell' to actors that play important roles in the dominant selection environment.

Consortium partners and other enthusiasts are generally people who were already struggling with the routines of the incumbent regime, prior to the project and the SBIR trajectory. For them, *Windstreek* is a way to express their ambitions for a more sustainable way of producing chicken meat.

Wider attention of a variety of actors can partly be explained by contextual factors, like an increased pressure from animal protection groups, particularly on the broiler sector. Another factor is the recent public discussion on the use of antibiotics in animal husbandry at large. The negative environmental effects of the organic way of keeping broilers also plays a role. It will depend largely on the actual performance of *Windstreek* whether these actors will actively support scaling-up in the future.

4.3 New Livestock Husbandry

The 'New Livestock Husbandry' project does not focus on a particular animal sector. Several five-day workshops were organized, each of them focussing on a specific sector. In each of these workshops, between five and eight farmers and the same number of agricultural advisors are present. The workshops are split in three phases. In the first phase, the farmers are stimulated to identify their individual ambitions. The second phase focuses on the challenges that interfere with the accomplishment of these ambitions, while solutions are generated to address these challenges. In the third phase, solutions are selected and combined to a new design and an action plan is set up. This results in a personal fit with the ambitions and

situation of the individual farmer. One of the posters that was made in New Livestock Husbandry is presented in Figure 3.

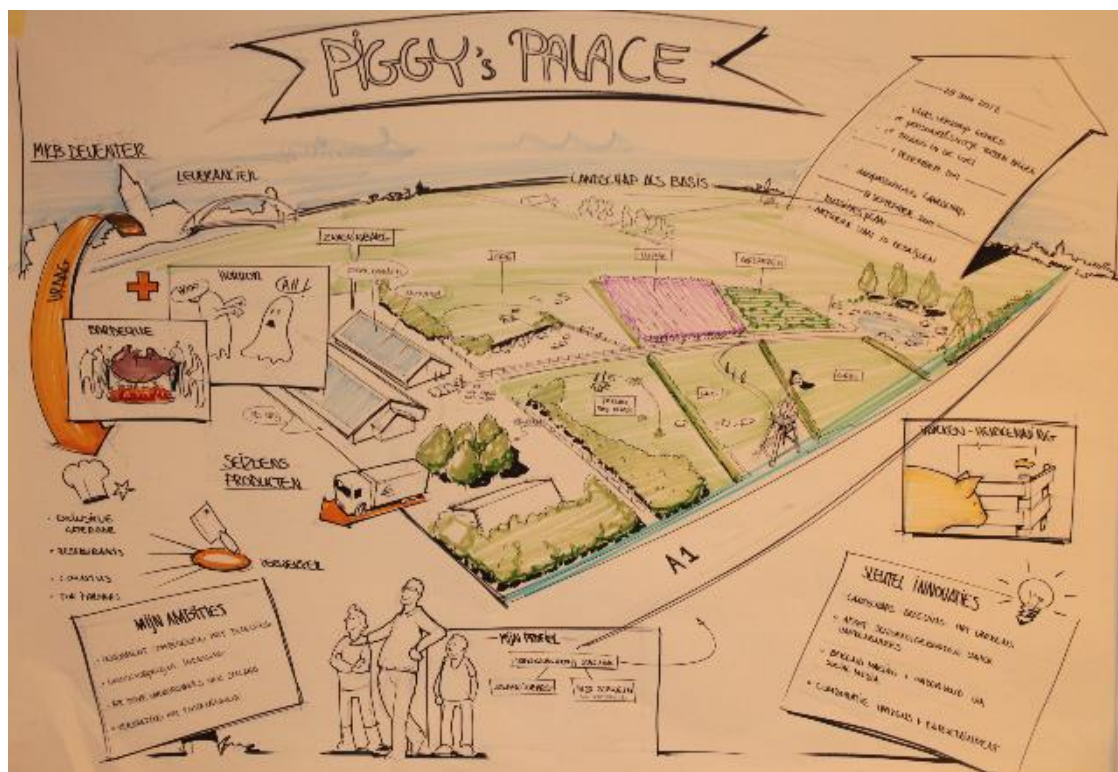


Figure 3. Piggy's Palace: Poster by one of the participants in New Livestock Husbandry

As can be observed in Figure 3, the focus of the design is on the farmer and his family, rather than the system. The plan is very personal with specific emphasis on the context of the farm, with a link to the present situation. The focus is mostly on the farm and its direct environment, i.e. the sphere of influence of the farmer. Some aspects of the plan are technical, but most are not and address issues like management, organisation, communication and collaboration.

4.3.1 Effects and their causes

The short-term effects of New Livestock Husbandry are far greater than those of the other two projects: two thirds of the participating farmers (over 40 in total) seriously start with the plans that they developed in the workshop. Some of the participants did already realize their plans, or are in the middle of realization. Others are improving their plans and make preparations for realization. The radicality of the things they realize varies to a large extent. Some farmers choose adjustments within the present system; others build a completely new farm and develop their own supply chain. Also the degree of success differs between the participants.

Despite the large number of initiatives, there is hardly any cooperation between the farmers. They all gather their own resources, build their own network, develop their own knowledge and create their own markets. They try to achieve their own goals, without any relation to the innovation trajectories of others.

To realize their plan, the participants often require various forms of support. In some cases, government and other institutional actors offer special subsidies or exemptions to rules and procedures. However, the majority of the innovation trajectories makes use of existing space for development.

Besides the individual innovation trajectories of the farmers, agricultural advisors are involved in the project, so that they can use the tools and ideas of New Livestock Husbandry in their everyday practice. A number of agricultural advisors explicitly stressed the enriching character of the project for their advisory work. Others find it hard to take the ideas and tools with them back to their own organisation. These advisors do see the added value of (for example) searching for the ambitions of the farmer and involving neighbours in the innovation trajectories, but this does not seem to fit in with their daily work.

A third way in which the outcome of New Livestock Husbandry was propagated was via presentations by project team members for representatives of the regime. Although many of these actors were enthusiastic about the presentations, none of them was prepared to actively support the farmers in their innovation trajectories, and none of them was prepared to change their behaviour to facilitate innovation in general.

An important explanation for the specific results of New Livestock Husbandry and the differences with the two other projects, can be found in the central focus on individual farmers. This focus leads to a strong sense of ownership among the participants and a strong motivation and endurance to realize their plans. Thus, the projects that are initiated can be traced back to the ambitions, personalities and circumstances of the participants. This implies that innovations are not always new (although they are new to the farmer in his/her context) and that ambitions are often far from radical, sometimes not even really breaking with existing routines. As a result, further development stops when the local project is finished. Because the participants are only interested in their own farm, the initiated change will not reach further than their farm.

This does not mean, however, that New Livestock Husbandry structurally failed in stimulating system innovation. Not only is the project – in terms of numbers – the most successful of the three in initiating and stimulating innovation amongst farmers; it also helped the farmers to look critically at themselves and the system in which they operate. This does not only help them in their current innovation trajectory, but also in dealing with future challenges and makes them more receptive for change. Moreover, some farmers in New Livestock Husbandry were very ambitious in their innovation trajectories, creating path-breaking innovations with which they inspire others.

In their attempts to deploy and apply their experiences in practice, the agricultural advisors and project team members struggle with the focus on the individual farmers in the project. As the solutions and designs are all developed with a specific local farm in mind, these are not easy to communicate to others. Furthermore, although the tools are generally applicable, they are hard to transfer outside New Livestock Husbandry, because without a context they are too vague and too abstract.

5 Evaluation

5.1 Articulation of promises

All three projects clearly articulate expectations and promises, but they do so in widely diverging ways. In Pork Opportunities, a very general future vision is conceived, that reflects a sense of urgency and promises potential improvements on many aspects. It is a vision that many can agree upon, as it only sketches rough contours and leaves a lot of room for different implementations. It invites actors to reflect on the way they think about the pig sector and articulate their own promises. This appears to work for a large number of pig farmers as well as for representatives of the regime. Various stakeholders create their own future vision of the pig sector, using building blocks from Pork Opportunities. A central element in all of these future visions is the awareness that it is possible to improve several aspects at the same time. The 'pig toilet' is the most illustrative example of this: by using the natural cleanliness of the pig, animal welfare is improved, ammonia emissions are decreased and the quality of manure rises (manure is more suitable for arable farming).

In Broilers with Taste the designs are much more technical, underpinned by calculation and meant to be build in the way they are presented. It features a clear set of closely related promises, free of context. There is little room for differing interpretations, so the promises are appealing to a limited group of actors.

At the same time, raising high expectations – technically and visually powerful designs that are strongly deviating from the status quo – is attractive for several others.

In New Livestock Husbandry participants create a future vision on the basis of what they learn about themselves and the context in which they operate. This gives them a very concrete and user-friendly set of promises, as they are personal and related to their own context. Although all of these visions are quite deviant in comparison with the average business plan of a Dutch farmer, most participants easily adapt to the rules of the regime. Ultimately, most of them wish to transform their own farm and their direct environment, not a complete production sector. Because of the personal character and the context-specificity of the designs, the promises of most of them are not very appealing to others.

5.2 Network building

With respect to network building, it is critical who are involved in the project. The consortia that initiated change in response to Broilers With Taste and Pork Opportunities are for the greater part formed during these projects. Thus, a larger variety of actors in the project leads to a higher potential for network building afterwards. This is important as almost all initiatives require a range of actors to realize their plans and overcome obstacles. Participants of New Livestock Husbandry are clearly disadvantaged here, because there were no market parties, NGOs or governments involved in their workshops. They are encouraged to build their own network, but this turns out to be troublesome for most of them. Likewise, initiatives that stem from Pork Opportunities suffer from the absence of market parties.

Furthermore, network building strongly depends on the articulation of promises discussed above. Again, the farmers in New Livestock Husbandry are in a disadvantaged position, as their promises are personal and strongly contextualized. The promises made by Broilers with Taste and *Windstreek* are especially appealing to actors who want to structurally change the current system, building a strong network that disassociates itself from the status quo. The promises made by Pork Opportunities, on the other hand, are appealing to a broad range of actors, including representatives of the regime, building a loosely structured network (or interconnected networks) that offers a range of opportunities for a variety of activities.

5.3 Learning

All three projects facilitate learning, but in different ways and at different levels. Broilers with Taste helps participants to gain a thorough understanding of the current system, its sustainability problems, and the possibilities to overcome these, including the technical and economic dimensions. The same kind of ‘system learning’ takes place in Pork Opportunities, but at a more general level without too much details. The primary learning experience by participants in Pork Opportunities is that the current system *can* be changed, and that each actor can have a role in this change process. New Livestock Husbandry specifically focusses on personal learning: not only the system itself is discussed, but specifically how the thinking of the participants shapes their opportunities (second-order learning). In Broilers with Taste, joint learning focused on designing, and realizing a path-breaking husbandry system was more important than individual learning processes.

Pork Opportunities is the only project that successfully facilitates a learning process for actors outside the workshops. The designs get others thinking about the future of the sector, directly by the brochure and presentations, or through follow-up initiatives.

5.4 Local initiatives versus global niches

Although RIO is aiming for global niche-development, it primarily facilitates local initiatives and projects. This is most clear for New Livestock Husbandry. Most of the participants in this project solely focus on realizing change on their own farm, without making use of or contributing to a global niche. Because of this

fragmentation, the project itself cannot be considered a niche (or niche-in-the-making) either. It only functions as a temporary platform for farmers to reach their goals. Some of the participants do interact with a global niche outside New Livestock Husbandry. For instance, some of them became part of the organic agriculture niche, while some others associated with certain forms of multifunctional agriculture.

This is slightly different for Pork Opportunities. Just like New Livestock Husbandry, it stimulated local projects, but at the same time these are part of a greater change trajectory in the pig sector. Changes occur (partly as a consequence of Pork Opportunities) in regulations, procedures, future visions, research programs, etc. However, this does not constitute a niche for two reasons. First, these activities very loosely structured, not forming a new 'community', which Geels & Schot (2010) see as a necessary characteristic of a niche. Second, there is no clear distinction between this niche and the regime, resulting in a great influence of the regime on the niche-developments, often neglecting and isolating radical local initiatives. Actually, it appears that a selection of the local initiatives is embraced by the incumbent regime, leading to incremental changes. The development of more radical change is still troublesome, despite the influence of Pork Opportunities.

The *Windstreek*-initiative, originating from Broilers with Taste, can also be considered a local initiative, but it does have the potential of becoming a niche. Not only is *Windstreek* designed without a specific context in mind, so that it can also be built in other places, it also has broad support of a variety of stakeholders. If it can fulfill its promises, in terms of technical, economic and sustainability performances, these actors might well be able to form a community around *Windstreek*, countervailing the incumbent regime.

5.5 Niche development processes

5.5.1 Shielding

In many of the initiatives stemming from the three projects, some form of shielding takes place. In Pork Opportunities this is most prevalent, as there are various regime initiatives that create space for development of local initiatives. These include expectations on regulation and procedures, subsidies, and innovation projects, which all function as shields for these initiatives, protecting them from the selection criteria of the regime. However, this direct niche-regime relationship raises barriers for radical changes. The innovations have to fit the terms and conditions set by the regime or they will not be supported sufficiently. If innovations do not fit, pig farmers risk losing their protection. Here, the absence of a global niche is felt: protection from such a niche would offer more possibilities, especially for path-breaking innovations.

The same holds for New Livestock Husbandry, where the only shielding for most farmers also comes from the regime. Here the struggle for protection is even stronger, as the network building and articulation of promises has been limited, and no representatives of the regime were involved in the project. Whereas, for instance, the relation of an initiative with Pork Opportunities can be a legitimation for a subsidy, New Livestock Husbandry does not have the same effect, as the general promises are not shared.

Until now, shielding of *Windstreek* has taken place in the same way as with the other two projects: the regime offers some space for this kind of initiative, in this case by facilitating a specific SBIR tender. However, there is a difference with the other projects. Because of the future potential of the system, several groups have started to support its development. These include specific consumer groups, who stress sustainability issues, and local or regional governments that seek to distinguish themselves as facilitators of sustainable innovation. Because of the power of the total concept, *Windstreek* has more potential than the other initiatives to yield this kind of shielding. And specifically this kind of shielding offers much more space for radical innovation, because it is independent of the regime.

5.5.2 Nurturing

Nurturing is understood as shaping possibilities for the development of path-breaking innovations by creating a new Innovation System (Smith & Raven 2012). Using this definition, little nurturing takes place in the initiatives that stem from Pork Opportunities and New Livestock Husbandry. The initiators mainly focus

on implementation and realization, without considering changing the context in which this takes place. This results from the fact that many of these initiatives are carried out by single farmers, which does not cause problems for them as long as their plans are not really path-breaking. As a result, no further protection is needed.

However, there are several exceptions: several farmers, who develop new knowledge, create new markets and reinvent the way in which they interact with their (natural and social) environment. This requires new network building and a thorough learning process, while engaging actors that can contribute to (and profit from) the innovation trajectory. When asked for the underlying reasons of their particular innovation trajectory, these farmers all refer to Pork Opportunities or New Livestock Husbandry as turning points in their development. At the same time it must be noted that these farmers are non-typical in terms of their creativity, visioning, endurance and communication skills. This enables them to do new things that others can or will not.

For Broilers with Taste most of the nurturing has yet to come. As the promise of *Windstreek* can only be fulfilled if the embedded novelties are realized in combination, further development will require comprehensive R&D. Moreover, *Windstreek* requires a wider system change to function, relating to the value chain and the market. As the goals of Broilers with Taste are more ambitious than those of the other projects, this will require more nurturing of the required developments.

5.5.3 Empowerment

Empowering is understood as strengthening the niche to become competitive with the regime (Smith & Raven 2012). It is not very likely then, that empowerment would result from projects that have finished only recently. Nevertheless, since Pork Opportunities and New Livestock Husbandry primarily created local initiatives (in the absence of a global niche) that follow quite short innovation trajectories, there are quite some initiatives that already have been empowered. All of them fall within 'fit and conform' empowerment (Hoogma 2000), which means that they have become competitive within an unchanged selection environment. This implies that these initiatives result in incremental changes, although there are also several initiatives that tinkered with path-breaking innovations. In these cases, the empowerment of the niche in the sense of competitiveness with the regime, at the same time lead to disempowerment with respect to sustainability (Smith & Raven 2012). Thus they dropped the path-breaking aspects they entailed, as these farmers do not have the ability nor the will to change the selection environment.

Other initiatives, that stem from Pork Opportunities and New Livestock Husbandry, continue developing their local niche, creating their own local market, both as shielding and nurturing mechanism, sometimes succeeding to scale up to a regional market. These initiatives seem to postpone their moment of empowerment. They are not ready for a confrontation with the regime as they lack the strength of a mature global niche. To survive and maintain their path-breaking aspects, they have to keep operating as a local niche. If a global niche develops in the future, their possibilities will be extended and 'stretch and transform' empowerment (Hoogma 2000) might become feasible.

For Broilers with Taste, the moment of confrontation with the regime is still far away. Because of its radical and encompassing changes, it has to follow a 'stretch and transform' path, leading to structural changes in the selection environment. To make this possible, first a more global niche has to be developed, implying that the initial focus has to be on shielding and nurturing.

6 Discussion and conclusion

We studied the first effects of three recent projects in redesigning animal production systems. Although many initiatives have been identified that build on these projects, none of them has yet established a global niche. The initiatives follow their own local innovation trajectory (for Pork Opportunities and New Livestock Husbandry) or they are still in the phase of niche-in-the-making (Broilers with Taste).

Although global niches are (still) absent, all three projects have actively stimulated articulation of promises, network building and learning, resulting in diverse configurations of shielding, nurturing and empowering. By doing so, they have all facilitated new developments that are normally out of reach for the average farmer.

It can be argued that innovations, that are carried out by individual farmers, are not likely to result in niche development, as innovative farmers generally aim for changes on their own farm, not in the system. In practice, in many of these initiatives, that were initially path-breaking, farmers chose to decrease their level of ambition, thus adapting to an unchanged selection environment. As Broilers with Taste has wider goals and is carried by a diversified group of actors, this project still has the potential to develop into a global niche. At the same time Pork Opportunities and New Livestock Husbandry have engendered some initiatives that have become local niches, where the initiators are motivated and able to keep this niche alive, further shielding and nurturing their path-breaking innovations. Furthermore, following Pork Opportunities also institutional players have started changing their behaviour. Although these changes are not radical, Pork Opportunities has altered the direction and speed of incremental transformation for the regime, thereby providing more space and support for niches based on path-breaking innovations.

We conclude that all three projects have contributed to system innovation in one way or another, but that, until now, path-breaking changes have only been realized on a very small scale in local initiatives. The largest promise for future regime changes lies in the potential of Broilers with Taste. However, the ability of Pork Opportunities to alter the research agenda and create more space for sustainable production and commercialization alternatives, and the achievements of Pork Opportunities and New Livestock Husbandry in producing initiatives that retain as local niches, also have their value in terms of transitions. Although in the current state of regime and landscape, this is not likely to lead to wider structural change, the projects do offer alternative pathways for the future, if circumstances might change and the tension between landscape and regime increases.

We therefore conclude that RIO can ignite and facilitate niche innovation, which, depending upon regime and landscape characteristics, may eventually lead to a transition of the regime. In answering how the RIO approach may contribute to the perceived effects (the last question formulated at the end of the theoretical framework), three aspects stand out: design, interaction and reflexivity.

Concerning design, in all projects, the newly developed designs provided people with a strong and tangible visualization of possible alternatives, opening them up for more solutions and possibilities than they initially thought. This is due to the focus on goals and functions, thereby avoiding short-term conflicts and perceived problems, before solutions are generated. The designs are not only important for articulation of promises, they also facilitate network building. Whether this contributes to global niche development, depends on several design process conditions, especially the ambitions of the project, the system barriers that are addressed and the heterogeneity of participants. Initiators and design are in a constant interaction with each other. An appealing design is able to attract a capable group of actors, and a capable group of actors is able to create and develop a powerful design. A strong design facilitates a joint focus and spark a consortium to start and grow, using its capacity to enthuse and enroll new actors, and to provide a common vision.

Concerning interaction, all projects illustrate that involving a heterogeneous group of stakeholders is essential. A heterogeneous group increases diversity, enables the conciliation of perspectives, enhances heterogeneous network building, and opens up possibilities that are unattainable for stakeholders alone. In aspiring system innovation, chain parties need each other, just like niche players and institutional parties need each other.

Stimulating reflexivity is the third important aspect of RIO. The primary focus of RIO on goals and functions, rather than on solutions, stimulates reflection on *what* has to be done, rather than *how*. Furthermore, the process stimulates a critical attitude towards participants' biases, as well as towards the rules of the game from the regime. This turns out to be a powerful way to scrutinize taken-for-granted perceptions and tacit routines, which in turn results in shared learning, a better mutual understanding, network formation and the articulation of promises that are seen as such by a wider array of stakeholders.

The combination of design, interaction and reflexivity enables the shielding, nurturing and empowerment of path-breaking niche innovations, and is a distinguishing feature of RIO compared to other stakeholder approaches. As this chapter has made clear, this is not a straight-forward exercise: niche development and system innovation are man-made processes in a continuously changing environment. It is the combination of the planned activities in the RIO projects, and the unplanned and often unforeseeable responses to this from the regime, that determines whether this will eventually contribute to a transition.

Acknowledgements: This chapter is based on research conducted within the Programme KB-16 Transitie & Innovatie (KB-16-002.05-007), financed by the Dutch Ministry of Economic Affairs.

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