

Bridging Consumer-Farmer Mobile Application Divide

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Abstract—Electronic mediums such as websites, feeds, blogs and social media sites are on a daily basis influencing our decision making, are improving our productivity and are shaping futures of many consumers and service/product providers. This research identifies that both customers and business providers heavily rely on smart phone applications. Based on this, mobile applications available on iTunes store were studied. It was identified that fruit and vegetable related applications used by consumers can broadly be categorized into purchase applications, diaries, tracking health applications, trip farm location and cooking applications. On the other hand, applications used by farmers can broadly be classified as: weather tracking, pests / fertilizer applications and general social media applications such as Facebook. To blur this farmer-consumer application divide, our research utilizes Context Specific eTransformation Framework and based on it identifies characteristic future consumer-farmer applications will need to have so that the current divide can be narrowed and consequently better farmer-consumer supply chain link established.

Keywords—Smart Phone Applications, SME, Farmers, Consumer, Fruit and Vegetable, Technology, Business Innovation.

I. INTRODUCTION

THIS research is based on the past studies which identified that farmers within peri-urban Sydney region are struggling because current fruit and vegetable markets within the region are extensively dominated and guided by the agent driven market demands. In New South Wales, Australia 70% of businesses are classified as small to medium (SMEs) [1] and 8.7 % contribute to the field of Agriculture in some way [2]. To identify if and how concerning farmers in peri-urban region could be assisted, this research aims to identify alternative strategies that both farmers and consumers could deploy that could in turn help guide market diversifications [3] and also provide alternative channels via which fruit and vegetable consumers could approach the markets.

II. REGIONAL FARMER SCENARIO ANALYSIS

Data for this study was collated via two sources:

- farmers scenario study – that helped identify current farmer interactions and their technology use; and
- iTunes iPhone applications study – that helped identify fruit and vegetable mobile applications aimed at farmers and consumers;

Initial farmer scenario studies were carried out with five

local farmers. All five farmers resided in peri-urban Sydney region, all were growers of stone fruit and all were second or third generation farmers. Initial farmer data was collected via open ended interviews and qualitative studies. The aim of the interviews was to identify farmer typical traits [4], [5]. This allowed for the questions about the typical life on the farm to be asked. The questions also took into the account tools and technologies a typical farmer would tend to utilize in order to be able to solve day to day problems. After interviews, collated data was transcribed and then analyzed utilizing the Scenario Based Analysis [6]. Scenario based analysis allowed for the data collected to be meaningfully grouped. The groupings identified typical work on the farm, websites used to make decisions, context specific applications used as well as use of mobile applications. Summary of the analysis is presented in Table I.

From Table I. it can be seen that all five farmers are in general faced with the similar situations. All own family farms, all sell produce via agents and have all predominately had long standing farms within the region. Based on the data collected, it appears that all farmers effectively use computers, have strong home computer networks, have smart phones and rely on technology day to day.

When asked about the problems they often encountered on a daily basis and the resources they utilized to solve those problems and find required information, farmers identified that they predominately relied on online sources and that they used the following applications and/or websites to identify potential solutions:

- NSW farmer website
- Local council and government websites
- Weather applications
- Weather warning application
- Facebook
- Pesticide and Fertilizer applications

Farmers also stated that in more recent time price prediction application was designed [7] and that it is currently being tested.

The scenarios helped identify that farmers are technology savvy, that they rely on their computers and mobile phone applications and that they predominately search for the information that is essential for crop planting, monitoring and growing. It was also identified that none of the interviewed farmers made full use of the electronic technologies. Only two farmers in the more recent times, attempted to utilize Facebook to promote some of the farm work to the public and try to attract the local community. In order, however, to be able to implement any possible future changes and strategies

and to try and identify means via which farmer – consumer cooperation could be enhanced, it was crucial to holistically review interactions, business and market initiatives from both consumer and the farmer perspectives. Therefore, to conduct this analysis a Context Specific eTransformation was utilized [8]. The framework states that in order to effectively implement change within any business, the business needs to take into the account Strategy – goals and visions, Structure –

organizational directives, Tasks and Processes - operations and Tools and Systems – systems utilized [8]. It also identifies that in order for the change to be successfully implemented, it is essential to address context – the situation in which the business operates; industry specific knowledge – knowledge crucial to work within the particular industry, as well as the dynamic context that is shaped by business collaborators and customers interactions.

TABLE I
 WEBSITES AND APPS CURRENTLY USED BY PERI-URBAN SYDNEY

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Snapshot Situation	-Family farm -Proficient user of technology. -Sells produce via agent.	-Comes from family farms - Sells produce via agent. -Works alone	- Comes from family farms -Works alone -Sells produce via agent	-Family farm -Has number of workers -Sells at the local market and via agent	-Comes from family farms - Sells produce via agent. -Works alone
Online Systems - Basic and Interactive Sites Used	- Regulatory systems (pesticides) - Regional farmer websites	- NSW farmer website - Regional farmer websites	- NSW website - local area website	-Regional farmer websites -Weather applications -Uses agronomy website to upload questionnaire fruit and gains results.	-Regional farmer websites -Weather applications -NSW Agriculture site for fertilisers
Apps	-Weather Apps -Australian Pesticides and Veterinary Medicine authority		-Uses Facebook	-Pest Pro –identifies pests	-Uses Facebook. -Currently testing use of online blogs (kids, parents, local community).
Context Specific Systems	-Uses weather applications - Plans to use developed price prediction system [7].	-Uses weather applications Plan to use developed price prediction system [7].	-Plan to use developed price prediction system [7].	-Uses camera to periodically take photos of fruit and check for disease by uploading to a site. Plan to use developed price prediction system [7].	-Plan to use developed price prediction system [7].

III. TYPICAL FARMER CONTEXT APPLICATIONS USED

Small to Medium Farmers in peri-urban Sydney tend to be predominantly focusing on the survival, the basic existence. Farmers earning is often determined by the agents' market sales and therefore, farmers often have no or have very little input into any future outlooks. Their main focus is produce and the ability to bring the produce to the market. Therefore, farmers seem to lack detailed Strategy and are reluctant on look into future goals and visions. It is worth noting that interviewed farmers did not utilize advertising much either. Advertising has only been done by two farmers indirectly via Facebook. Farmers also stated that for those who belong to the farmer' associations, information about specific farms is often posted on the associations' websites. Such sites often have a community focus and are rarely aimed at attracting wide array of shoppers directly.

Based on the scenario analysis findings collated, farmers who are located within peri-urban Sydney often have relatively small land due to the urbanization that has happened over the last few decades [9]. Lands that previously accommodated farms are now large industrial and urban centers. Farms that remain in the region today operate as small family based businesses. An often crucial decision about the work on the farm is made purely by the main farm owner, or the family. Farmers tend to grow same produce year to year. Such patterns were established over the generations and to date they still have not changed. Therefore, Task and Processes are predominately planned and pre-set. As farmers grow same produce, they require same tools and systems. Therefore, any type of the change implementation within any

of the current farming processes would require strong support mechanisms in order to be executed.

Tasks on the farms usually flow in a very linear fashion. Supply chain has been same for decades. Farmer sells their produce to the agents. Based on the market demands, agents buy goods from the farmers and re-sell them to the markets. To have the fruit and vegetable picked and packed farmers predominately work with their family members but per need basis they may also contract staff during the busy months (planting, picking, packing). While making decisions farmers actively use mobile technologies including websites, blogs and mobile applications. In particular they heavily rely on external web pages such as pages of governmental and agricultural bodies. Some farmers also rely on pesticide applications to upload photos that have been taken of the produce, upload them to the application, check health of the fruit and vegetables and identify which pesticides to use. They also rely on weather applications to predetermine how to save crops and for example identify how much to water the plants as excessive water may be damaging to the crops while too little water may have detrimental effects.

Financial markets for the regional farmers are strongly predetermined by the agents they work with. Farmers for decades have been depending on agents to purchase their goods. Considering this process was set in place, farmers have so far not been advertising much to the public. Their ability to advertise and sell directly is often also guided by the farming bodies and the associations [2]. In more recent times some farmers have been trying to utilize Facebook and blogs via which they are attempting to engage public to come and visit their farms. One of the regional farmers is for example also

trying to run events for the families and teach children about farming in order to engage with the potential consumers.

TABLE II
 COMMONLY USED ITUNES APPS BY CONSUMERS OF FRESH FRUIT AND VEGETABLES DATA WAS COLLECTED FROM

Selling fruit and vegetables	Fruitfinder	This app allowing consumers to purchase direct from certified group of fruit growers.
	Aussie Farmers Direct	This app allows users to purchase farm fresh produce. In this instance farmers have an aggregated pool from which they are selling local certified fruit and vegetables. Consumers are able to set their shopping patterns and set deliveries.
	Buy Local Eat Seasonal	Yarra Valley is another local community association that allows consumers to buy local fruit and vegetables. App emphasises that it is important to buy local seasonal food which guarantees fruit and vegetable freshness.
	Farm Gate Trail	This App identifies farms within Hawkesbury region. It specifies when farm markets are run, who attends them as well as gives a detailed explanation about the services some farms may offer.
Nutritional facts, tracking and warnings, recipes	My Net Diary	This app is aimed at those who would like healthy and in the process would like to lose weight. This app also allows users to keep a food diary, tracks the amount of exercise they do, and food intake.
	Clean and Green Eating	This app has over 150 recipes. Recipes focus on meeting particular requirements such as eating raw food, eating vegetarian, lactose free. Furthermore, users can track specific requirements, create shopping lists and manage cooking.
	Traffic Light Food Tracker	This app allows users to monitor nutritional values of products and based on the nutritional intake the system displays a traffic light report.
	Nutritional Fact	This app keeps a track of the nutritional content of food. App is often used to monitor overall calorie intake.
Buddy Apps	Swap It Don't Stop It	This app helps users swap sweets for nuts, fruit and other healthy varieties. It also allows users to track progress, join fitness classes and monitor food intake.
	The Eatery	This app is a photographic food diary. It allows users to share pictures of food with their friends. Based on this they receive feedback as to how particular dish rates health wise.
Educational Apps about healthy eating	Yummo Adventures	This app is aimed at children. It educates them about healthy eating and required consumption of fruit and vegetables.
	Superfoods HD	This app teaches users about a wide range of superfoods and how to integrate them in a diet.
	Eating Well	This app has series of recipes. Users can filter food, ingredients and share it with friends.
	A to Z Nutrition Facts	This app identifies nutritious values and labels them in accordance to the traffic light report.
Trip and Direction Maps	Food Tripping	This app identifies quick healthy alternatives to fast food, such as food markets, juice houses, coffee and tea houses, vegetarian restaurants and farmer's markets.
	Harvest – Australian Farmers Market	This app reviews Harvest community. It contains information about local markets, stalls and local community.
	Local Food Loop	This app helps identify Australia's farm gates, markets and stalls.

Considering both farmer and the consumer are important players in the effective provision and supply of fruit and vegetables this research focuses on two factors namely, the farmers, as the main providers of the required resources such as fruit and vegetables and the consumers, as the typical shoppers that purchase, prepare and consume fruit and vegetables. Currently it is known that peri-urban farmers and the consumers rarely interact directly. As it can be seen from the scenario analysis some contact is being established via Facebook, though it is limited and is only present case by case. Farmers tend to rely on the agents to bring the goods to the markets or deliver fruit and vegetables to the stores so that consumers can purchase them. However, taking into the account that in today's society new business processes are being established such as those of Amazon, Facebook, Uber, it can be seen that with the implementation of technology and with the adequate business process re-engineering businesses processes can change and new modes of interactions be formed. Therefore, with the new process implementations it is expected that businesses will no longer have to rely on the methodologies established over thirty years ago but would instead be able to adopt new modes of interactions and business operations. To identify the extent at which consumers and farmers today rely on same processes to make decisions

studies were undertaken to identify currently available fruit and vegetable applications that are used by the consumers.

For the analysis to be conducted, fruit and vegetables were taken to be the primary connecting mechanisms within the supply chain that integrates farmers and the consumers. For the consistency purposes, and taking into the account that all five interviewed farmers had iPhones, iTunes applications store was studied [10] to identify fruit and vegetable focused mobile applications that are currently available to the Australian fruit and vegetable consumers.

IV. MOST COMMON FOOD RELATED APPS ON iTUNES COMMONLY USED BY TYPICAL CONSUMERS

Considering therefore, that the successful and effective supply chain depends on both farmers and the consumer, the second part of the study looked into electronic strategies consumers utilize in order to gain more information about the fruit and vegetables. In today's society, individuals often tend to utilize websites and applications to gain more data on particular topics. This study focuses predominately on iTunes iPhone store application as it is a source of many currently available mobile applications. Search keywords such as 'farming', 'healthy food', 'fruit and vegetables' were used.

After a carefully undertaken investigation, collected data

was recorded and grouped into distinctive categories. It is worth noting that the examples of most frequently identified applications are recorded in Table II. All identified applications are currently available for use within Australia.

As it can be seen from Table II, consumers are now searching to buy fresh fruit and vegetable produce. However, it is also worth noting that this is not farmers themselves selling directly to the consumers but that it is grouped farmer bodies often selling to the public. These bodies, such as for

example Farm Gate Trail and Harvest – Australian Farmers Market in turn provide required memberships, certifications and quality requirements so that direct consumer sales can be undertaken. Furthermore, it is also worth noting that consumers in general are strongly focusing on healthy eating and healthy lifestyles. Therefore, it is very likely that the future applications could very easily allow consumers to also be able to search for cooking classes, family picnic events, farm tours and similar community events.



Fig. 1 Apple Menus, Apple Events, Apple Farms

Tracking devices that record vitals, shopping lists and nutritional consumptions are also becoming popular. [11] Many are also being designed to take into the account food consumption, ingredients and health ratings. Therefore, food is also becoming a part of healthy living and a driver of wellbeing. This is particularly true for fruit and vegetables. In addition, organic fruit and vegetables are becoming popular among certain groups as well as local and seasonal delicacies within particular regions. Considering this, in today's age users are also keen to find out about the events in their current locations, what is nearby, when events are happening and what the easiest way to get there is. Healthy food and farm trail maps are also being formed to compliment and link regions, communities, events and peoples' interests.

Consumers these days are also demanding to receive just in time information that is specific to the location – geo coordinates, time – seasons, year and actual time as well as context, for example healthy eating or cooking with seasonal vegetables. This further means that general consumers also want to know where to find fresh fruit and vegetables, when to buy them, how to cook them and where and how to consume them.

V. BRIDGING THE CONSUMER FARMER GAP

Current systems that consumers utilize and those which farmers depend on for the successful farm operations differ.

Each group utilizes applications required either for their direct business – such as farmer needs to check weather in order to know how to save or water crops, while consumer needs to search about how and where to purchase healthy fruit and vegetables, cook food, and track food consumption. Therefore, it appears that each group is targeting predominately their end result – growing fruit and vegetable and consuming it respectively. In more recent times it appears that farmer associations have attempted to unite and are trying to sell produce directly to the consumers. Having reviewed all iPhone fruit and vegetable related applications that are currently available on the market, it can be seen that at present stage there is no one common application that unites the complete fruit and vegetable supply chain starting from the farmer and finishing with the consumer.

Based on the data collected directly from the farmers and the data that has been gathered through the analysis of the currently available applications a prototype application was designed. Figs. 1 and 2 depict a prototype that portrays some of the important characteristic an application which would have the power to bridge the gap between the farmer and the consumer would need to have. New proposed developments would empower [12] both farmers and consumers, would bridge the divide that is currently present and would also create new market segments. Therefore, the proposed application combining farmer and user needs would need to

allow each group to gain what is essential for them and give each group power to achieve their goals. For example, farmers would need to be able to advertise their produce and their farms directly to the consumers with the aim to sell their produce, increase market share and gain profits. Customers on the other hand would need to be able to look where to purchase fresh fruit and vegetables, where the farms are, how

to get to the farms, how to buy produce online and directly from the farms. To be empowered and be able to learn more about the certain types of produce both farmers and consumers would need to learn more about the complete supply chain as well as the activities undertaken by the cultivators and the consumers.



Fig. 2 Apple Map, Apple Purchase, Apple Facts

First step that needs to be considered is how fruit and vegetable are planted and where they grow in terms of the farm locations. Farms are seen as the locations where fruit and vegetables grow but are also identified as places where activities such as fruit picking, cooking classes, tasting and similar activities can take place.

Consumers in general like to know about their environments. This can be seen within many food centered applications, food cooking, preparation, even restaurant based applications. Users in general tend to search for places where they can consume healthy food which further helps strengthen the importance of farmers markets, farm trails and farm gates to healthy food sources.

Today's society is also very keen to work on strengthening individuals' health by tracking food consumptions and assuring global wellbeing. Considering, nutritional values of products and what they contain in terms of fiber, vitamins, and minerals is becoming important characteristic that many consumers search for, make decisions based on and share with their friends. Also, knowing how to cook and prepare healthy food is becoming one of the important characteristics as it is closely aligned to healthy food purchases. Ability to locate a farm, identify what it offers and purchase fruit and vegetables is becoming important too. At present many individual farmers are not able to sell directly to the public due to the safety restrictions, however larger groupings can quite easily overcome these barriers. This can be seen based on the established groupings and association based brandings. Therefore, the system that brings together consumers and

farmers needs to allow farmers to access required data- data about the weather, pesticides, fertilizers and at the same time allow consumers to search for data needed to make daily decisions in terms of shopping and cooking. For both to be possible, it is also essential to gather context specific data such as the perimeter of location as well as the services offered in a given time at the particular farm. This then highlights the importance of supporting activities, those which in fact neither farmer nor the consumer can survive without. Farmers on the other hand need also to be aware of the environment in which they operate. They need to be aware of many other factors rather than just simply of growing fruit and vegetable which has been their main focus for centuries due to the barriers set by agents which did not allow direct market penetration.

Today, when boundaries between pure agent-farmer relationships are slowly starting to blur; it is becoming apparent that farmers should no longer be just focusing on growing the farm produce but should also take into the account that it is crucial to interact with the consumer as in fact their supply chain is only complete once the consumer has finally purchased and utilized the produce. Consumers these days tend to search for specific produce and they also look for the locations where they can find them. Consequently, having the information aggregated and by being able to review the supply chain holistically, it is expected that the proposed application could be used by both farmers and consumers to meet their individual needs. It is also expected that the application like this, could open doors to new business ventures. Having a common platform for data exchanges and

process executions would assist in establishing a powerful system with multi user access which would help the contextual application framework to grow and in a long term establish closer links between farmer and the consumer.

VI. CONCLUSION AND FURTHER STUDIES

In conclusion, this research identifies that at present there is a divide between farmers and consumers. Both seem to be focused on their operational roles. Farmers focus on the work on the farm, seeding, growing and picking fruit and vegetables. Consumers on the other hand, focus on healthy life, well-being and fruit and vegetables cooking and consumption. They search for recipes, places where to find healthy produce as well as how to monitor intake and the nutritional values of each produce.

To unite farmer and the consumer it would be important to aggregate data that is crucial to both groups and with it also initiate some new supporting processes that would help assist both farmers and consumers.

First, it is important to have means how to map and locate farms, identify directions to the farms and the routes from the farm to the consumers, next it is important to identify what farms offer – events, fruit picking, packing, direct purchases and cooking classes. Following this, it is essential to allow users to purchase supporting instructions and recipes online as well as be given the access to identify nutritional values of each crop.

It is anticipated that future studies will look into how applications like the proposed prototype, will commence to provide alternative and diversified new business opportunities and will create partnerships that will help benefit both farmers and the consumers.

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