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Towards an entrepreneurial innovation system for small-holder farmers in sub-Saharan Africa

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Abstract

Growing population pressure, climate change and urbanization necessitate the increase of agricultural production and innovation. Horticulture by means of protected cultivation primarily for vegetables production seems promising by creating a controlled environment for light, temperature and moisture and against diseases. But there is a gap between the high-tech precision horticulture as practiced for instance in the Netherlands and the context and capacities of African smallholder farmers. On the one side high-tech large-scale greenhouse cultivation is introduced by foreign companies, management and capital, while on the other side many smallholders grapple with lack of quality inputs, lack of funding, lack of frugal small-scale technical solutions (greenhouses, irrigation systems, water provision, disease and residue treatment, monitoring soil fertility etc.), lack of infrastructure and lack of capacity. Over and above an analysis of the situation the paper proposes a way forward consisting of three elements: entrepreneurship and capacity training (1), a strategy of gradual growth (2), and finally a comprehensive business innovation system (3). The research is based on long-term student involvement by internships and master thesis studies from the Delft University of Technology and includes the experiences of a Dutch consortium of entrepreneurs and researchers (greenhouse constructors, seed companies, pest control, financial institutions, entrepreneurship). This consortium tries to raise the capacities of smallholder farmers and take them to a higher level. Findings show that in principle there is a business case for introducing existing smallholder farmers and young entrepreneurs to protected cultivation under the leadership of more experienced farmers, supported by a network of stakeholders (retailers, banks, Dutch and African companies, academic partners, NGOs, government agencies). Cooperation of many stakeholders, the creation of an enabling environment and training of capacity appear to be crucial conditions for success.

Keywords: entrepreneurship, smallholder farmers, business culture, business innovation system

Introduction: The gap between high-tech horticulture and low income entrepreneurship

Dutch greenhouse constructors and greenhouse entrepreneurs are highly reputed around the world with greenhouse technology that has become high-tech. The aluminium used is sharply calculated and designed, the glass is on the millimetre disposed to let in as much light as possible, the height maintains the temperature lower or warmer for a longer period according to need. The use of artificial substrate prevents diseases, the glass and the nets keep insects out. A sophisticated irrigation system, of course computerized, provides the crops with

exactly the right food and fertilizer in the right time sequence, the CO2 added artificially inside the greenhouses stimulates the growth of the plants, and the last invention, artificial led lights of specific colours contributes to that same result. Then comes all the plant knowledge, the precision of the work, strict planning and calculated use of water and heat. And to combat diseases specific insects are released into the greenhouse to counter disease germs.

All of this explains the typical graphic presentation of the production power of these greenhouses in Figure 1. Although it is a rough approximation, the increase in production is quite in line with the increase in investment. A greenhouse that costs €40 per square meter delivers 40 kg of tomatoes, and an investment of €70 per square meter goes to an amount of 70 kg of tomatoes per square meter. These greenhouses are also most frugal in the use of water and therefore they are environmentally friendly, and they last more than 20 years. They are the best solution anywhere in the world, as confirmed by the successful production by Dutch greenhouse farmers in developing countries on big farms producing flowers and other crops for the international market. Governments often support this large-scale approach and are inclined to provide the companies with large tracts of land and the privileged use of water resources, because of the foreign currency it brings in and because of the necessity to feed their metropoles. Research shows that agriculture has a promising future in Africa (UNDP 2012). Modern agriculture with the support of technology is indispensable for feeding a growing population, especially of the big metropoles in Africa and it may prove to be the future export product for Africa, since Africa is the continent with the highest percentage of land that is suitable for agriculture, but not yet in use (Jayaram 2010).

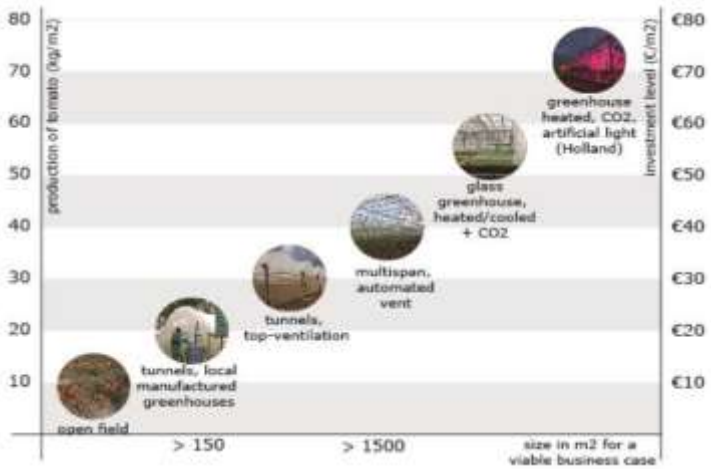

Figure 1 Relationship investments and production (Delphy Report 2017)

Of course, even in this high-tech approach, there are still many problems such as the availability of the right inputs, like seeds and seedlings, fertilizers and pesticides, irrigation equipment and greenhouse equipment in general. Often knowledge and skills of vegetable production is lagging behind, the judicious use of pesticides is at a low level as is also the awareness of consumer demand. In the value chain many problems need to be solved, like reaching out to the right markets, supermarkets and customers, and finally there are issues like packaging and cooling to avoid losses (Gonzales e.a. 2016).

The bigger problem though is the human (f)actor, as expressed in the sentence “Farming takes place predominantly on a smallholder base in Ghana” (Gonzales e.a. 2016, 10). This sentence can be applied to all of Africa. Worldwide there are now 500 million smallholder farmers.

They produce 80% of the food consumed in Africa and Asia (UNEP, 2013), which means 2 billion people, nearly 1/3 of the population (Vorley e. a. 2012). They are often considered as the weak link in the food chain and not as an asset for increasing food production. Often their property rights are not well secured (Wiggins e. a. 2010). Many of them already lost their land due to the introduction of large-scale mechanized farming (Cotula e. a. 2012). The insecurity of their properties, especially if they are not land owners, is a further obstacle for development and investment (Besley 1995). Often in the past their economic welfare has been sacrificed to industrial development, by transferring revenues from agriculture to industrialization and keeping food prices artificially low (Johnston e. a. 1961, Bryceson 2002). Neoliberal economic and agricultural policies on top of that have led to a widespread reorientation of rural livelihoods. Roughly 40% of the African rural households' income is now derived from non-farming sources. Indeed, a landless agrarian class is emerging because many turned to income diversification, finding or trying to find other sources of income besides agriculture (Bryceson 2002). Many farmers are survivor farmers (Berner 2012) and many of them women for whom agriculture provides a side income (Fox e.a. 2013, Berner 2012). Research in Kenya shows that the great majority of smallholder farmers does not have sufficiently access to supermarket chains due to lack of financial and human capital. An emerging group of middle-class farmers dominates the supermarket chains (Neven e.a. 2009). Smallholder farmers could organize themselves in cooperatives in order to enter these supermarket chains, but this can only be effective on condition that they have the capacity to meet the requirements of those supermarkets: year-round supplies, quality and easy procurement. But again the lack of access to financial and lack of organizational capital as well as infrastructure and financial services stand in their way (Neven e.a. 2009).

This brings us to an awkward situation where on the one side, we have high-tech greenhouse technologies lying ready on the shelves. On the other side, there is lack of infrastructure, inputs and enabling environment. This is compounded by lack of capacity, training in skills and knowledge, and a conservative mindset among the majority of smallholder farmers. This leads to a further set of questions: How can this gap be bridged? Can it be done? What social and institutional strategies for change are available? How is technology included and possibly refurbished to meet those challenges? Is there a way forward by means of frugal innovation? And what does that mean in this case?

In order to answer these questions the paper will first expose the approach towards entrepreneurship training by the Delft University of technology, more specifically the Delft Center for Entrepreneurship. Next the application of this entrepreneurship program to rural development in Africa will be described. In particular, an *approach towards growth of smallholder farmers* will be proposed and experiences on the ground will be reported. The growth strategy for smallholder farmers proposed here, takes into account the approach towards entrepreneurship teaching from the Delft University of Technology and takes into account the African business culture and regulatory environment. It puts forward a specific approach towards entrepreneurship that focuses on capacity building and its includes ideas about a comprehensive business innovation system in order to take agriculture in general and especially horticulture to a next level.

The entrepreneurship training program from the Delft University of Technology

The Delft Center for Entrepreneurship runs and education program on International Entrepreneurship and Development. Each year 60 students are enrolled in this program and all of them go abroad for an internship assignment to the benefit of an NGO, a small enterprise or

university. This means that 20 teams spread all over the world, primarily African countries, and many of those students assignments are related to rural development, often in support of smallholder farmers.

Recently many types of courses and training modules are offered to meet the growing demand of entrepreneurship teaching in low income economies. But in cases where teaching in entrepreneurship is present it doesn't always go beyond mere theory. Teaching entrepreneurship in full classrooms with high number of participants doesn't have a big impact in terms of creating an entrepreneurial mindset either. The entrepreneurship training program developed by the Delft University of Technology constitutes an attempt to do so. The training consists in step-by-step making a business plan that is realistic and could be put to practice immediately after the course.

Whereas for Western students it is often their dream to start an enterprise of their own and be independent, Asian and African students preferably try to find a job at a company or state agency. However, since there is lack of jobs, and since unemployment often rises to 40% or more, there is serious need of an entrepreneurial attitude, in order to create new initiatives, new markets, new products and services. At the Delft University of Technology a straightforward training module in entrepreneurship has been developed. It functions as a hands-on tool that doesn't spend too much thought to theory, but teaches the essentials of entrepreneurship in a learning by doing approach. Actually the training consists in making a realistic business plan. Once participants in the course have done so, they can teach it by the same method to others, their students or practitioners etc.

The training consists of the following 10 steps:

1. *Focus:* in order to get focused on business cases that are promising, the team members need to distinguish important challenges from less important and urgent problems from less urgent ones. The question here is: by listing all the important and urgent problems of society, can one find the one point on which you can and want to make a difference?
2. *Chose a challenge*: the team members chose a relevant issue to take as point of departure for their further work. Besides important and urgent it should also be realistic.
3. *Exploration of revenue model:* is it realistic to expect in some way that it would be possible to make a living from this challenge? And if so; what is the product/service, who is the customer, who is going to pay and for what? Suppose somebody would like to start a fishery and grow fish in large quantities to meet the demand for cheap and healthy food. In a context where people are completely not used to eating fish, that might not be realistic. Or, maybe it still is, but not without a proper advertisement campaign.
4. *Chose concepts:* the basic idea should be outlined and different options compared. What do you want to do? Who is going to do it? For whom? The best option should be chosen to be further elaborated.
5. *Design a business model:* the business canvas model from Osterwalder (Osterwalder & Pigneur 2009) is used to make a first draft of all the elements that need to be addressed in a complete business plan. What is the value proposition? With whom will the product be made? What are the supposed customers and how are they reached?
6. *Market mapping:* how can a market be identified and what may be different market segments and target groups?

7. *Know your customer:* a more precise idea of the customer should be established. What may a customer think about the project? What advantages may he or she see? What disadvantages?
8. *Validate assumptions:* the business plan has been developed to such an extent that it is possible for the course participants to go out and interview people in the street or to interview experts or colleagues etc. in order to get feedback on the business proposition. At first sight this may seem superfluous, because the course participants will have thought it well over already, and supposedly they are much more knowledgeable than their proposed target groups or stakeholders. Experience shows that often the opposite is true. Just because one may be more knowledgeable one may as easily have skipped one important step in the complete business idea, which is indispensable. Example: a household size water purification device for desalination was once designed and developed. It seemed to be a good business option to sell these devices to individual households. The device can turn brackish water into purified drinking water. One thing the developers did not consider, however, is the question: Where do individual households get their brackish water from? For individual households that may not be so easy. The example illustrates that it is easy to overlook some essential elements, which may be obvious for the first layperson interviewed.
9. *Resources inventory:* where do all the people necessary to produce the service or product come from? Where does the investment come from? Etc. etc.
10. *Make a roadmap:* the roadmap should specify the road ahead when this business plan is turned into a real functioning business. Which steps are to be taken? What are different milestones in the growth of the business as foreseen? Etc. etc.

At the end of the course the participants are also trained in pitching their business plans for a group of potential investors. Can they convey their message in very clear words in a very short time and still be very concrete and convincing? It is one thing to have complete oversight and deep insight into the subject matter, it is quite another thing to explain it in simple and clear language to people who do not share that knowledge and expertise and nevertheless provide a very clear picture.

Issues in internal management and external environment

This training module has been applied in a number of African and Arab countries. It has been adapted to the context of emerging economies by adding two important themes: how to deal with possible obstacles in the (internal) business culture? And how to surmount possible obstacles in the (external) institutional environment? These problems count for all SMEs to a higher or lesser degree, in Africa as well as Asia and Latin America. They are also relevant to the Western situation, although naturally there are gradual differences.

As far as the internal management style is concerned the following issues need attention:

1. The level of *hierarchy*: even in small companies the dealings of management with employees tend to be quite hierarchical, with a strict culture of command and obedience, albeit to different degrees in different businesses. If the command structure is too strict, the employees do not internalize responsibility. As a consequence they do not professionalize. They may be very obedient, but as soon as the manager turns his back (mostly his) the speed of the work is slowing down. For modern businesses which often are supported by sophisticated technology a more professional attitude is required, responsible, independent, which in turn requires more *egalitarian* and open relationship between management and workforce. There should also be a feedback loop from the bottom to the top.

2. A culture of closed *in-groups* within the company between different departments, possibly different ethnic groups of languages, may be an obstacle for good cooperation. Mutual *trust and cooperation* cannot be taken for granted but needs to be fostered and explicitly exercised and cultivated with the aim to create internal cohesion and cooperation. Otherwise the business cannot be successful.
3. *Commitment* is important: features of committed work are a combination of *initiative, adequate planning* and a positive attitude to *labor and achievement*. These are indispensable elements in the management of complicated technology in fast changing environments. Decisions relating to fine-tuning of the equipment and monitoring of the production process should be taken care of right at the shopfloor in order to keep the production going. If a problem shows up, do the employees then consider themselves as responsible and as turning points of change? Or will they wait for the manager and not take initiative? Do they adhere to the planning and are they inventive in doing so in case of setbacks? Does the management value that the workforce has a judgment of its own in solving issues, or does that involve risks? Is the management itself also characterized by a positive attitude towards labor? If the manager leaves the office early and doesn't set a good example, the employees will not be motivated either.
4. Is there a culture of *equal treatment*, and equal access, or are some groups or employees more *privileged* within the company than others? If some individuals or groups are more privileged it affects the commitment of all the employees.

Any company that performs badly on one or more (mostly more) of these items, will feel the consequences in the long-term in the quality of the production and the targets met (or not met). The cultural capital of a company in the long-term defines its economic capital (Harrison 2000, Jackson 2004, 2011, Kroesen & Ndegwah 2017).

Actually often the internal problems of the company mirror social-cultural problems of the institutional environment. Without being repetitive two important issues stand out in relation to the institutional environment of doing business in many African contexts in different degrees:

1. *Cooperation* or lack thereof with other companies and with civil society groups and government agencies. Often between competitors there is lack of trust, and this creates obstacles for cooperation that could be for the mutual benefit. For instance, solar energy companies could benefit from a shared market strategy in the form of an advertisement campaign for solar energy (Tack 2010), if they would be willing to pay for it together. Or they could set specific market standards to ensure good quality of the products and make solar energy more attractive. In the case of farmers and vegetable producers, it can be challenging to create shared facilities for chain management and infrastructure or transport, from which they could benefit while at the same time being competitors.
2. *Access to the bureaucracy*: if it is necessary to pay an extra allowance for the clearance of imports or for a license, and if having friends within the government agencies is a condition for the success of the company, a less equal playing field is available. Small or medium-sized companies that do not have the required networks of reciprocity and solidarity face many difficulties in their operations. Such solidarity networks may also become costly for an enterprise considering the claims for support from family or friends in the network. It is difficult and sometimes impossible to refuse, the more so because at another time one may need support from these family members in turn if insurance facilities are lacking (Hyden 2006, 2008).

In the case of smallholder farmers the majority of them are not formally organized, and there is a lot that can be done on their behalf by investments in physical infrastructures, local processing, cool storage and warehousing, market formation and transparency (Vorley e.a. 2012). But these opportunities can only be taken by cooperation and trust between the different stakeholders (who may be at the same time competitors) and with the support of reliable government regulations and institutions.

Training in entrepreneurship should include these issues which are part of the local codes of doing business. It is not sufficient to limit entrepreneurship training to individual businesses. In order to make SMEs resilient to internal and external threats, would-be entrepreneurs need to be prepared for the demands put on them to survive in this environment. They need to be capable of managing their companies and their external relationships through the labyrinth of trust and distrust, building the external environment required for doing business at the same time as building their business itself (Faustino & Booth 2014, London e.a. 2014). In the case of smallholder farmers improvement of their lot requires many policies, institutionally and economically, to be adapted, like land tenure regimes, license policies, taxation regimes that do not only favour large land deals but also include small-scale producers (Vorley e.a. 2012).

An important issue in fostering entrepreneurship in this regard, not often considered in the literature, is capacity building, in the sense of changing the local narratives and mindsets (Kroesen, Darson, Ndegwah 2015). The group of smallholder farmers is the most conservative part of rural Africa, often still governed by patriarchal sociocultural norms and practices. Key to these are the gender roles, and the tradition of extensive low risk strategies towards farming (Tshikuku 2001, 2015). Generally (subsistence) farming is considered as a last resort and not as a respectable and honourable profession. By the use of more modern technology, which is an indispensable requirement in order to increase productivity, this imago can be changed. Young and jobless people might take the lead in this transition. The older generation often doesn't even know of bookkeeping and may not even have a savings account. They always did agriculture without such support systems. In addition, the business environment for agriculture is changing also in emerging economies especially by ICT applications. These are accessible through mobile phone or iPhone, are increasingly available and in use, such as for the transfer of money, access of market prices, analytic tools for disease control, weather information, growth monitoring and monitoring of water provisions etc.

The SURE approach

After this detour on entrepreneurship and local context we return to the question: how does this apply to smallholder farmers? Through many years within the minor program International Entrepreneurship and Development many experiments and initiatives have been deployed on agricultural entrepreneurship, especially horticulture. Different types of greenhouses in different climatic circumstances have been tried, as well as a number of different technologies and business options. Students participating in the program (by a three months internship abroad) attempted different designs and different prototypes, conducted market explorations, devised business plans, even courses on farming and manuals. Other students did research on related activities like carpentry, e-bikes (for local cheap transport), different types and sizes of solar systems for productive use, the potential of biogas etc. *The central question around which these activities revolve is: How can smallholder farmers increase their production, enter the market, become entrepreneurial and grow?* This question counts for smallholder farmers, but also for related activities like building greenhouses, water

provisions, biogas, solar energy solutions, small-scale machinery for food processing and packaging, etc. etc. These as well offer business opportunities for Sustainable Rural Development (SURE). This SURE approach takes its point of departure from the business opportunities, and the power and motivation of local people. Their initiative is supported in order to create value on the basis of the opportunities they have. In this way they grow in power, ability and capacity. It is the explicit objective of this approach to empower their capacity and promote the development of the countryside on that basis. Another objective is to make the countryside more attractive as a place to live and work instead of suffocating metropoles.

How can smallholder farmers in rural areas, who until now only produce for the subsistence of their own families increase their production and enter the market? Often we are dealing with people who only are involved in agriculture out of necessity, because of the lack of any other resources, job or income. Many housewives do some agriculture as a side job, while their husbands provide the main income, as a support for the family, but not for commercial reasons (Berner e.a. 2012). But even commercial farmers often specialize in staple foods like rice and maize. Their capacities for running an enterprise should not be overestimated. Besides such "soft constraints" there may as well be some hard constraints like high population density (small plots of land), low soil quality, low rainfall and high temperatures and locations with underdeveloped infrastructure, resulting in little market access (Fredriksson e.a. 2016, Fan e.a. 2008). These conditions may have a higher impact on the chances of commercialization and agricultural transformation than the "soft constraints" like household resources, risk propensity and entrepreneurial capacity (Chirwa & Martita 2012, Fan e.a. 2008).

Nevertheless often the land that is available offers the possibility to increase the production, at least if water is available. To begin with the farmers could make better use of seeds and fertilizer. A farmer should then buy high quality seeds at the beginning of the season instead of using the seeds left over from the harvest of last year. But already at this stage a change of mindset is required (Tshikuku 2015): it is a big step to take care that some money is left at the beginning of the new season in order to be able to buy those better seeds. It requires anticipation and planning and self-restraint in view of other urgent matters that need money. Protected cultivation may be promising, but the farmers need to break with existing cropping systems and need capacity, technical support and skills to do so (Nordey e.a. 2017). Here as well some "hard constraints" make their influence felt. Many commercial farmers have to sell their produce due to economic need at a time of low prices, during harvest time, while later they have to buy food, when prices are high. High input prices may in such circumstances become serious obstacles (Ongeri 2014). Such "hard constraints" should be surmounted in one stroke with "soft constraints" such as knowledge, skills, mindset and entrepreneurial values in order to make any progress. For instance, the farmers should know or learn simple facts like that high-quality seeds perform better if they are not just put into the ground, but first grow in a nursery, so that they are not flushed away by the rain. They will also have to learn bookkeeping and keeping track of the produce. They will also have to learn to grow crops in view of customer demand and not based on farmers traditions. For the farmers involved these are big steps, because they are not only learning new things, but they also learn to learn in a new way. This new way of learning itself needs to be learned in the first place. In the former days they would learn from tradition and example and now they have to internalize new knowledge in a more self-conscious way and that often means also to look at oneself from a different perspective: not as a person who goes with the flow, but as an "agent of change". Considering the traditional way of learning, on-the-job learning may be more

successful than learning in the classroom. In the SURE approach it is more suitable to prepare would-be horticultural farmers during a short time in class and start the production with protected cultivation as soon as possible, but do so with a long-term provision for monitoring and supporting them in their learning curve. All this is involved in the building up of capacity. People who have learned to work in this way can also find another job later, if that turns out to be necessary.

The SURE approach starts small while thinking big. Three steps specifically lead from small to big.

1. **Step-by-step improvement of the production**. Some examples have already been mentioned. Better seeds, fertilizers, breeding practices, integrated pest management / spraying, bookkeeping, also water provisions. Horticulture provides a relevant option also for farmers with small parcels of land, by the use of tropical greenhouses. The big advantage of the step-by-step SURE approach is that no big financial investments are required, which are supposed to lead to immediate results, but to require a high degree of professionalism. The costs of a tropical greenhouse, depending on size, can be recovered already within one or two years, if the produce is chosen strategically. Step-by-step in this way growth takes place at three levels: (1) by means of small *investments* (and small risks), (2) by learning new skills and *expertise*, (3) by growth in capacity and *entrepreneurial mindset* to deal with these innovations effectively. It may be commendable to start with only a small greenhouse, say 8 x 15 m, and become familiar with horticulture in this way, without being fully dependent on it yet. But that takes provisions for marketing the produce cooperatively. Also women groups could in this way cooperatively go beyond subsistence farming.
2. **Cooperatives or small enterprises**. If a number of farmers are involved in these processes, new steps become possible in as much as the produce increases. Even if only 10 or 20 farmers go along with this approach at a certain moment it will be feasible to cooperate and do something on processing and packaging. This adds value and again leads to an increase in income. Especially in the beginning it can be helpful to share particular facilities. This can be a machine to process cassava and make flour or a machine to produce juice, or simply improving the quality of packaging so that the produce can be transported over larger distances and reach new markets. If other farmers see the good example and the advantage they will follow. First farmers can cooperatively buy inputs. Cooperatives for credit may be more challenging, but the Sacco model of group lending under the supervision of the bank may be a typical African solution. A cooperative for market outreach brings new challenges in the sense of standard quality, certification, constant delivery etc.
3. **Chain management**, infrastructure and regulation. Even in order to reach out effectively to the local market some form of chain management may be necessary. The products need to be transported and delivered elsewhere, mostly in the cities, preferably cool and well packed. That takes good logistics, technology and infrastructure. It requires mapping how offer and demand can be brought together per product in order to guarantee a market. In the case of exports good cooperation with customs needs to be established and the produce needs to be certified. That is also important for access to supermarkets. The state authorities are indispensable in doing their part by devising enabling policies and regulations for the increase of agricultural production.

In the SURE approach these three issues – investments, skills/technology, capacity – dovetail into each other in a comprehensive process of growth, step-by-step, bit by bit, in order to keep pace with the learning curve of the smallholder farmers (Vorley e.a. 2012, Kroesen & Darson 2013). Which steps should and can be taken often depends on the local context. Precisely through growth in small steps the smallholder farmers will be able to keep pace. The transfer

of new knowledge can easily result in shooting over one's head. Overwhelmed by too much information the farmers involved will not get to grips with the knowledge provided. Everything went too fast. Often people only learn by turning new information into habit and routine. That's the way farmers mostly learned their profession, from the former generation in a process of learning by doing. The same SURE approach can also be applied to other areas, where not only new knowledge and skills are required, but also a change of mindset.

Research for a viable business plan Nairobi

One of the student teams from the Delft University of Technology has worked on a business plan for a group of farmers organized in the neighborhood of Nairobi (Seed2Feed, Alberts e.a. 2018). This is meant to prepare the ground for a training program for a group of 40 to 50 farmers tutored by 3 or 4 lead farmers who are already more experienced in horticulture. Such a training program should adopt the principles put forward in the SURE approach. This is not an easy way to profitable business, but the Dutch initiators considered it important to create an entrance to modern farming for smallholder farmers who are not yet on that level, in response to the challenge mentioned before, to bridge the gap between modern technology and traditional smallholder farming. A straightforward business approach without taking into account the social environment doesn't work for this target group, not even for traditional commercial farmers (Rivera-Santos & Rufin 2010).

A Dutch consortium is coordinating efforts in that regard. A pilot, initiated by three business partners, Koppert Biological Systems, Rabobank and Rijk Zwaan is taking place in Kenya, These parties are founding fathers of the Seed2Feed Foundation which coordinates the pilot project. The foundation started in 2017 as a result of the Rabo Seed2Feed conference, an international conference about the question how the Dutch horticulture industry could contribute more in addressing food security issues, especially in Africa. The pilot aims to set up a business initiative to help Kenyan commercial smallholder farmers expanding from open field farming to protected farming in tropical greenhouses and nethouses and to provide access to finance and markets.

In the pilot a number of Dutch and African institutions in horticulture and related areas cooperate. Consortium members, apart from the above-mentioned Dutch partners, SNV, a Dutch development organization , Kenya Highland Seeds, which sells seeds, but also supports farmers with extension services, Ojay Green limited, a social venture to which the future horticulture farmers will become suppliers. It supplies local supermarkets, hospitals and hotels and also educates and advises smallholder farmers, and furthermore Holland Greentech, an East African based horticulture enterprise involved in supplying horticulture inputs and greenhouse related equipment and related services. In addition also the Delft University of Technology contributes to this initiative with students internship trajectories from the minor program International Entrepreneurship and Development. The students from the Delft University of technology participating this year (2017/2018) studied food safety, greenhouse options, irrigation solutions, access to finance and dealing with diseases and residues. They also reviewed the level of capacity of the farmers. On the basis of that information they devised a flexible business plan that allows for different inputs and processes these inputs, resulting in an economically viable business case in the end. Many different types of information are relevant in that regard. Prices were taken into account also of water pumps, irrigation systems, tanks, fertilizers, insurance and labor costs etc. The final business plan

(including an Excel sheet, allowing different inputs and calculation procedures) shows a positive outcome on the intended experiment. That means: a positive outcome for a business plan that includes training of farmers in the way proposed, and suitable financial schemes provided by banks, and finally cooperative marketing of the produce by Ojay Green.

The students observed two risks related to the project which required more intensive attention. One is the seasonal lack of water, an increasing problem in Kenya in general. At some locations farmers were without water for more than three months, making it impossible to use any greenhouse or apply any form of agriculture whatsoever during that time. Of course that affects the business case. The other major issue is the capacity of the farmers. The farmers that were selected for the program appeared to be less experienced than initially assumed. That makes capacity training an even more important issue. It also shows that capacity training shouldn't only be on the shoulders of commercial partners. NGOs need to participate in it as well as development donors and government agencies as well as educational institutions. As in many other cases capacity training and the social responsibilities it entails cannot always be included in a realistic cost recovery model (Rivera-Santos & Rufin 2010). It should be kept in mind that capacity building includes both entrepreneurial skills and an entrepreneurial mindset and attitude as exposed in the Delft approach towards cross-cultural entrepreneurship described above. That may entail quite a social transformation.

A business innovation system

The comprehensive approach of the Dutch/Kenyan consortium referred to above is a good example of what one can call a business innovation system. Innovation and entrepreneurship and market growth cannot be achieved by means of separate and individual business plans. In order to have real impact a more systematic approach is required. This is especially the case if increase of production is targeted by means of value addition and sophisticated technology. Innovation should take place along the whole chain from production to markets, including all the infrastructure required (Fisher & Qaim 2012). If a number of stakeholders puts such an innovation system in place a lot of small entrepreneurs or would-be entrepreneurs can tap into and made use of the different aspects of it. Seemingly that runs contrary to the Delft approach to entrepreneurship as described above, which may apply to enterprises of all sorts and occupations. The sector of profession that an individual entrepreneur wants to step into often depends on the individual choice of the entrepreneur participating in the program. A business innovation system, however, has the objective of innovating a complete sector and offers a number of opportunities for individual entrepreneurs from which to choose. This more comprehensive approach has the advantage that it becomes more easy to provide all sorts of support from professional to financial etc. to all the business activities included in the system. Along the whole chain there is room for many different initiatives, providing all sorts of business opportunities. Greenhouse constructors, irrigation provisions, cooling and storing, equipment and businesses to measure the level and source of nutrients the soil contains, disease management, packaging, manyfold ways of processing and packaging the food, transportation, etc. etc. they offer as many business opportunities for small and medium-sized enterprises.

More partners and agencies need to come in. It is not sufficient that just one consortium of Kenyan/Dutch business partners is investing time and money to improve the activities along the chain. Many similar initiatives are required. In addition, Kenyan government agencies should also be involved, in the form of extension officers, infrastructure improvement, agricultural policies that are conducive to an entrepreneurial growth of smallholder farmers,

financial provisions for growth of the sector (tax regime etc.). System changes cannot be brought about only by individual enterprises. A policy and regulatory framework should be in place to prevent that individual initiatives suffocate under the pressure of a malfunctioning institutional environment (Vorley e.a. 2012).

There is a role also for institutions of higher education. The business innovation system that is required offers opportunities for both teaching and research. The business innovation system for agriculture offers a local research agenda for home grown research by universities and research institutes in Kenya and throughout Africa. It will not be a rocket technology, but it provides an important opportunity for innovation and also for cooperation with institutions of higher education elsewhere in the world, like the Delft University of Technology in the Netherlands. No large amounts of money and investment are required to do the research and the research is immediately relevant to put to practice. Especially there is frugal innovation agenda, both on the level of technology and institutions. A lot of small machinery for food processing (irrigation, cassava flour, making juice) is not available, because the same gap mentioned at the beginning of this article in greenhouses also turns up when it comes to processing machinery. Mostly everything that is available is designed for large-scale application by big businesses, which excludes smallholder farmers or small cooperatives of farmers and related activities by default. In addition, agricultural technologies are changing and becoming more sophisticated. As already mentioned, ICT technology increases in importance, providing monitoring systems, weather information, information (systems) on plant diseases and treatment and many more, from which all the businesses in the innovation chain can benefit. This type of innovation is not only interesting for African universities that have to deal with small budgets, but increasingly also for high-tech research institutions in well-developed economies. Agriculture is changing and more technology and more sophisticated technology as well will enter the scene.

Conclusion

It has become clear that there are no straightforward easy solutions for rural entrepreneurship. The problem for smallholder farmers is a multi-faceted and complicated one. Many projects initiated with all good intentions failed nevertheless. It is important to learn the lessons from these failures. This paper tried to do so by pointing out first that many entrepreneurial initiatives from the bottom up are required. It also shows that there are many options, not only by focusing on horticulture, but also taking into account value propositions related to agriculture, the building of greenhouses, irrigation systems, producing of fertilizers, seeds, small machinery for food processing, ICT monitoring, information systems, etc. etc. Two important issues are put forward that are often overlooked, the quality of the internal management style and the external business operations, that is, dealing with other actors in civil society and their relationships to the government. Often the challenges posed by the external environment are severe and not easy to deal with. But the quality of the internal management style, if it builds solidarity, motivation, commitment for professional work, can make all the difference for survival in a harsh environment. A strategy for step-by-step growth is proposed in that regard. *Especially smallholders, even commercial smallholders, should better not immediately start with high-tech and big business.* The farmers need to grow into it and become familiar with new procedures, new attitudes, a new repertoire of professionalism and social relations. They can grow step-by-step by investing time and again in new frugal and affordable technology, by capacity training in dealing with the technology, with the business and with its external environment. Also the institutions that support (commercial) smallholders should understand that, although the final objective is a complete transformation

and modernization of agriculture, especially horticulture, *the first steps are very small and need a strong commitment and spiritual resilience and endurance to turn it into a success.*

Finally it should be underlined, that such a strategy can only work if it is supported by conducive government regulations, building trust and cooperation with many partners and stakeholders along the chain, and that entails an inclusive business innovation system. By inclusive we mean: many initiatives along the chain are required to reach the desired effects. All these businesses and initiatives are co-dependent on each other and therefore they should cooperate as much as compete with each other. *This can only work if also the government place its role by proper regulation and policy setting.* All of this taken together shows a way forward, more than that: it can turn a negative into a positive. Africa is the continent with the most land that is suitable for agriculture, but still not in use, even if the areas available for wildlife are respected. While African countries in general at the moment need food imports, the export of food could as well prove to be the great opportunity that is waiting for Africa.

Small is beautiful, but big is powerful, goes the saying. But for the purpose of the problem which is the focus of this paper, the question how smallholder farmers can grow and enter the market as entrepreneurs, another motto may be required. Something like "many times small is big". Many small initiatives that multiply and add to each other along the whole chain of activities can lead to a system change. Africa has the potential to become a big exporter and a big player in a field that throughout the succession of development fashions and policies has been neglected: the field of agriculture. This can only succeed if these initiatives are well coordinated along the whole chain of activities and by a host of local and international stakeholders. It has always been the case that entrepreneurship is not only a matter of individual initiative, but also and foremost a matter of large-scale cooperation reaching out through large networks.

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