Business modelling for a digital compliance platform: Taking stock and looking forward

(D3.2.1 Desk study and interviews)

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FarmDigital

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This report presents findings from a desk study and the first round of stakeholder consultation on the business models of Ag data platforms that are relevant to developing a compliance platform. It assembles possible analogs and antilogs that can be used to gauge the options for the compliance platform as envisaged by FarmDigital.

Key words: data platform, business model, value network, digital compliance

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Summary

S.1 Key findings

Key issues to be addressed in business modelling of the compliance platform are the following:

- The level of collectiveness or openness in ownership structure and platform development
- The value creation mechanism through data and information exchange
- Monetarisation strategy
- Launching strategy
- Governance.

S.2 Methodology

A wide range of business models are used for developing Ag data platforms in agrifood chains. This report presents findings from a desk study and the first round of stakeholder consultation on the business models of Ag data platforms that are relevant to developing a compliance platform. It assembles possible analogs and antilogs that can be used to gauge the options for the compliance platform as envisaged by FarmDigital.

Acronyms

Acronym	Explanation
Ag	Agriculture
Ag tech	Agricultural technology
Ag data	Agricultural data
API	Application Programming Interface
IaaS	Infrastructure as a Service
PaaS	Platform as a Service
PPP	Public Private Partnership
SaaS	Software as a Service

1 Introduction

1.1 Background

As digitalisation of farming processes continues to expand and intensify, the supply of and the demand for farming data are rapidly growing (Sonka, 2014; Zhang and Shen, 2011). Farm data are generated by a variety of farming operations, ranging from financial and production records traditionally kept by farm management to machine-generated data coming from sensors and smart farm equipment. Demand for farming data is on the one hand driven by the need to make informed decisions and on the other hand pulled by informational institutions such as standards and certification schemes for governance purposes such as transparency and sustainability (Ge and Brewster, 2016; Verbeke, 2005).

To meet the demand for information and to prove compliance with relevant requirements, farmers in the agrifood chains must record and report all kinds of data. The majority of this agriculture-related data are still paper-based, spread over different systems and difficult to exchange between interested parties. There is an imperative need to improve the efficiency of information capture and information exchange by many parties involved. Against this background, digitalising agricultural business data and linking data from different sources has become an important item on policy and research agendas.

FarmDigital (www.farmdigital.nl) is a Public-Private Partnership research programme within the Dutch top sector policy (http://topsectoren.nl/english) that has been developed in response to these developments. The two top sectors Horticulture & Propagation Materials and Agri & Food strive for transparent agricultural supply chains to guarantee food safety, security and sustainability. To this end, the availability of reliable data and efficiency in data exchange are essential. FarmDigital aims to contribute to these aspects by developing and marketing an Open Information Architecture (OIA) that allows for an easy exchange of compliance data for relevant stakeholders. Standardisation authorities, certification bodies, business communities and scientific groups all work together within Farm Digital, coordinated by Wageningen Economic Research, to deliver results on the following three aspects:

1. Open Information Architecture
2. Prototype as 'Proof of Concept'
3. Business model and continuation.

Research on business model and continuation (work package 3) concerns four themes:

1. Impact of the prototype
2. Business models
3. Sector strategy to enhance digitalisation
4. Value and ownership of data.

This report results from the study on business models.

1.2 Scope and objective

This study consists of a desk study on business models related to Ag data platforms and stakeholder consultation through interviews and stakeholder workshops (information on the interviews can be found in the Section References). An Ag data platform is interpreted as an IT-based inter-organisational arrangement dealing with the collection, storage, exchange and use of Ag data. The scope of the desk study is limited to Ag data platforms with publicly available information on their key features.

The objective of this study is to examine main types of business models that are used for developing Ag data platforms in agrifood chains and identify viable options that can be used for future development of the compliance platform envisaged by FarmDigital. More specifically, the research intends to provide answers to the following questions:

- What types of business models are being used for Ag data platforms?
- What features characterise the current landscape of Ag data platforms?
- What are the analogs and antilogs of the compliance platform envisaged by FarmDigital?
- What are the challenges and enabling options for future development of a compliance platform?

1.3 Structure of the report

Chapter 2 introduces key concepts regarding Ag data platforms and business models to set the framework for the stock-taking and the analysis. Chapter 3 paints the big picture of Ag data platforms and zooms in on a number of cases based on the desk study. Chapter 4 discusses the possibilities and challenges for a compliance platform based on the findings from the desk study and the outcomes of the stakeholder consultation. Chapter 5 concludes and discusses future outlooks of a compliance platform within FarmDigital.

2 Analytical framework: Ag data platforms and business models

2.1 Introduction

Ag Data platforms may differ from one another in many aspects. Before taking stock of Ag data platforms and their business models, it is necessary to establish an analytical framework to ensure that key issues are included in a consistent way. In this chapter, we present the analytical framework by first defining the key concepts used and then describing how related data are collected and classified. The two key concepts used are: 1) Ag data platforms (described in §2.2); and 2) Business models and business modelling (described in §2.3). Data collection and classification are focused on business model related aspects as presented in §2.4.

2.2 Ag data platforms

Platforms have become a defining feature of the contemporary information society. While platforms used to be understood as merely technical infrastructure for developing or running computer programs, today they are increasingly viewed as a technical and organisational context in which a community can interact to achieve a specific purpose (Klievink, Bharosa and Tan, 2015). Platforms can be considered IT-based inter-organisational arrangements, in which the platform acts as an inter-organisational coordination hub (Markus and Bui, 2012). Following this conceptualisation, an Ag data platform can be defined as an IT-based inter-organisational arrangement dealing with the collection, storage, exchange and use of Ag data. The compliance platform envisaged by FarmDigital can then be viewed as a case in point in the broad spectrum of Ag data platforms for collecting, connecting and analysing Ag data for compliance purposes.

It follows from the conceptualisation of Ag data platforms that two issues are essential:
1) IT solutions; 2) Inter-organisational arrangements.

What IT solutions are supported and provided by a platform depends on the envisaged interactions among the whole user community. The design of the entire IT solutions is referred to as the service architecture of the platform. The service architecture of an Ag data platform can be illustrated as the service architecture diagram in Figure 1.

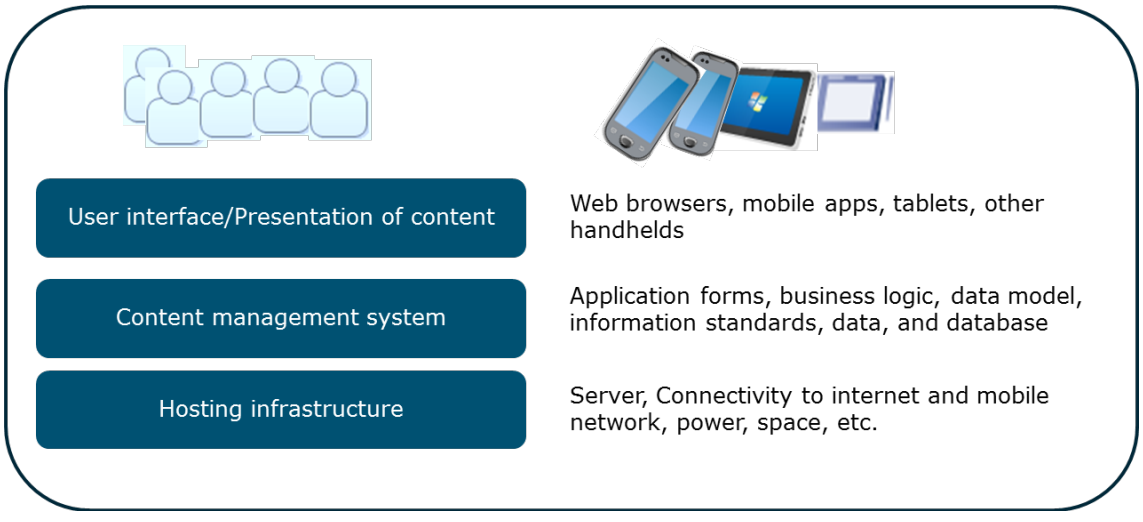

Figure 1 *A High-Level Ag data platform service architecture*
Source: Own illustration based on Liu (2011)

The business model of an Ag data platform is an aspect of the inter-organisational arrangements that enables the development and sustainability of the information architecture. The business model of a platform is intimately related to its governance structure as both can be seen as institutional arrangements. Such arrangements include not only formal contracts and agreements on rights and obligations, but also on informal norms, cultures and expectations that are considered lasting sources of value for platforms (Parker, Van Alstyne and Choudary, 2016).

2.3 Business models and business modelling

The notion 'business model' is sometimes referred to as a 'term of art': it can be easily recognised but very hard to define. Nevertheless, business models have been defined and categorised in many different ways. Following Osterwalder and Pigneur (2013), we refer to business model as the way in which an organisation creates, delivers and captures value in economic, social, or other contexts. An organisation can be an individual firm, a group of firms, or a consortium of firms and other organisations. To develop a framework for describing and identifying business models relevant to FarmDigital, we build on existing literature on business model canvas and value networks.

2.3.1 Business model canvas

In academic literature and among practitioners, there are many different definitions and interpretations of business models. In an attempt to integrate different business model definitions, Osterwalder (2004) proposes the so-called 'business model canvas' (see Figure 2). This framework allows to easily develop new business models or to document existing ones.

The business model canvas consists of nine building blocks that describe essential elements of business operations. More importantly, the nine building blocks together and the relationships between these blocks clarify the business proposition. The business model canvas and the nine building blocks are illustrated and discussed in Table 1.

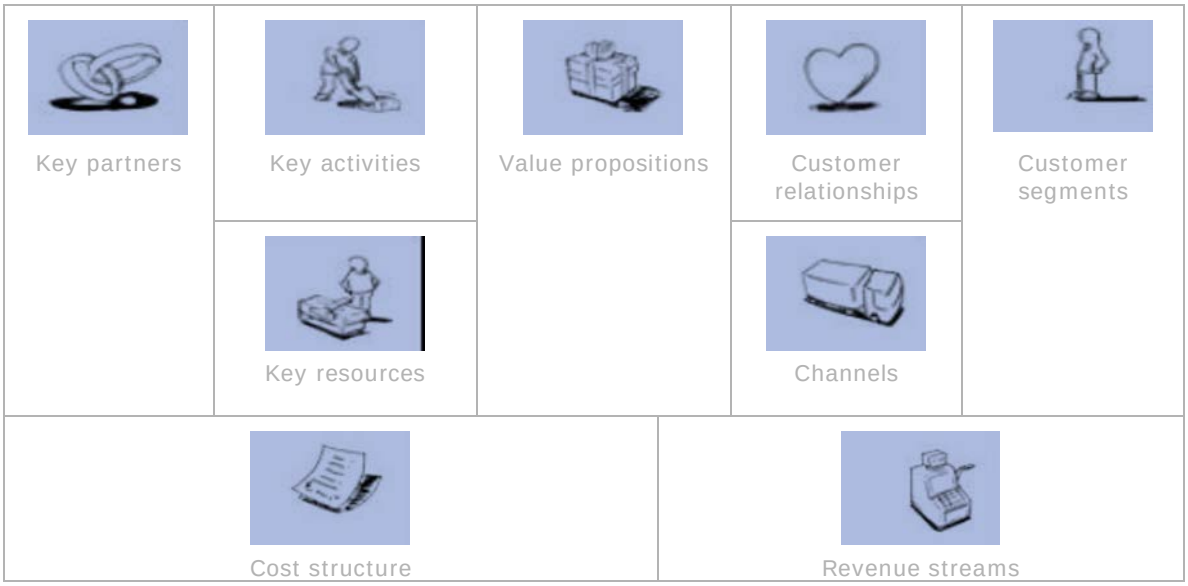

Figure 2 *Business model canvas*

Table 1 *Building blocks of a business model*

Building blocks	Explanation
Customer segments	The separation of a group of clients into sets of similar individuals that are related from a marketing or demographic perspective.
Value propositions	An analysis or statement of the combination of goods and services offered by a company to its customers in exchange for payment.
Channels	Touchpoints used by a company to market its products or services to customers. Channels can include communication, distribution and sales channels.
Customer relationship	The development of an on-going connection between a company and its customers. These relationships are established and maintained with each customer segment.
Key resources	The resources necessary to create value for the customer. They are considered an asset to a company, which are needed in order to sustain and support the business.
Key activities	The most important activities in executing a company's value proposition.
Key partners	The essential strategic and cooperative partnerships.
Cost structure	The costs that are associated with each of the above element.
Revenue streams	The income generated from the sale of goods or services, or any other use of capital or assets, associated with the main operations of an organisation.

2.3.2 Value networks and network-centric business models

Although the term 'company' in a business model canvas as described in Table 1 can be extended to an organisation consisting of several companies, the business model canvas is essentially a firm-centric approach that often follows a linear thinking of value creation in 'value chains'. Such a linear approach has its limitation when values and costs are generated and distributed in networks that span traditional boundaries. The value network approach circumvents this limitation by taking a network perspective and viewing the business as a competing ecosystem.

Adopting a network perspective provides an alternative business modelling approach that is more suited to New Economy organisations, particularly for those where both the product and supply and demand chain are digitised (Peppard and Rylander, 2006). The compliance platform envisaged in FarmDigital belongs to this category as it aims to create value by improving data exchange among different stakeholders.

For business models concerning shared and open data, the following network-centric business models are commonly used (Eckartz and Folmer, 2015):

- Freemium
- Cross-subsidisation
- Network effects.

Freemium describes a business model and pricing strategy in which the provider provides a core product for free to a large group of users and sells premium products to a smaller fraction of this user base. A well-known example of a freemium business model is Skype which provides free computer to computer calling and sells premium products in the form of voicemail, conference calls and world-wide connection to landlines and mobile phones.

Cross-subsidy is a business model and monetarisation strategy that charges higher prices to one group of users in order to subsidise lower prices for another group of users or using the revenue of one activity to finance the costs of another activity. A classic example of cross-subsidisation is ink-jet printer manufacturers who sell printers at relatively low prices, but make their margins on selling ink.

Network effect, or network externality, refers to the effect that one user of a good or service affects the value of that good or service to other people. Furthermore, the value of a product or service is dependent on the number of others using it (Shapiro and Varian, 2013). With many users, a platform may tap on network effects by enabling a data and software ecosystem that enlarges the user community and/or reduces the maintenance costs of data and tools (Messerschmitt and Szyperski, 2005). Moreover, the community jointly improves the quality of the datasets and toolsets, e.g., by providing complementary data or tools to fulfil the needs of the users. Positive network effects are

considered the main source of value creation and competitive advantage in platform businesses (Parker et al., 2016).

Since data sharing and exchange lies at the core of a data platform, these three business models are considered highly relevant to the business model of the compliance platform.

2.4 Describing business models for Ag data platforms

2.4.1 Taxonomy of e-business models

A large part of the e-business literature is concerned with the development of descriptions of specific models. More specifically, it describes how businesses use the Internet to interact and how value is created for customers and other stakeholders.

To integrate different e-business models, Rappa (2010) proposes a broad and cogent taxonomy of which businesses may combine several different categories as part of their overall e-business framework. The taxonomy distinguishes nine basic categories and subcategories as shown in Figure 3.

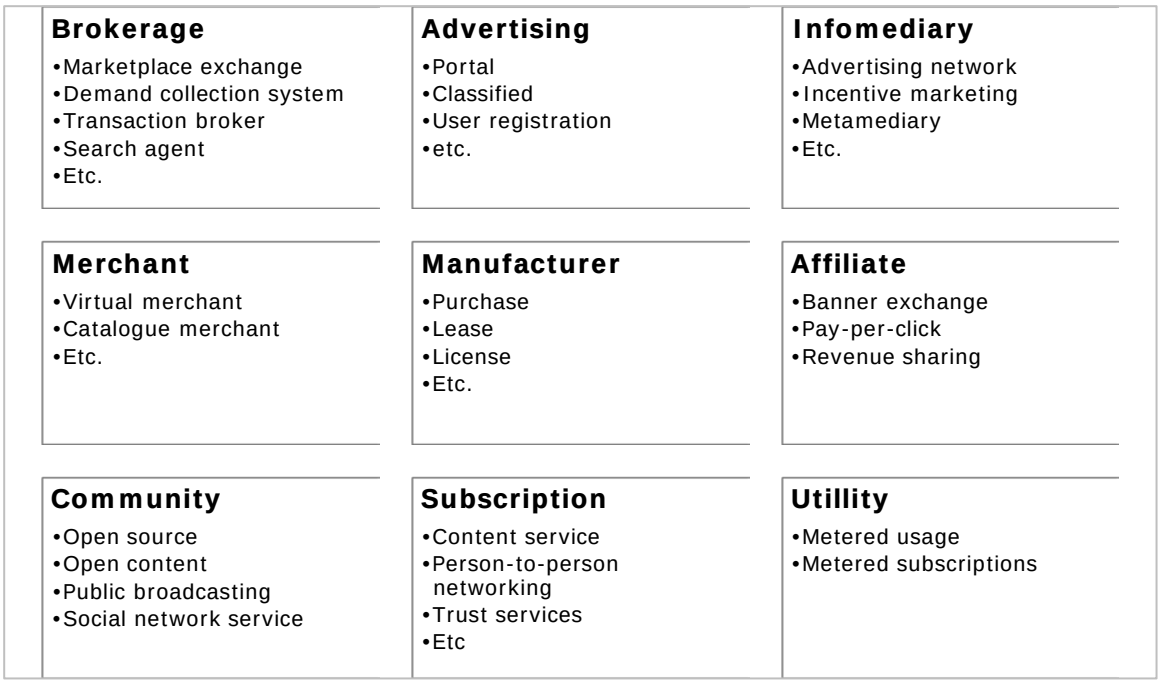

Figure 3 *Taxonomy of e-business models*

2.4.2 Service models of platforms

When considering platform businesses and cloud computing, three service models are commonly discussed in the literature (Boniface et al., 2010; Stanoevska-Slabeva, Wozniak and Ristol, 2010):

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

Software as a Service (SaaS) is a model developed in the private sector and adopted in recent years by IT solution providers, where the customer access the software and hardware over the internet, via a web-browser, instead of purchasing the software and hardware and hosting it on their own premises. The SaaS providers may host the software on their own hardware at a data centre.

The platform as a service (PaaS) model refers to the provision of a development platform and environment providing services and storage, hosted in the cloud. The infrastructure as a service (IaaS) refers to the provision of 'raw' machines (servers, storage, networking and other devices) on which the service consumers install their own software, usually as virtual machine images. While the focus of SaaS is on providing solutions and applications, the focus of PaaS and IaaS is on the development of such solutions and applications, i.e., the key users are developers of solutions and applications.

2.4.3 Business models of Ag Data Platforms

The analytical framework suggests that Ag data platforms can have a vast number of combinations of components and as holistic entities each of them will have idiosyncratic features that are not captured by standard typologies. This poses a great challenge to describe their characteristics in a comprehensive and repeatable way. To enable different typing and categorising, our approach is to first collect basic information on different features of each platform and then combine, when relevant, different taxonomies to characterise and analyse the business models. The information is coded or categorised as much as possible to enable structured comparison and analysis. The main features covered in our desk study include, among others, the following:

- Basic information (headquarters, year of launch, size of the company, geographic coverage, short description)
- Ownership structure (private versus public, monopoly versus dispersed, etc.)
- Customers (agriculture/non-agriculture)
- Data (farm, machine, production, environmental information)
- Funder/Investor (equity, venture capital, public funding)
- Product (hardware, software, analytics)
- Monetisation (Data sales, community, data analytics, transaction cut, subscription, utility, etc.)
- Pricing strategies (Flat-fee, freemium, custom pricing)
- Governance (private/corporate, cooperative, consortium, network).

3 The landscape of Ag data platforms

3.1 Introduction

With the rapid development of ICT and mobile internet, a variety of Ag data platforms have come onto the market to address different issues in agrifood value chains. This chapter attempt to paint a clearer picture of Ag data platform businesses to provide a frame of reference for business modelling for a compliance platform. In particular, this stock taking attempts to assemble several analogs (features of other platforms that can be emulated) and antilogs (features of other platforms that should better be avoided) for the compliance platform being developed in FarmDigital.

3.2 Overview of Ag data platforms

Ag data platforms have been cropping up since the late 90s. Since 2010, there has been an explosive increase in number and diversity. Many of the platforms are well documented and researched by various parties related to agriculture and IT.[1]

Ag data platforms differ in multiple ways as shown in the tables below. One way in which they differ is whether or not the platform was originally designed specifically for the agriculture sector.
Furthermore, platforms differ in the following aspects:

- Mission and focus
- Services and users
- Data technology
- Type of data
- Source of data
- Use of data

[1] See for example in this document 55 Ag tech providers offering data services: https://www.iowafarmbureau.com/f/c03924db-fcc4-4537-89aa-b5a1f18fb79c/agstate-final-appendix-1-atp-list-7-dec-14 and the database in websites such as https://agfunder.com/ and http://techcrunch.com/

Table 2 *Profiles of a selected number of Ag data platforms*

No	Platform	Country	Business status	Data-technology	Type of data	Source of data	Use of data
1	John Deere (JD)	Global	Running (founded in 1837, since 2011 into data-business)	Web portal with various tools, acquiring Precision Planting as in November 2015)	Machine data, yield data (agronomic), business data (financial and logistics)	Collected by farmer, machine, open data	Decision support for farm management
2	Monsanto	Global	Running (originally founded in 1901)	FieldScripts, Climate FieldView™ platform	Seed information, soil information, yield data, weather data	Provided by farmer + platform	Planting tool and yield management
3	Farmers Edge (FE)	Canada (Global)	Running (founded in 2005, now 150 employees)	Precision agronomy, Variable Rate Technology,	Crop growing, soil information, Satellite imagery and in-field telematics	Provided by farmer + Platform	Decision support for crop production, fleet management, logistics
4	Farmers Business Network (FBN)	US	Running (founded in 2014)	Data streaming, data sharing, data analysis	Farm data (soils, seeds, fertilisers, chemicals, yields, economic and weather)	Provided by farmer and peers	Performance feedback and advice
5	Farmobile	US	Running (founded in 2013)	Data collection device, data integration, data analysis	Machine-generated data, farm data	Collected by farmer and peers	Data-driven decisions, precision agriculture
6	365FarmNet	Germany	Running (founded in 2013)	Web-based software	All farm data (plant, animal, feed, etc.)	Provided by farmer and peers	Decision support for farm management
7	Akkerweb	The Netherlands	In development (founded in 2012)	Open source, GIS	Field data, sensor data, GIS data	Farmer, sensor, satellite, census	Farm management, Development of apps

Figure 4 visualises the current landscape of Ag data platforms as a 'battle field' fought by established players in venture capital, agribusiness (such as Monsanto and DuPont), ag-tech (such as John Deere and Trimble), and other technology companies (such as IBM and Oracle) and start-ups with different backgrounds in business, tech, and farming.

In the context of compliance data, developments in ICT, quality and sustainability standards and NGOs such as the Rainforest Alliance are the driving forces of data flows within and beyond the farming business. As in all businesses, developments in ICTs have resulted in an explosive increase in data flows in agriculture and the trend is likely to be self-reinforcing. NGOs are considered a major driving force for the increase of compliance data due to their demand for transparency and evidence for sustainability (Vellema and van Wijk, 2014). Standards refer to requirements on products and production processes which necessitate measurements, data transfer and data analysis.

While all initiatives concern Ag data, the source, type, and use of data vary greatly, from whole farm management data to a specific aspect of verifying compliance (certification). These differences imply different exchanges of data and the value created for the parties involved. Understanding these differences is critical for understanding the different choices of business models and governance arrangements.

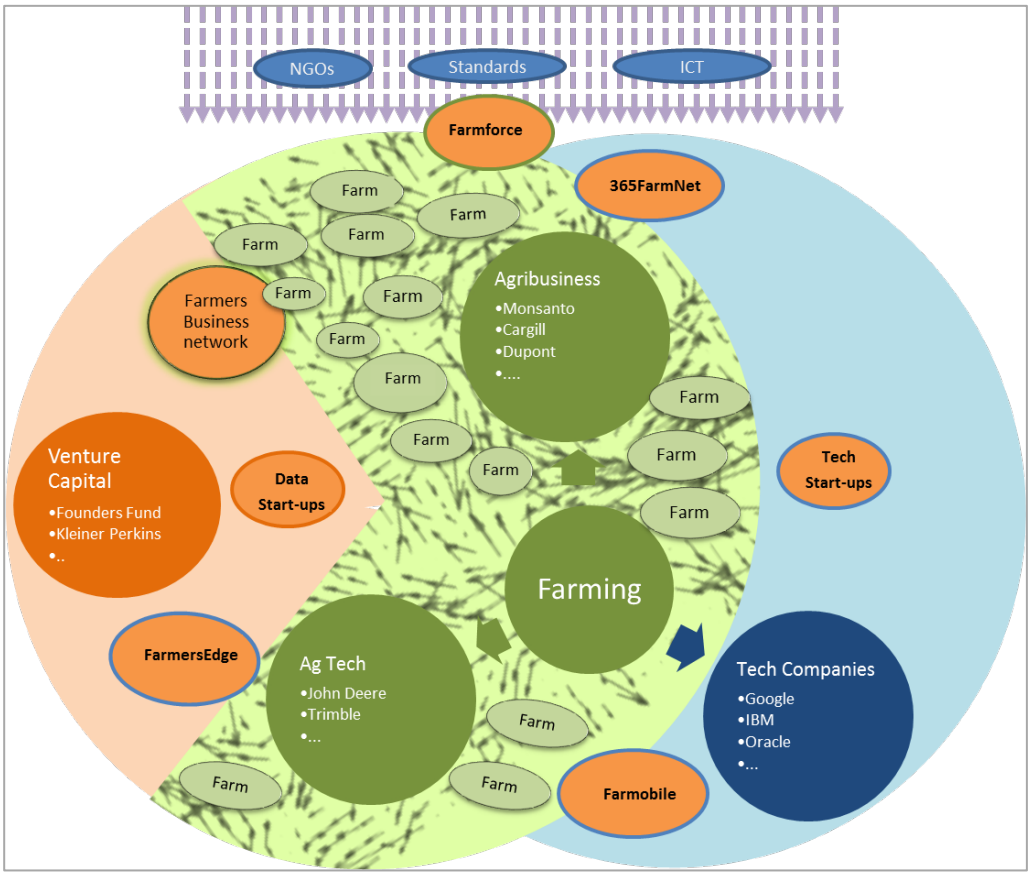

Figure 4 *The landscape of Ag data platforms*

3.3 Close-up: Cases

In this section we zoom in on a number of Ag data platforms to provide more detailed insight.[2] The highlights of these platforms are shown in Appendix 2.

3.3.1 Extended service and business by Ag business and Ag tech

FARMserver

FARMserver,[3] a precision Ag data platform developed by the seed company Beck's Hybrids, is a typical example of private agribusiness companies extending their business by providing data and IT service for precision agriculture.

As stated by the platform itself, FARMserver adheres to five major 'foundations'.[4] First, the farmer owns the data in their entirety and has the rights to control who has access to those data - be they landlords, field advisors, bank representatives, etc. Second, the data collected are secured on the company's own private servers. FARMserver uses the latest technology to be secure, redundant and reliable. Third, the platform is designed to be compatible with all systems. This flexibility allows customers to use any colour of equipment. Fourth, the web-based system supports all mobility phones and tablets. And fifth: FARMserver provides consultants and support service with farming experience, and is available to help download data from field monitors and walk customers through how to use the data.

Similar developments are observed among Ag equipment and tech companies like DuPont (the Encirca platform), Trimble (the Connected Farms) and John Deere (MyJohnDeere.com) that are creating data platforms to allow efficient management of Ag equipment through machine-generated data.

3.3.2 The acquisition spree by Ag business giants

The Climate Corporation (Climate Corp)

Climate Corp analyses hyper-local weather measurements gleaned from the National Weather Service across some 2.5 million locations and forecasts on a daily basis. Melding the analytics prowess of big data, it processes the data along with 150 billion soil observations take from Department of Agriculture surveys and crunches the data to generate 10 trillion 'weather simulation data points'. Those are then used in the company's weather insurance pricing and risk analysis systems.

A similar acquisition strategy is being used by other large Ag business companies. For example, John Deere, the world's largest agricultural machinery maker, has formed a joint venture with cloud provider DN2K to integrate DN2K's MyAgCentral with the John Deere Operations Center (at MyJohnDeere.com) utilising the available Deere API.[5]

3.3.3 Ag tech Start-ups raising investment capital

A majority of the Ag data platforms are Ag tech start-ups funded or to be funded by venture capital. Fund-raising activities of Ag data start-ups are well tracked at AgFunder[6] and TechCrunch.[7] AgFunder is seen by many to be the premier marketplace for Ag and AgTech start-ups seeking to raise investment capital from accredited investors. TechCrunch, similarly, offers a well-maintained database of tech start-ups all around the world.

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[2] The data on these platforms were collected between October 2015 and June 2016 and have not been updated since then. Some information may become outdated.

[3] https://www.farmserver.com/

[4] http://www.aggateway.org/News/Newsletter/2015JuneNewsletter/NewMemberFARMserver.aspx

[5] http://www.precisionag.com/data/deere-cloud-provider-dn2k-form-sageinsights-joint-venture/

[6] https://agfunder.com/about-us

[7] http://techcrunch.com/

Agricultural data and analytics technology companies continued to attract investment capital and farming apps have caught much attention by major economic journals like the Economist[8] and Wall Street Journal's (see coverage of Croatian start-up *Farmeron* and Estonian start-up *Vital Fields*[9]).

FarmLogs

FarmLogs, headquartered in Ann Arbor, Michigan, provides easy-to-use record keeping technology for farmers all across the United States. The key motivation is the understanding that a farmer's livelihood depends on keeping track of records such as rainfall, commodity prices, fertiliser applications, seed planting rates, when pesticide was applied last, and more. The long-term vision for FarmLogs is to help farmers grow row crops as efficiently as possible, while enabling them to easily use cloud-stored and aggregated data for sustainability and profitability.[10]

FarmLogs is the classic example of a company that's translating data that already exists in the public domain to help farmers make better decisions.

Farmers Edge

Based on the information public shown on TechCrunch's crunchbase,[11] 'Farmers Edge is the leader in Variable Rate Technology (precision Ag)'. The company's description states that the company provides 'advanced agronomic solutions to drive profitability with a proven track record in precision agriculture'. In particular, the company boasts using scientific tools to identify and map field variability. Through optimising crop inputs, the results as stated on the website are higher yields, better quality and less environmental impact.

Farmers Edge has a SaaS business model that used to charge USD8.95/acre per year. To better compete and causing disruptive effect in the marketplace, Farmers Edge revamped the firm's business model focusing on adding value to farmers' operations at an affordable price (price fallen by 50% to USD3.95/acre).[12]

Farmobile

The Farmobile system originates with a USD1,250 annual subscription fee, at which point the new subscriber receives a bright orange, hardened-plastic (Farmobile claims it's nearly indestructible) Passive Uplink Connection, or PUC. The PUC plugs into any piece of farm equipment's ISOBUS port and initiates real-time transfer of data such as machine diagnostics (speed, rpms, etc.) and location, crop moisture, yield and more, via mobile cellular network connection into what Farmobile terms a grower's Electronic Farm Record (EFR). That EFR is housed on Farmobile's cloud servers, and growers have absolute power to authorise or deny access.

By allowing the big equipment companies to dictate many of the parameters around data collection and storage, Farmobile's CEO Jason Tatge believes that growers currently are overlooking the standalone value of their data. 'All of these data are being housed and basically locked up by single entities, and there's disproportionate value coming back to the guy that owns those date - the farmer,' he says. 'We want Farmobile to be a neutral place to establish the true value of the data.' That notion brings about perhaps the most intriguing aspect of what Farmobile is looking to do - the company hopes to soon release a still-under-development set of tools for subscribers to market their data like a commodity.

Farmobile is the only company that states the possibility of sharing revenue from data sales with the farmer.[13] The idea is that if Farmobile can create a marketplace for the data, then it will be able to monetise it if a farmer chooses. As Tatge said, 'We never own the data; we simply provide a place for farmers to store their data and we store it in our database for the farmer to use as needed and/or share with partners'.

[8] http://www.economist.com/blogs/schumpeter/2013/04/farming-apps?fsrc=scn%2Ftw%2Fte%2Fbl%2Fvirtualfields
[9] http://blogs.wsj.com/tech-europe/2013/08/02/estonia-startup-helps-farmers-manage-crops/
[10] http://www.urbangateway.org/news/farmlogs-connects-farmers-cloud-expands-10-million-round
[11] https://www.crunchbase.com/organization/farmer-s-edge-laboratories#/entity
[12] http://www.grainews.ca/2014/12/10/a-new-business-model-for-precision-ag-data-packages/
[13] https:/agfundernews.com/ag-data-sector-raises-further-6-7m-in-farmobile-and-s4-funding-rounds5184.html

3.3.4 Social enterprises seeking social investments

Ensibuuko

Ensibuuko is a social enterprise in Uganda that creates disruptive digital solutions to make financial services easily accessible to unbanked and underserved people. It has a partnered with Mercy Corps' Agri-Fin Mobile[14] programme to provide mobile banking services to small holders farmers in Africa with the aim to improve financial inclusion. Mercy Corps' Agri-Fin Mobile programme seeks to improve productivity and incomes amongst smallholder farmer through bundling essential agricultural information and financial services in affordable, unified platforms and mobile phone channels to promote mass uptake commercially.

tech4farmers

Another platform with a social objective is tech4farmers, which operates a digital commodity exchange and warehouse receipt system with the aim to provide farmers with real-time access to market information.

3.3.5 The value generating community

Farmers Business Network (FBN)

FBN is an agronomic peer-to-peer network with the mission to improve the livelihood of farmers by making data useful and accessible.

An important aspect of the FBN service is yield benchmarking. After cleaning yield files (FBN also helps to post-calibrate yields), FBN benchmarks each field by numerous factors, such as their seed choice, population, rainfall, GDU's, planting date, and soil quality.

This is democratising farm data[15] - by crowdsourcing, farmers create their own aggregated data set that gives them objective, farmer driven information on which to base decisions.

FBN integrated with John Deere's API to allow MyJohnDeere Operations Center users to seamlessly transfer data to FBN.

365FarmNet

365FarmNet is a manufacturer-independent company that is engaged in the software-based services sector (SaaS). The company is based in Berlin. It has adopted a pioneering role by drawing up practical solutions for operational management and accommodating the growing requirements of specialised, networked farming. The software has the same name and enables the farmer, for the first time, to manage all operations with a single uniform program.

In their own words, 365FarmNet 'takes software solutions for the farm to a new level'. From planning to documentation through to analysis, all tasks are - for the first time - handled with a simple and intuitively operable program. It supports the farmer in organising operational tasks in a professional way. Reliable data, its secure storage, automated synchronisation of master data and mobile access on smartphones and tablet PCs help 365FarmNet to get to the heart of operational management. Due to the modular structure and integration of partner companies the software is able to adapt flexibly to operational requirements at any time and is characterised by an easy, intuitive operability.

Akkerweb (Farm Maps)

The Dutch platform Akkerweb (Farm Maps) started out as a research project on GIS functionalities. It has become an independent organisation (consortium) owned by the Dutch cooperative Agrifirm, the IT company Dobs Automatisering, and Wageningen University.

Akkerweb offers companies, cooperatives and growers' groups the opportunity to develop and demonstrate applications on a collaborative basis, and – where appropriate – to take these into

[14] http://disrupt-africa.com/2014/12/ugandas-ensibuuko-partners-mercy-corps-mobile-banking-platform/
[15] http://www.croplife.com/equipment/precision-ag/farmers-business-network-bigger-data-sets-for-better-decisions/

production. Development costs of applications are much lower because Akkerweb offers generic functionality, which is shared with all applications.

3.3.6 Public-private-partnerships

Farmforce
Farmforce is a mobile service that links smallholder farmers to other actors in the agro-value chain. Its strategic value proposition is to reduce transaction costs for contract farming, aid compliance with food standards, improve traceability of goods from the field and agronomy of scale.[16] Farmforce has many features that are analogous to the compliance platform envisaged by FarmDigital.

Farmforce is an integrated mobile/web traceability platform used by exporters to manage small-scale farmers and enable them to access markets and adhere to the protocols set for the fresh produce export market (ensuring farming risk factors such as MRL are strictly observed). The platform is funded and co-invested by Syngenta Foundation for Sustainable Agriculture (SFSA) and SECO. Farmforce makes it easier for exporters to work with small scale farmers in outgrower schemes. It ensures that the exporters, contracted by overseas chain stores to supply fresh fruits and vegetables, get consistent good quality produce, fair transaction costs and most importantly traceability to the smallholders farmers.

- Digitally capture GLOBALG.A.P. required production information
- Obtain real-time alerts of non-compliant activities
- Full traceability from planting to sale
- Save time collating information from many farmers
- Simplify audits.

3.4 Synthesis: trends and issues

Ag data platforms are part of a young industry, but the offerings are growing and diverse. Ag data and technology observers have noticed that the rise of Ag data platform is not without growing pains.[17] Based on our desk study, the main findings are summarised below**:**

Ag data platforms spring up like mushrooms
Farmers have every option from John Deere's precision ag data management solutions, backed by one of the world's largest companies and deepest networks of dealers, to modern day start-ups such as FarmersEdge, FarmLogs, Farmobile, Granular, or Farmers Business Network. In between these two young and old extremes are adolescent companies, such as Climate Corporation, Farmserver, and Encirca (DuPont), which are relatively new ventures but paired with established industry players. More new companies come online each month.

Key decisions that software helps farmers make include when and how much to irrigate a field, based on soil moisture data, weather predictions, and crop health; and planting and harvesting decisions, based on yield data or weather. Fertiliser applications can be much more prescriptive, based on factors such as soil nutrient density, enabling farmers to save money on areas that do not need as much, but also optimise yield across a property.

Ag data platform is an industry in need of standardisation
In spite of the many options available to farmers, no single Ag technology provider has created a cradle-to-grave farm management solution that satisfies all needs. Farmers are therefore often using different platforms for different purposes. This creates a need for standardisation to achieve interoperability between different platforms.

[16] http://www.m4dimpact.com/analysis/case-studies/farmforce
[17] http://www.agweb.com/blog/janzen-ag-law-blog/four-takeaways-from-the-precision-ag-data-platforms-conference/

As companies race to provide farmers with data solutions, they often keep their solutions proprietary. As a result, one machine may not communicate well with another machine, and cloud X may not communicate well with cloud Y. There are efforts to bring standardisation to the industry, such as SST's AgX platform, but widespread standardisation is still expected to be years away.

Useful data analytic tools are still a work in progress

Our stock-taking shows that data collection tools are developing and maturing quickly. Data analytic tools are however still a work in progress as most of them are still being developed or tested. This can be explained by the inherent complexity of linking and integrating different types and sources of data that were collected without a common purpose and format. Technically it is now easy to collect agronomic and machine data, but finding a platform that can crunch the numbers and provide a farmer with useful, practical information that improves their farming practices is more difficult. Data analytics are still evolving. Also, the return-on-investment (ROI) is still unknown for many farmers wondering whether to sign up for data analytics.

The main road block to widespread adoption is the lack of trust and interoperability

Observers state that farmers are still reluctant to let go of their data because they do not trust Ag technology providers due to considerations like privacy and competitiveness. Trust is not something that can be won over by clever marketing materials. It takes time and commitment from both farmers and Ag technology providers.

As noted by the Open Ag Data Alliance,[18] farmers are currently overwhelmed with walled gardens of incompatible data generated by their existing systems. To make the hardware and software systems they use to interoperate– that is, to share information and be able to adequately rely on each other to help support decision-making requires more than technical solutions. This process is likely to suffer from farmers' concern about what will happen to their data and questions about data ownership and intellectual property.

Farmers are increasingly aware of the value of data

The opportunities to improve farming efficiency are seemingly endless, which is why the options for farm management software and Ag data platforms on the market for farmers are increasing. But with that opportunity come a range of challenges for the industry as it develops. One of the challenges has to do with the ownership and value of the data.

The ownership of data has had much discussion among farming communities. The ownership issue is essentially a control issue - control of the flow of information, the cost of information, and the value of information (Loshin, 2001). Farmers worldwide are becoming more interested in knowing which companies have access to and can profit from their agronomic and financial data. Ag data platforms are aware of farmers' concerns and have clear vision on the applications of data. Granular, for example, sees the following three applications:[19]

- Data for better management decisions
  The best use of data from any individual farm is to help that same farm operate more profitably.
- Data to learn from peers
  Ag data platforms create technology-enabled peer group through which farmers are able to accurately and anonymously benchmark their performance against peer farms.
- Data in supply chains
  Ag data platforms can enable farmers to share their data with supply chain players to increase the competitiveness of themselves and the supply chain as a whole.

Business modelling is a continuous and evolving process

In the world of Ag data platforms, business modelling is a continuous process. Business models are evolving as new products and services are developed and stakeholders in the value network interact with each other. Several Ag data platforms were first developed within a collaborative project and then turned into business operations (e.g. Akkerweb). Many platforms are built by start-ups addressing

[18] http://openag.io/about-us/principals-use-cases/
[19] https://www.granular.ag/real-value-of-farm-data/

specific problems in agriculture (e.g. Farmobile to collect data from smart machines) that then expand the range of products and services (e.g. data analytics, benchmarking) after being funded by or establishing partnerships with public or private institutions or major incumbents in agribusiness and Ag tech. As the number of platform users increases, new features and services are added. Pricing strategies are adapted accordingly, in response to or in anticipation of changes in the industry and the market. This means developing the business model for a compliance platform is likely to be an adaptive process as well.

4 Business modelling for a compliance platform

4.1 Value network of a compliance platform

One of the key objectives of FarmDigital is to support compliance processes in agrifood chains by establishing an OIA in the current landscape of information flows. The OIA concerns and will be influenced by a wide range of stakeholders who provide, request, and make use of farm data for various purposes. These stakeholders and their interactions constitute the value networks of FarmDigital. To develop business models for FarmDigital, it is important to first obtain insight into its value networks.

Figure 5 illustrates part of the value networks surrounding a compliance platform as envisaged by FarmDigital. Green solid lines in Figure 5 indicate current flows of information and green dotted lines indicate the planned information flow. The blue solid lines show the values generated by the information exchange, which can be revenue or nonmonetary value such as trust or advice. Blue dotted lines indicate values that can be created along the information exchange, but is currently not being created.

Stakeholders in the network include not only ‘direct data requestors’ like the retail, traders, and cooperatives and direct users like growers, cooperatives and certifiers, but also indirect ones such as consumers and NGOs. Research institutes can be part of the value network as well when data from the platform can be used for research. Interactions with the users are fundamental to the platform. Important relationships in the value network are also those with incumbent platform providers and software solution providers. FarmDigital can consider replacing functionalities of existing systems or complement on shared user relationships, which would entail different entry strategies of the platform in the Ag data platform market.

Figure 5 clearly shows that a compliance platform must serve at least two sides of the ‘data market’: growers or cooperatives on the one side who provide compliance data and certifiers on the other side who use the data to verify compliance and issue certificate. One of the toughest challenges associated with creating a business designed to service two-sided market is the so-called chicken-or-egg problem (Parker et al., 2016), i.e., when both sides are equally essential, which one comes first? And for platforms starting from a zero user base, the challenge is how to attract one side of the market without the other. This chicken-or-egg problem will be discussed in Section 4.3 as part of the challenges in user acquisition.

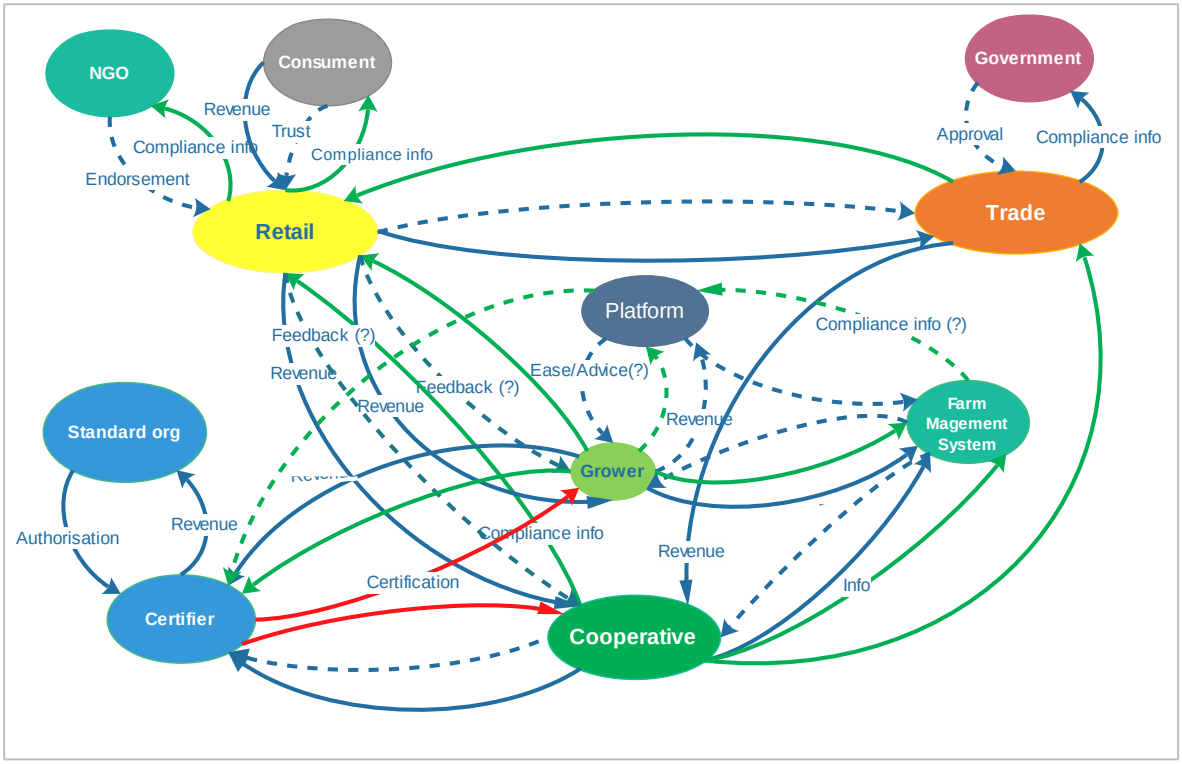

Figure 5 *Part of the value networks of the compliance platform*

4.2 Ownership structure of a platform

Platforms typically have different ownership arrangements and ownership structure can change over time due to acquisition, mergers, horizontal or vertical integration (Nocke, Peitz and Stahl, 2007). With 'platform owner' we refer to the entity that has the right to develop and market the platform services and is responsible for the technical, economic and social performance of the platform. A platform can be owned by a single company or organisation (i.e., monopoly ownership) or by a number of intermediaries (i.e., dispersed ownership). Our stock-taking shows that owners of Ag data platform can be private for-profit companies (large Ag tech companies adding data services to existing products, start-ups backed with funding from venture capitals), social enterprise (for-profit entity with a social mission), or a consortium of partners. As shown in Nocke et al. (2007), the strength of network effects plays an important role in the choice of ownership structure: monopoly platform ownership is socially preferable when network effects are strong and vertical integration may be welfare-enhancing when network effects are weak. They are also the ownership structures likely to emerge in such cases.

Based on the findings from the desk study and stakeholder consultation and considering the objectives and positioning of FarmDigital, there are a number of options conceivable for the envisaged compliance platform:

1. Private for-profit company running the platform using various pricing strategies (e.g. Farmers Edge);
2. Social enterprise running the platform in partnerships with other enterprises or organisations (e.g., Farmforce);
3. Cooperative with farmers that manages its own data infrastructure (e.g., GiSC);
4. Not-for-profit consortium of interest groups and organisations (e.g., FarmLink);
5. Strong chain organisation that fulfils the role of orchestrator in information exchange through the chain (e.g., Feedlogic);
6. A not-for-profit consortium of companies running the platform as add-on to their existing services and provide service to certifiers and other organisations in the compliance processes (e.g., Akkerweb);

7. A not-for-profit public-private partnership between standard organisations that ensures unified format in data exchange and farm management service providers ensure data registration and exchange (e.g., Muddy Boots);
8. A public organisation (like the RVO[20] or Logius[21] in the Netherlands) that manages the platform as a public infrastructure for data exchange.

As shown in Figure 6, these options can be broadly classified into three categories based on the level of collectiveness of the responsibilities and the extent of profit-seeking in the objectives.

Each of these options has its advantages and disadvantages and the choice of a particular ownership for a particular platform is by no means cut-and-dried. Besides the envisaged network effects, the vision and strategy of the key initiators of the platform is likely to play a decisive role. For any ownership structure, however, it is important to understand the playing field of the platform through stakeholder analysis and assessment of the business landscape.

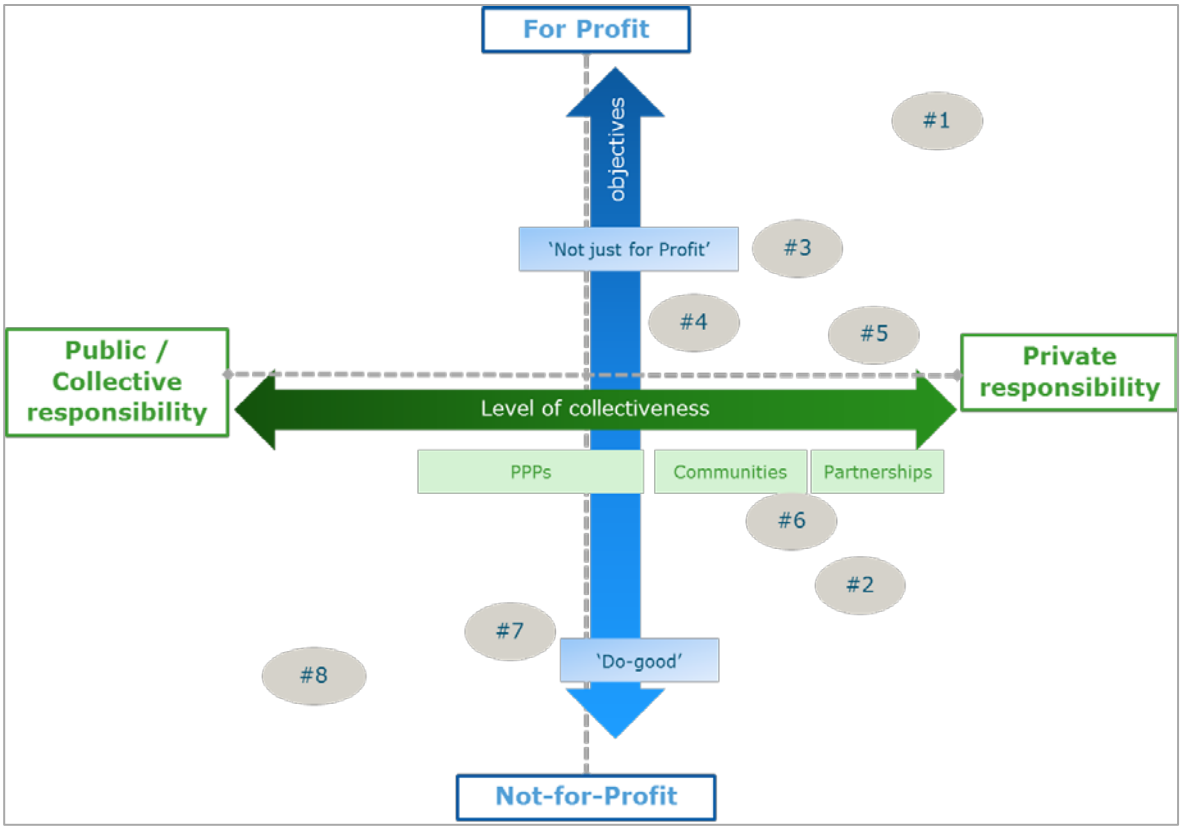

Figure 6 *Options for platform providers*

4.3 Launching strategies for a compliance platform

Developing and maintaining platforms is known to have the following challenges:
- User acquisition
- Scaling up
- Balancing interests.

As part of the business modelling, the launching strategy of a platform should seek to address these challenges effectively. A number of options and considerations are discussed below.

[20] http://www.rvo.nl/
[21] https://www.logius.nl/over-logius/

User acquisition: On-boarding and engagement of users

User acquisition is of critical importance in the launching phase of the platform, especially for platforms starting from a zero user base. Generally used strategies for user acquisition are the following:

- Use of marketing to inform and invite users to try and test the platform, this can take the following forms:
  - Direct (marketing) approach:
  - Use of media, magazines and professional literature
  - visiting conferences and fairs;
  - Internet based marketing (incl. social media);
- Design and create incentives for the core interaction between the data provider and the data consumer. Such incentives need not be monetary, but can also be 'fame' or 'fun'. Farmers want a good return on investment, a program that isn't too time-consuming or complex with support. And the 'fame' and 'fun' factor should not be underestimated. Gamification has been widely used as an engagement strategy and data-collection tool (Law, Kasirun and Gan, 2011).
- Solving the chicken-or-egg dilemma: in their seminal book on Platform, Parker et al. (2016) described eight strategies that can be used. Four of these strategies can be applied to the compliance platform:
  1. 'follow-the-rabbit', i.e., use a non-platform demonstration project to model success, thereby attracting both growers and certifiers;
  2. 'the piggyback strategy', this means connecting with an existing user base from a different platform and stage the creation of value in order to recruit users for the compliance platform;
  3. 'the marquee strategy', which means providing incentives to attract members of a key user set onto the platform. In the case of FarmDigital, this can be a leading grower in a certain sector;
  4. 'the big-bang adoption strategy': using one or more traditional marketing strategies to attract a high volume of interest and attention to the platform.

Scaling up

There are very few examples of business models for mobile application platforms for agriculture that have scaled to 100,000s if not millions of farmers and do not rely on ongoing government or donor support. This may have to do with current low level of digitalisation in agriculture and the limited scope of Ag data uses. Given the accelerated rate of digitalisation of agricultural transactions and rapid development of Ag data analytics, this situation is however expected to change. The key to scaling up is to enable network effects and interactions among users of the platform that would result in increased amount and scope of data and data services. What would be more useful to know is the percentage of users that are active users versus users who have tried the system only once or twice.

- Design and create incentives for interactions with other users.
- Leveraging on network effects: enable positive feedback loop so that existing users introduce other users in the network.

Balancing the interests

The challenges related to balancing the interests of different stakeholders range from providing the right incentives for businesses to co-develop and use a platform, standardisation of data definitions and system-interfaces, to allocating decision-rights in the public–private governance structure. To meet this challenge, stakeholder analysis should be seen as an integral part of platform design.

4.4 Platform thinking and enabling conditions

One of the innovative aspects of platform business models is the platform thinking that differs significantly from traditional linear thinking in which a producer adds value to a product then sells it to the customer (Choudary, 2014). Platform thinking recognises the interaction between producers and consumers of data and information[22] and network effects as the core of a platform.

[22] The same user of the platform can assume different roles, which leads to the role of 'prosumers', i.e., users that both provide and consumer data and information on the platform.

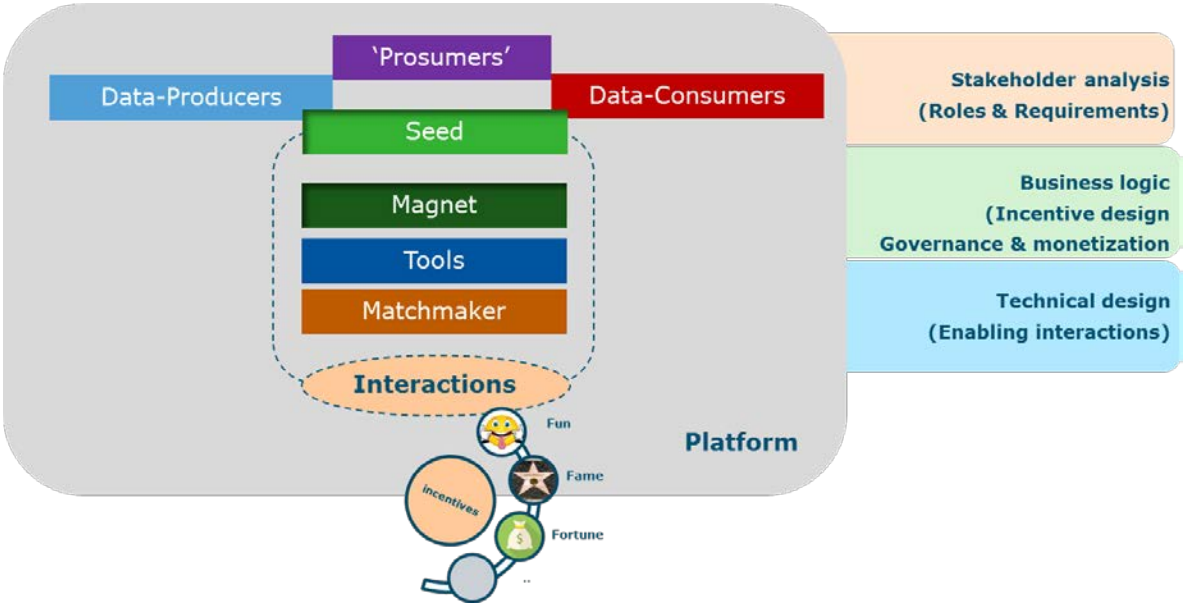

Figure 7 *Platform strategy and building blocks*

Enabling mechanisms and tools

A platform must provide a useful function or service and should provide third party access and governance (Choudary, 2014). A basic tool the platform should provide is in connecting markets, i.e., to consummate the match between data provider and data requestor. Other enabling mechanisms include creating network effects and a user community (a community-driven strategy).

Such tools can also be revamping traditional services like the extension system or the local retail trusted advisor. For example, FBN is seen as modern-day digital equivalent to the original extension system. However, instead of research being bottled up in tiny university test plots now with FBN every farm and every acre becomes its own test plot.

Platform envelopment

As a new entrant in the market, a platform can choose several strategies: replacing incumbents or collaborating with incumbents to leverage shared user relationships. Due to network effects and switching costs in platform markets, entrants generally must offer revolutionary functionality to win substantial market share. A second path, envelopment strategy is often considered more feasible (Eisenmann, Parker and Van Alstyne, 2011).

Using a platform that has been through several software development cycles and has a large user base and client references can reduce the risk and cost of implementing and operating a platform compared to developing a system from scratch.

Partnership

The very nature of a platform being an inter-organisational arrangement means that FarmDigital will operate in a network and needs to consider partnerships or alliances.

Our desk study finds many examples of partnerships between Ag data platforms and other players in the field:

- Prime Meridian was promoting FBN to its customers by including a free one-year FBN subscription for any farmer that signs up for its Precision First data management plan.
- In October, FBN integrated with John Deere's API to allow MyJohnDeere Operations Center users to seamlessly transfer data to FBN. 'This allowed us to clean, map and benchmark yield data live, during harvest,' Baron explains. 'Turning data into analysis and decisions should be frictionless, fast and easy, no matter what system they are using.'
- John Deere with MyAgCentral[23]

[23] http://precision.agwired.com/2015/11/11/sageinsights-integrates-myagcentral-with-myjohndeere/

- DuPont and AGCO[24]

Creating utility and value of data

Both from our desk study and from consultation with stakeholders through interviews and stakeholder workshops, a frequently repeated message is that there is disproportionate value going back to the farmer who supplies and owns the data (cf. report stakeholder workshop).

Farmers have in principle no problem providing information but would highly appreciate feedback or return on the utility of their data. This is repeatedly emphasised in stakeholder workshops and interviews.

[24] https://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.67B7A699-83F6-DCFA-C83B-799345064078

5 Conclusions and future outlook

5.1 Strategic choices for the compliance platform

Our desk study shows that a wide range of business models are used for developing Ag data platforms in agrifood chains. Examining the data platforms and their business models helps to identify key issues and strategic choices to be made for the further development of the compliance platform envisaged by the project FarmDigital.

Based on the desk study, a first round of interviews and workshop carried out in this research, we may conclude that the key issues to be addressed in business modelling of the compliance platform are the following:

- The level of collectiveness or openness in ownership structure and platform development
- The value creation mechanism through data and information exchange
- Monetarisation strategy
- Launching strategy
- Governance.

5.2 Collectiveness in platform development

Business modelling of a platform must take into account the business landscape of current and future Ag data platforms. Given the fact that Ag data platforms and other data-driven initiatives are springing up like mushrooms, a key aspect is the integration of different Ag data platforms: will it be a 'cathedral' (i.e., one compliance platform that replaces other data platforms as illustrated in Figure 8), or a 'bazaar' (i.e., two or more data platforms with various farm management solutions that are connected to make compliance and data sharing easy, as illustrated in Figure 9)?

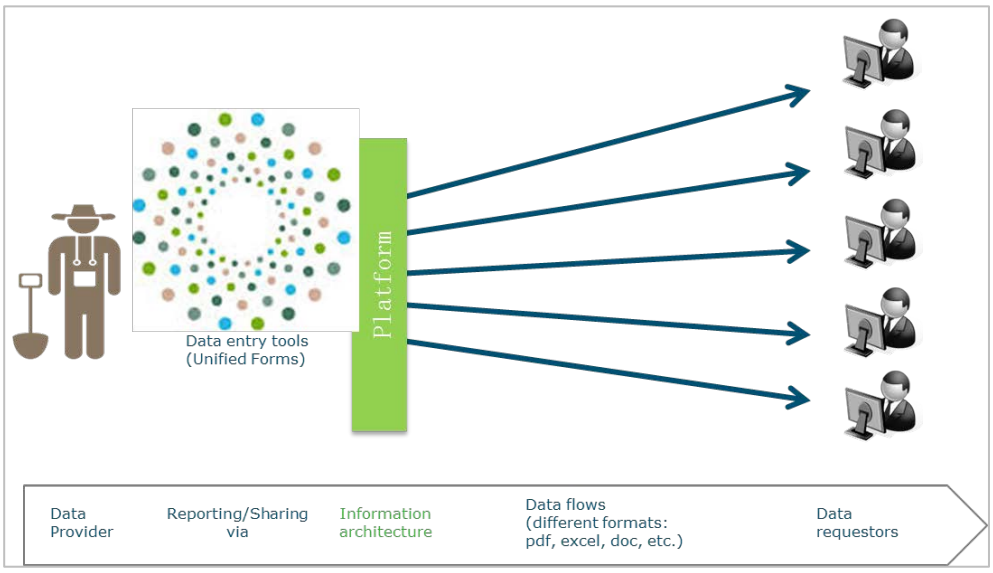

Figure 8 *One compliance platform that replaces all*

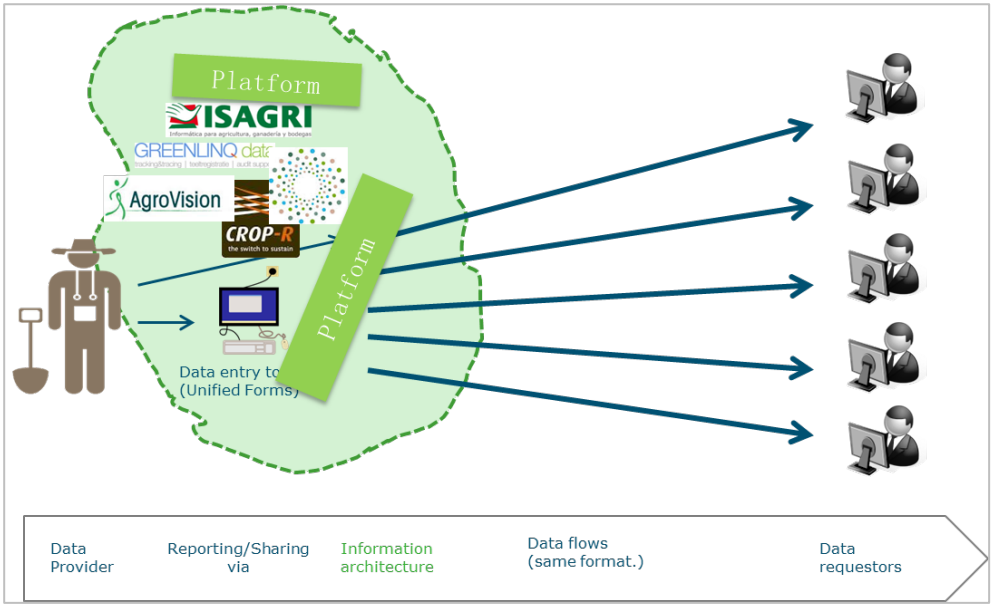

Figure 9 *An ecosystem of farm management software and platforms*

The metaphor of 'cathedral' versus 'bazaar', as popularised by Raymon (1998), implies two different software development strategies. The cathedral approach refers to a monolithic development process where the bazaar is the busy and tumultuous world outside the cathedral where the development takes place in a competitive business ecosystem. From a network perspective, the bazaar form of development is better equipped to deal with complexity, problems, and inventions than the cathedral form. The preference for a 'bazaar' model is confirmed by feedback received from solution providers that are currently not involved in FarmDigital.

In the 'bazaar' scenario, a platform stands the best chance of success when it taps on and enables synergetic collaboration among platforms in user acquisition and market expansion. Together they offer more value to existing users in the value network and can attract more potential users. One attractive option for the compliance platform is to enable data-sharing with data flows that can be used in combination with apps developed by others.

It is argued by Klievink et al. (2015) that researchers can make strong contributions to the development and adoption of collaborative public-private platforms by helping the stakeholders (such as policy makers, businesses, IT providers and practitioners) understand which obstacles they might face down the road and which strategies can help them overcome the obstacles. This is an aspect that will be addressed in the study on stakeholder analysis (Deliverable 3.2.3) and sector strategy (Deliverables 3.3.1 and 3.3.2).

5.3 Harnessing the power of Big Ag data

As an industry where farmers and agribusinesses have to make innumerable decisions every year, agriculture has been an obvious target area of application for big data.[25] IoT and big data analytics are poised to make significant impact on the future landscape of Ag data businesses and therefore FarmDigital. For the business model, it is therefore important to anticipate the impact of IoT and big data analytics on compliance processes.

Big data analytics can also alert farmers to problems on a certain field, such as a pest infestation, or drought conditions, reducing the need for manual checks of every piece of land regularly. With existing and increasing labour shortages in agriculture, the ability for big data analysis to create efficiencies

[25] https://agfundernews.com/what-is-ag-big-data5041.html

that reduce the need for physical manpower is a big benefit for the industry particularly for very large scale operations.

5.4 Going global

The problems to which the project FarmDigital aims to provide solutions are not limited to the Netherlands. It is therefore highly pertinent to consider the globalisation of solutions provided or enabled by FarmDigital. Globalisation of the compliance platform can tap on the strengths of the Netherlands in Agri-IT, information standards and sustainability reporting. A number of global business structures for the compliance platform can be considered:

- Functional structure
- International division
- Product division
- Geographic area division
- Franchising
- Matrix division.

In considering globalisation of the compliance platform, two aspects deserve attention:

- **Avoiding reinventing the wheel**
  There may be a well-functioning mobile application platform for agriculture already operating in the country. In that case, there may be no need to reinvent the wheel.

  Instead FarmDigital should find ways to enable, enhance, or catalyse the use of the existing platform. This may include bringing more farmers, users or subscribers on to the platform; creating or improving the quality of the content; providing funds for market research on the real needs of the farmer; monitoring and evaluating impact and customer satisfaction; identifying best practices; and documenting what does and does not work.

- **Capacity building**
  In developing countries where smallholder farmers are the main users, providing education and literacy training is considered crucial to the success of data platforms (Liu, 2011). Considering the empowering nature of capacity building, alignment and synergy can be sought with development agencies having similar objectives.

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12 http://www.agweb.com

Deliverables within Farm Digital

Kruize, JW, Robbemond, RM, Verwaart, T., and Wolfert, J. (2015) Preliminary Architectural Framework

Deliverables D1.2.1, D1.2.3, D1.3.1, D1.4.1 and D1.5.1

Interviews and communications with project consortium Farm Digital

- Agrico
- ERF
- ISACert
- Jumbo
- Business Council Meetings (On June.26 and Nov.26, 2015)
- Stakeholder Panel workshop (On Nov.30, 2015)

Appendix 1 List of Ag data platforms studied

Platforms	URL	Headquarter	Launched	Coverage (Geographic)
FarmersEdge	https://www.farmersedge.ca/	Canada	2005	Global (Canada, Australia, US, Brazil, Russia)
Farmeron	http://farmeron.com/	Croatia	2010	Global (US, Croatia)
VitalFields	https://www.vitalfields.com/	Estonia	2011	Estonia, UK
365FarmNet	https://www.365farmnet.com/en/	Germany	2013	Germany
GeoMation Farm	www.hitachi.com	Japan	2003	Japan
M-Farm	https://mfarm.co.ke/	Kenya	2010	Kenya
FarmDrive	http://www.farmdrive.co.ke/	Kenya	2013	Kenya
AgroSense	https://agrosense.limetri.eu/	NL	2011	Global
CROP-R	www.crop-r.com	NL	2011	NL/Belgium/France
Akkerweb	https://akkerweb.nl/	NL	2012	The Netherlands
Ensibuuko	http://www.ensibuuko.com/	Uganda	2012	Uganda
tech4farmers	http://www.tech4farmers.com/	Uganda	2012	Uganda
Muddy Boots	http://en.muddyboots.com/	UK	1996	UK
Farmforce	http://www.farmforce.com/	UK	2012	Global (Developing countries)
Geotraceability	https://www.geotraceability.com/Geotraceability/en/home.php	UK	2012	UK
Agrivi	http://agrivi.com	UK	2013	Global (150+ countries)
Simplot/SmartFarm	www.simplot.com	US	1923	Global
Farm Market iD	http://www.farmmarketid.com/	US	1973	US
SST	http://www.agxplatform.com/	US	1994	Global
aWhere	http://www.awhere.com/	US	1999	Global
Monsanto	https://www.climate.com/	US	2006	Global
iCropTrak	http://www.icroptrak.com/	US	2009	Global (>50 countries)
Conservis	http://www.conserviscorp.com/	US	2009	Global (U.S., Canada, Australia and Russia.)
Farm Hack	http://farmhack.org/tools	US	2010	Global
FarmLink	http://www.farmlink.com/	US	2010	USA
Myfarms	www.myfarms.com	US	2010	Global
Connected Farm	https://agdeveloper.trimble.com/about/	US	2011	Global
MyAgCentral	www.myagcentral.com	US	2011	US

Platforms	URL	Headquarter	Launched	Coverage (Geographic)
FarmLogs	https://farmlogs.com/	US	2012	US
MyJohnDeere	https://www.deere.com/en_US/products/equipment/ag_management_solutions/ag_management_solutions.page?	US	2012	Global
Apitronics	http://www.apitronics.com/	US	2012	US
Farmobile	https://www.farmobile.com/about/our-story	US	2013	US
Grower Information Services Cooperative	https://www.gisc.coop/faqs/	US	2013	US
Farmers Business Network	https://www.farmersbusinessnetwork.com	US	2014	US
Granular	https://www.granular.ag/about-us/	US	2014	US
Encirca	www.encirca.pioneer.com	US	2014	US
AGCO	www.AGCOtechnologies.com.	US	2014	Global
Farmserver	https://www.farmserver.com/	US	2014	US

Appendix 2 Highlights of Ag data platforms

Initiatives/Solutions	Slogan	Use of farm data	Data ownership, privacy and liability arrangements	Access control/Pricing
365FarmNet	*"The software for your business"*	Decision support for farm management	Data is only provided to third parties with approval of farmer. Certified service providers guarantee data security.	Varies per module, between 0.83-4.00€ per month per 100 ha
Akkerweb	*"Your field in view"*	Data sharing, Development of apps	Grower, authorisation	Free account, payment by app developers
GeoTraceability	*'Build trust and transparency throughout supply chains" "putting smallholders on the map"*	Traceability and supply chain management	Privacy policy, data non-confidential except Personal Data (Access to own personal information may be charged a fee of £10)	No fees for farmers, Mapping costs vary according to the context. For cacao in Ghana approx. $15/ha;
John Deere	*"Turning data into insight at any time anywhere"*	Decision support for farm management	Only access to data for the trusted partners.	It is open for everybody. It is free of charge.
Monsanto	*"Unlock the yield potential in your fields"*	Planting tool and yield management	Data is only shared with subsidiaries and business partners.	Access by payment: $10 per acre.

Initiatives/Solutions	Slogan/Mission	Use of farm data	Data ownership, privacy and liability arrangements	Pricing/Access control
FarmersEdge	*"Grow more precisely"*	Decision support for crop production, fleet management, logistics	Data belongs to the farmers.	Access by payment: $3.95 per acre.
Farmers Business Network	*"Put your farm's data to work'*	Performance feedback and advice	Anonymous aggregated data. No data sharing with anybody	Access by payment: $500 per year.
Farmforce	*"Integrated Mobile Platform to manage smallholder farming"*	Outgrowers management, yield forecast, harvest planning, loans, traceability, compliance	Privacy statement, Consistent with the *Privacy and Security Principles for Farm Data*	Setup and subscription costs for exporter /aggregator based on # modules, users, etc.
FarmLogs	*"help growers use technology to create a better future for their farms"*	Field management, Rainfall tracking, yield maps, input planning, nitrogen monitoring, nitrogen and seeding prescriptions, etc.	Privacy policy: The data you enter through our Service is your data. Full control over who to share personal information.	Both free and paid subscriptions. Version with prescriptions $2499/year plus $8.50/acre; $749.00/device per year
Farmobile	*"Farmobile simplifies data from machines to decisions'*	Data driven decisions, precision agriculture	Data owned by the farmer. Farmer controls who has access to data.	Access by payment: $1,250 per year. 50% revenue derived from selling the data.

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The mission of Wageningen University and Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 5,000 employees and 10,000 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.