A Sustainable Farm System for Peri-urban Sydney SMEs

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Abstract: Past studies indicate that Small to Medium farmers in peri-urban Sydney, Australia region are forced to operate in a very linear fashion and therefore are strongly dependent on a single system actor, known as the 'Agent' to sell their produce. This study aims to identify if and under which circumstances, Sydney farmers could have resources that would allow them to no longer have to depend upon any single system (ie. The Agent). This research identifies that in order to remove single actor dependency, the Sustainable Peri-urban Farm system, would need to allow farmers to receive inputs and feedback from both natural and manmade systems and vice versa. The well integrated, Sustainable Farm system, would create a base where farmers could receive resource and coordination instructions from the Environmental and Biological Systems while systems like Communication, Health, Market, Transport, Education and Agri-tourism Systems would help farmers support and nurture new collaborative business ventures and opportunities.

1 INTRODUCTION

In New South Wales, Australia 70% of businesses are classified as Small to Medium (SMEs) (Griffith and Wilkinson, 2012). Out of those 70%, 8.7 % contribute to the field of Agricure (Connolly et al., 2012). In peri-urban Sydney, capital of New South Wales State, (SME) farmers are experiencing difficulties and are often unable to sell their produce directly to the markets, so instead rely on the 'Agents' to sell the yield. One of the main reasons for this, is that in Australia two large supermarket chains, Coles and Woolworths, hold a duopoly and require certain quantity of produce before they can accept sales (Keith, 2012). Studies conducted in 2014 by Hol indicate that farmers not only have to meet quantity requirements but are also forced to wait for four to five weeks before they can find out how much they could earn (Hol, 2014). During these studies it was also identified that farmers often know that they are taken the advantage of, however are unable to make any changes. To assist them an online application that allows farmers to monitor selling prices in terms of minimum and maximum sale values was developed. Based on the imputed data the system computes most optimal payments for each produce. It was identified however, that the application like this will only allow farmers to document and confirm current farmer worries and that unless any other actions are taken, will not be able to change the crop selling process. It seems that for this to change farmers will need to look into market diversifications and the abilities to approach markets through other channels (Hol et al., 2014).

Therefore, this study begins by identifying that currently only one factor stands between farmer and the customer, 'the Agent', who dictates the yield price and sales. For this model to change, farms need to become a part of more self-sustainable existence.

In nature as well as in engineering, self-sustainable are the systems that are able to self-organise, adapt and when required change. When applying this concept to agriculture it can be seen that sustainable agriculture is a system that can evolve by taking care of resources, environment its users and beneficiaries (Hatwood, 1990).

To place this into perspective, researcher reviewed two systems, one natural and one manmade. In nature it can be seen that circulation of water is a system where rain and snow fall, snow melts the water passes through drains, flaws into oceans, rivers and lakes and is then utilised by living beings and organisms, it also evaporates and continues to circulate and self-organise.

This change within the systems is easily seen when for example new cities are formed, buildings

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and shopping malls built, new roads developed and large areas concreted. Water system continues to flow; in turn it may create craters or even landslides, new rivers and lagoons however the water system per se stays unchanged.

Traffic on the other hand is a good example of manmade self-organising system where roads are built, cross roads implemented, viaducts constructed and they all in harmony allow for the movement of people and goods. In the cases of accidents for example, or at times when roads are closed due to events, disasters or any other activities, traffic is not put into a stand still. Alternatives are in place such as different roads or even different modes of transports that can be utilised for people or goods to be transported.

In both of the above described systems, it can be seen that there is no single point of failure. Natural disasters can strike, humans' concrete land, but water will continue to circulate. Similarly roads may close, accidents may happen but traffic will still continue to flow.

Therefore, this supports the notion that within the ecosystems (systems that exists together with other systems) no single system should depend on any single instance or single actor (Nachiara et al., 2007). Therefore, farmer dependence on 'Agents' alone needs to be further investigated.

This in turn means that if in fact farming can become a part of the sustainable system, it will need to be able to receive inputs from the systems it is surrounded by, it would need to be capable to complete essential and supporting farming processes and would in turn need to provide outputs that would feed into other systems and their processes.

Moreover, if SME farming is to become sustainable, the model under which it is to operate, should be scalable, self-organising and should have the ability to evolve through a feedback loop (Nachira et al., 2007).

Consequently, sustainable SME farmer system in peri-urban Sydney for example, if effectively implemented, may be able to learn from the other systems. The system could learn from the farmers in the other locations and from the actors of the other surrounding and supporting systems. In turn this structure could create a sustainable knowledge ecosystem (Nachira et al., 2007). Such system would allow when required, the Sustainable Farm system to change its properties based on the stimuli it receives from the environment and the system itself. Therefore, the system would become self-adaptive and would be able to change based on the environmental requirements.

So, to identify parameters that would allow for such Sustainable SME Farming system to be developed, five farmer scenarios with the aim to answer the following were collected:

- Which natural and manmade systems surround and affect farmers and which systemic reactions farmers may need to counter act?

-How could system notion (input-process-output) help link and support positive systemic Sustainable Farm System reactions?

2 STUDY DESIGN

To answer the above questions and point out how farmers perceive systemic interactions it was identified that five carefully selected farmers from within the region will be interviewed. All selected farmers reside within peri-urban Sydney region, have English as their first language, are at least second generation farmers and are all growers of the stone fruit. Selected farmers all know about each other's farms but do not in any way work together nor collaborate.

Questions asked in the interviews were open ended. Firstly, general data about the farms was collated identifying current situation, nature of work and technology used. Open ended interviews and qualitative studies were applied as it has previously been identified, that they are a good way to study behavioural traits of users in regional areas (Toyama, 2010, Dhir et al., 2012).

After interviews, collated data was transcribed and then analysed utilizing the Scenario Based Analysis (Rosson and Carrol, 2002).

Scenario based analysis takes into the account that for each problem faced by a particular user group there may be a variety of the problems experienced or a variety of actions taken. Following the analysis all data was carefully categorised into systems farmers interacted with and systems that could be enhanced (natural and manmade) to further help assist farmers. In addition, systems used were categorised into natural systems and manmade.

3 TOWARDS A SUSTAINABLE FARM SYSTEM

Based on the scenario analysis it can be identfied that if a Sustainable Farm is to operate as a Sustainable System it would need to allow for its activities to self-organise, evolve over time and differentiate when

needed. Thrfore, to construct this model the following was identified:

-*Natural Systems farmers depend on*

-*Manmade Systems important for farmers*

Each System has been identified via scenartio analysis process. SME Farm Sustainability System Topology is presented in Figure 1. It is important to note that topology identifies systems and their sub-system elements or components. Each component within the map has been labeled with the symbols.

-***No entry***- red cicle with the white horisontal line signals activities farmers depend on but have no or have a very limited control of;

-***Green tick***- signals activities which have already been implemented by one or more of the scenario farmers;

-***Light bulb***- represents activities that have been implemented by SME businessess, however not by the case scenario farmers;

Therfore, to answer which *natural and man-made systems surround and affect farmers and which systemic reactions farmers may need to counter act* it was identified that Environmental and Biological systems influence farmers signifficantly and that farmers have limited or only partial active control over it. However, it was also identified that farmes have reactive and preventative controle over these. To explain this in more detail, it can be seen that farmers have no control over weather, consequently they continuously they have to monitor weather applications and channels to work productivelly. They have no influence over natural soil dryness or high temperatures however, if there is no sufficient water farmers water the plans in addition to the water received via general precipitation. Furthermore, if farmers monitor soil quality they may be able to add feertilisers to assure plans can effectively grow. Biological systems place continuous constraints on farmers and their produce. For example, farmers regulaly need to control and save crops from bugs, pests, animals and weed. Farmers have no influence dirrectly but indirectly they can spray plants and protect them to assure successfully yield.

Other Systems, mapped in Firure 1 are manmade systems and they are: Communication, Health,

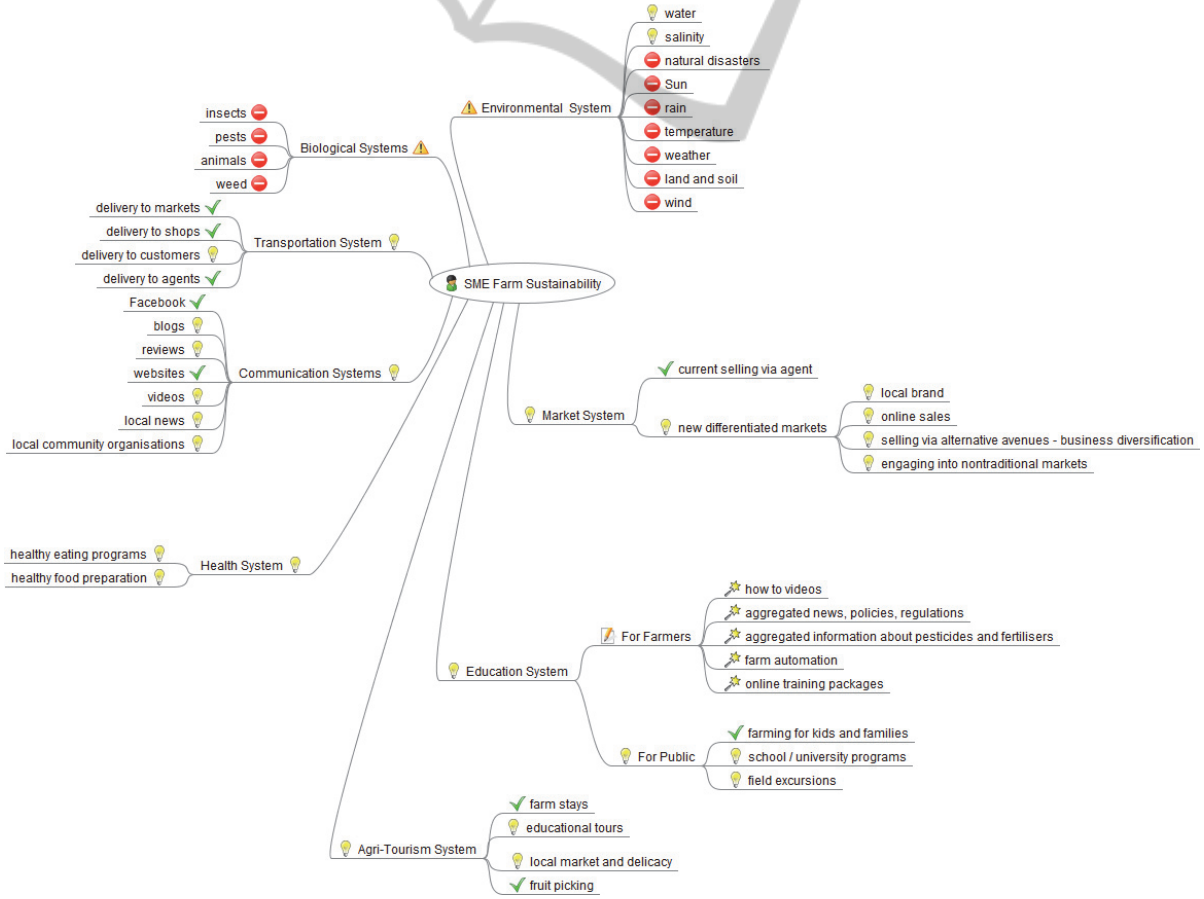

Figure 1: SME Farm Sustainability System Topology.

Transportation, Market, Education and Agri-Tourism Systems.

All scenario farmers identfy that successful communication is absolutely paramount for the sucessfuful and Sustainable SME Farms. Some farmers are already exploring how blogs and social media, like Facebook could encourage and enhance message exchanges.

Farmers also identify that websites, apps and videos could further enhance farmer education and could also provide channels through which farmers could educate wider community.

Furthermore, by allowing data within the agricultural websites to be aggregated (ie. Which fertiliser to use; what to plant where; current pricing models, regulation) farmers could make quicker and more reliable decisions. This would in turn allow for the context and time specific decisions to be made in a given time and place.

The agregated system could then open doors to new markets and business models (eBusiness – farmers selling online; eAustions – agents compeeting for farmers).

In the future, farms could also become integral cathalysts of Tourism system (farm stays, fruit picking and local markets, tasting). For example, many Sydney attractions such as iFly, Wet and Wild, the Blue Mountines are located in Peri-urban region (Destination, 2015). It is therefore expected that the regional proximity could assist in establishing links between tourist agencies and farms.

In more recent times, healthy lifestiles are beeing marketed and supported. Farmers have crucial knowledge and resources in the area. From one of the scenarios it can seen that farmers are organising healthy lunches and bringing people within the region together. They are also engaging kids in farming activities (ie. planting, picking fruit/vegetables).

Based on scenario analysis, it can be seen that many farms are already well connected with Transport, Education and health systems which has the potential opens many new opportunities.

4 SUSTAINABLE FARM SYSTEM

A Sustainable SME farm system in peri-urban Sydney region could become a part of a much larger systems. Farmer's earning in such case, would no longer depend upon the 'Agents' and their offering prices ('Agent' system would instead become a part of the Market subsystem).

In the new model, a Sustainable Farm system would be interlinked to a number of other systems where for example low agent prices would just simply shift sales and farmers' focus into alternative funding sources. Systems would exist in harmony and be a part of the larger ecosystem. They would influence one another but would each in their own right be able to adapt, self-organise and sustain.

When applied to the farming case, this would mean that the farmer would be able to identify based on geo coordinates and season, which crops to grow in the specific conditions (Walisadeera et al., 2013) and which pesticides to use.

Table 1: Systems Providing Inputs to Sustainable Farm System.

Systems Providing Inputs to Sustainable Farm System	
Biological Systems	Information about pests, weeds, animals and protection (pesticides, fertilizers).
Environ-mental Systems	Information about water, weather, soil, warnings, disasters, fire and precautions
Commun-ication Systems	Learning how social media is affecting and influencing consumers. Learning how consumers are becoming integral providers of information.
Health System	Current issues – ie. Obesity, heart disease, non-healthy eating, quick and easy meals, importance of organic produce.
Market System	Other SMEs sell via aggregated and auction sites and eBusiness. Farmers could also explore these opportunities.
Transpo-rtation System	Farmers utilize transport systems. A number of tourist companies consume utilise transport system. Known tourist routes could easily be changed so that new stops can be added ie. Tasting of local delicacies.
Education System	Various professionals, as well as farmers could share knowledge and skills via online learning platforms. Furthermore, work integrated learning could be implementing so that both farmers and students can benefit.
Agri-Tourism System	Peri-urban Sydney farms are located in the region where there are many tourist attractions. Tour groups could make some of the local farms their tourist stop destination. Similar agreements could be made with tourist agencies and tour guides.

Table 2: Sustainable Farm System Providing Inputs to Other Systems.

Sustainable Farm System Providing Inputs to Other Systems	
Biological Systems	Lessons learned, what worked, what did not that could form a knowledge base (a knowledge ecosystem). Ie. Which pest responds best to which pesticide?
Environ-mental Systems	Context specific knowledge should be stored and recorded so that it can be re-used per need basis (ie. what to do if there are high winds? Manipulation of soil content ie. How to add suitable fertilizers?).
Commu-nication Systems	Information about farms, healthy crops and healthy eating, tourist attraction could be shared with public via social networking tools ie. Facebook, blogs, Twitter. This would help promote farm activities to public and would also help increase number of followers.
Health System	Cooking classes, eating and buying fresh farm food would inevitably result in healthier population. Therefore, public could be encouraged to utilize healthy produce.
Market System	Farming SMEs could create a local brand by which the region could be known by. Furthermore, the brand would not only help build the identity but could also allow farmers to sell to larger markets (eBusiness). Furthermore, selling via Agents could completely get transformed into a new eAuctions.
Transpo-rtation System	Currently, goods are quickly distributed to the markets however in the future it would be expected that goods could be directly transported to the customers. Furthermore, a transportation system could also provide a link between the Tourism and the Sustainable farm. For example by modifying current tourist routes tourists would also be able to visit local farms.

Table 2: Sustainable Farm System Providing Inputs to Other Systems (cont.).

Sustainable Farm System Providing Inputs to Other Systems	
Education System	Based on the farmer knowledge and experiences, data could be aggregated and education systems developed. Such systems could also be used by farmers so that they can make decisions quicker ie. what to grow in which region based on soil and weather pattern? Furthermore, online resources are becoming abundant and online learning a norm. Therefore, new learning modules could be deployed for both farmers and global population. Farms could also become centers where work based learning curricula is implemented.
Agri-Tourism System	Farmers would share their knowledge and skills with the locals and tourist alike. Farms could become areas where both locals and tourists mingle and learn new skills. Such knowledge could be further shared online via blogs, recipes and websites.

Furthermore, the ecosystem environment would allow farmers to receive feedback from the other systems (ie. be able to identify most optimum irrigation methods). The Farm System would in turn also provide feedback about the pests, weed, pesticides and fertilisers where farmer experiences could be recorded and such data become valuable information for new scenarios (a part of the knowledge ecosystem).

Furthermore, by utilising local food and by promoting local products markets would start to shift which in turn could create some disturbances within the current models.

New implementations would create a feedback loop that would feed into Health, Transport and Education systems where new data could be recorded, stored and used when required.

Therefore, the Sustainable Farm would need to become receptive to inputs and feedback from its cooperating and coordinating systems. Detailed information is provided in Table 1.

The feedback loop is multidirectional, and therefore the Sustainable Farm System also provides inputs and feedback to its cooperating and

coordinating systems. Data is depicted in Table 2.

From Table 2 above, it can be seen that the interconnected, Sustainable Farm System, will based on the inputs of its surrounding Systems, have resources to produce new outcomes.

Consequently, each system within the ecosystem will be able to unite its coordinating / controlling systems (Environment and Biological – those that are natural but cannot be controlled, those that can be predicted and acted on) and cooperating systems (Transport, Education, Health, Communication – those that combined with Farming could produce higher values) and consequently become more flexible and open. In this case, Sustainable Farm system will no longer rely on a single 'Agent', instead it will become an equal participant of the ecosystem in which the Sustainable Farm system will exist together with its controlling and /or cooperating systems.

5 CONCLUSIONS

In the future SME farmers will depend on Systems both natural and manmade if they are to survive and sustain pressures currently placed upon them by the 'Agents'. So that farmers can receive adequate information in a given time and place both natural and manmade systems need to be monitored and controlled so that adequate access to timely and contextual information can be received. Farmers need to have access to outputs of the other systems and be ready to accept or when needed counter act the other systems (Natural systems). To further enhance wellbeing of the Sustainable Farm system, farmers will need to work closely in a cooperation with the other related manmade systems (ie. Transport and Tourism). Some system inputs can be used for the support, some can be utilised to initiate and create new business models and some to provide feedback to the other systems that in turn can be used to strengthen the relationships. By doing so, interdependencies between systems are going to be created and knowledge generated (Knowledge Ecosystem). Survival of the Sustainable Farm system will no longer depend on a single system the 'Agent'. New business structure will allow systems to grow, expand, adapt and change when and if required. This way Sustainable Farm system that feeds into and is receiving feedback from other surrounding systems, could be implemented and would therefore no longer exclusively depend on a single 'Agent' System.

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