TRADE & INDUSTRIAL POLICY STRATEGIES

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Wolfgang von Loeper: Sustainable farming – ensuring food security while preserving the planet

OVERVIEW

Climate change will have drastic impacts on South Africa's economy and society and the need to adapt is urgent. As the country embarks on a just transition to a low-carbon, climate-resilient and environmentally-sustainable economy, an opportunity exists to develop domestic small, green businesses. This case study forms part of a broader initiative on small business development in South Africa's climate change space. It presents the journey and experience of Wolfgang von Loeper, a South African agricultural scientist active in the climate change adaptation space.

Trade & Industrial Policy Strategies (TIPS) is a research organisation that facilitates policy development and dialogue across three focus areas: trade and industrial policy, inequality and economic inclusion, and sustainable growth.

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Case study by Muhammed Patel TIPS Economist: Sustainable Growth

FROM SUSTAINABLE FARMER TO SAVVY SCIENTIST

Wolfgang is a passionate and enthusiastic sustainable scientist. A philosophical glint appears in his eyes when describing his work – he chooses as the starting point the constraints on life in the universe. Having a farming history himself, Wolfgang started his agricultural career as a wine grape and olive farmer in the Cape. Abiding by an organic philosophy, he closely managed a "living" farm, rich in biodiversity. Wolfgang collected data from the farm in a meticulous manner, deploying scouts to various areas. These scouts documented farm conditions by hand, and would report back to Wolfgang, who would then enact whatever measures were necessary. This instilled in him the importance of collecting proper data for efficient and sustainable farming.

Wolfgang furthered his education studying economics, followed by a sustainable development focus in his Master's degree. He already had a background in programming and understood farming intimately. Through his tertiary experience, Wolfgang realised that large-scale industrial conventional farming as currently practiced was inefficient and taking place at the expense of the planet's and humans' future. He believed that sustainable farming practices needed to be implemented on a wide scale. Proper feedback from the farming ecosystem would reduce over-irrigation and the quantity of pesticides and fertilisers needed. A cohesive farming system was lacking, in his experience. A system which allowed for data to be collected meticulously and translated into simple key-metrics that a farmer could action on, in a way to make sustainable farming easier, was needed.

MySmartFarm was thus born as a company aiming to reduce inefficient and unsustainable farming, through data collection and monitoring farm ecosystems. MySmartFarm aims to be a disrupter in the agricultural space. It was set up with a mix of funding provided by the Industrial Development Corporation (IDC) and the remainder raised through private equity. In total R10 million was raised to develop the software and the appropriate online interface in the form of a software application and multiple mobile apps, linked with strategically-placed sensors throughout a farm.

KILLING NATURE FOR FOOD: THE PROBLEM AND THE SOLUTION

Fertile land occurs at a premium in the universe – thus far a habitable planet besides Earth is yet to be found, making it all the more important to look after the planet we have. Conventional farming practices developed on the back of industrialisation are unsustainable and a key contributor to climate change. Globally, the Agriculture, Forestry and Other Land Use (AFOLU) sector contributes about 24% to greenhouse gas (GHG) emissions (Smith et al, 2014[1]), which is more than any other industry.

Large-scale commercial farming is unsustainable in its current state for various reasons. Conventional farming typically uses a fixed schedule of irrigation, ignoring important data from the soil and crops. Scheduled irrigation is water-inefficient as the water needs of all crops and regions on a farm differ based on the soil conditions, among other things, and giving these crops identical doses of water is inappropriate.

Conventional farming also employs excessive pesticide and fertiliser use which reduces soil to an anemic remnant of a once "alive" soil system rich in biodiversity. These pesticides and fertilisers destroy the innate health of the soil and environment. The over-use of pesticides also creates inefficient and perverse pest cycles. When too many pesticides are used, both beneficial and harmful pests and insects are killed off. This serves as an attraction for other pests and insects to infiltrate which are subsequently treated with more pesticides, and so the cycle continues. Pesticides are also absorbed into food and ultimately also by the people eating it, and may have adverse health outcomes. Biodiversity loss is also a key problem with 70% of the insect population being lost in certain locations in Europe (Germany), for example, through over-reliance on pesticides (Hallmann et al, 2017[2]). Heavy fertilisation, spraying, heavy tillage, and no cover crops hurt the environment and farming ecosystems. Sustainable farming practices like cover cropping, companion crops and no-tilling increase the life of the soil and keep the soil in its natural, rich state, increasing yields and the resilience of crops.

HOW MUCH WATER IS REALLY NEEDED TO GROW FOOD?

Large-scale industrial farming typically employs a scheduled irrigation system which sees all crops receive identical doses of water on a given farm. Increasing the organic content of the soil increases the water-holding capacity of the soil reducing the need for irrigation.

Cover-cropping is a sustainable farming concept which refers to planting crops exclusively to enhance the life of the soil. Cover crops are commonly used to limit weeds and soil erosion, build and improve soil fertility and quality, control diseases and pests, and promote biodiversity. Cover crops also reduce the impact of droughts on yields due to reduced water stress and enhanced intelligence of the soil ecosystem. The water-holding capacity of the soil also increases.

Companion crops refer to the planting of crop species alongside the main crop, due to positive synergistic effects these have on the main crop. Companion crops thrive alongside the main crop and share a mutually beneficial relationship. For example, maize crops are not immediately perceptive of water stress, but companion crops can detect this stress sooner. Planting companion crops alongside maize increases the plant's ability to perceive water stress, and maize crops are able to detect water stress faster in the presence of these companions, enacting a series of life-preserving steps in the plant, thus increasing the probability of survival. Without companion crops, the resilience of the main crop declines.

Sustainable farming practices like cover cropping and companion crops also reduce the need for tilling and ploughing as the soil is healthy, which dramatically decreases GHG emissions. The ploughing and tilling of soil results in an eruption of GHG emissions after ploughing. With companion crops and no-tilling, GHGs are actually sequestrated, serving a mitigation role. Agriculture alone has the potential to decrease global GHG emissions by 20%-30% through practices such as cover cropping and companion crops (Pretty, 2008[3]; De Schutter and Vanloqueren, 2011[4]). This also increases the crop nutrients to a level that supersedes conventionally-grown crop nutrients. The positive effect is the crop that is harvested is much healthier. Sustainable farming practices ultimately remove the need for pesticides, fungicides, inorganic nitrogen and phosphate fertilisers as the soil is healthy. Sustainable farming practices also harness rainfall and replenish groundwater. They reduce water runoff and create channels for water to seep into groundwater, thereby increasing water retention in the soil.

[1] Smith PM. Bustamante, H. Ahammad, H. Clark, H. Dong, E.A. Elsiddig, H. Haberl, R. Harper, J. House, M. Jafari, O. Masera, C. Mbow, N.H. Ravindranath, C.W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling, and F. Tubiello, 2014. Agriculture, Forestry and Other Land Use (AFOLU). In Climate Change 2014. Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

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[4] De Schutter, O. and Vanloqueren, G. 2011. The New Green Revolution: How Twenty-First-Century Science Can Feed the World. The Solutions Journal 2(4), pp. 33–44.

[5] Chigumira, G. 2018. Briefing Note: Farming 4.0 – Implications for South Africa. The Real Economy Bulletin Second Quarter 2018. TIPS.

SUSTAINABLE FARMING AT THE TOUCH OF A BUTTON

The MySmartFarm solution involves a complete package consisting of the hardware, software and technical expertise provided to farmers to make their operations more sustainable. A specially-developed app allows farmers to assess the health of a farm through real-time feedback from sensors on a farm. Sensors are strategically placed throughout a farm which collect data on climate, soil moisture, water and diesel use, and spray applications. Artificial intelligence systems use the data for irrigation forecasts, crop and livestock production, pest and disease pressure, and for certification compliance reporting. The software leverages radio technologies and cloud connectivity to unify the data at a central database (dashboard), ready to be accessed. All the data is aggregated from the sensors and processed for the farmer through an app. The backend translates all the technical data into specific actions that the farmer can take to optimise crop yields.

This simplifies the system as the farmers do not have to interpret complex data and systems. The system provides the farmer with interventions tailored to the specific needs of different crops and sections of a farm. The farmer then knows exactly how much irrigation, fertiliser, and any other remedial measures are required to ensure good yields and a healthy crop. Forecasting allow farmers to be proactive rather than reactive. For example, a forecasted heatwave indicates that extra water should be supplied, given higher temperatures expected, which is less costly than having to remedy an already-stressed crop. A remote function is also available, which means the farmer does not have to be at a computer and can access the dashboard on a mobile phone or tablet.

MySmartFarm's hands-on approach in working with farmers ensures they understand the technology. Detailed feedback from the farm increases the ecosystem resilience over time and advice is provided to farmers on how to increase the resilience of their farm further. The system automatically selects and recommends the ideal solutions based on the data collected. A soil profile also indicates how the farmer can tweak it to optimise the microbial growth, balance the pH, and increase soil vitality. With the equipment, sensors are widely available and relatively easy to procure. Telemetry devices which collect and communicate the data were not available at the specification required and MySmartFarm had to develop its own intellectual property (IP) and solar powered telemetry devices. Renewable energy solutions were incorporated into the design of the devices, such that they can be deployed as a plug & play & forget communication system that works without any maintenance for many years.

Farming 4.0

Farming 4.0 refers to a new agricultural revolution that fuses digital, physical, automated and scientific systems. Agribots, aquaponics, smart collared cows, fenceless farming and e-shepherds, and aero/vertical farming are some of the emerging technologies that fuse the digital, physical, automated and scientific systems in Farming 4.0.

Source: Chigumira, 2018[5]

ALONG THE ROCKY PATH: CHALLENGES AND SUCCESSES

Along the entrepreneurial journey, MySmartFarm has had its share of trials and tribulations. Funding early on was accomplished through a 50:50 grant funding from the IDC through the Support Programme for Industrial Innovation. MySmartFarm worked closely with developers to craft the initial software. This version was provided to clients and, based on feedback, bugs were identified and fixed. The development was iterative and the software continually improved. At one stage, the software became unstable and missing roll-backs to previous versions resulted in a defective service which clients would not pay for. This loss of the operating software resulted in MySmartFarm going back to the drawing board and redeveloping the software from scratch. In this process it lost all of the seed capital, with little to show for it – a major setback for the firm, which needed to go into another funding round to finish the new version.

MAKING CONTACT

MySmartFarm is set to revolutionise the agricultural sector in South Africa, while placing sustainable farming as a paramount objective. Get in touch with MySmartFarm at:

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This case study forms part of a broader initiative by TIPS with support and funding from the Government of Flanders. It is complemented by a main report, *Small Business Development in the Climate Change Adaptation Space in South Africa*, which summarises the research findings on the topic, as well as five other case studies on South African-based entrepreneurs active in the adaptation space. These are available on the TIPS website at www.tips.org.za.