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Bites into the Bits: Governance of Data Harvesting Initiatives in Agrifood Chains

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Abstract

Data harvesting is becoming a booming business in agrifood chains where many players are taking bites into data generated by farming. While data technologies such as mobile apps, cloud computing and big data analytics rapidly develop and mature, business models and governance arrangements are still evolving. From a New Institutional Economics perspective and using the theory of multiple rationalities, this paper studies a number of data harvesting initiatives in agrifood chains to identify the key governance issues to be addressed. Implications for ongoing data harvesting initiatives such as the FarmDigital programme are discussed.

1. Introduction

As digitalisation of farming processes continues to expand and intensify, the supply and demand of farming data is rapidly growing (Sonka, 2014; Zhang & Shen, 2011). 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 for governance purposes like transparency and sustainability (Ge & Brewster, 2016; Verbeke, 2005). On the supply side, vast amount of farming data are being generated or automatically collected by smart machines. The internet, mobile technologies and cloud computing have accelerated the transfer, processing and sharing of data. There is a surge of data-tools in the market and even more are in the making[1]. Spurred by the supply of data and data technologies, data-driven business initiatives are steadily increasing in agrifood chains. Farming is no long just about harvesting food, but becoming a booming data harvesting business where many players are taking bites into data generated by farming (Orts & Spigonardo, 2014).

While data technologies like cloud computing and big data analytics rapidly develop and mature, many data harvesting initiatives are still exploring viable business models and

[1] See e.g. http://guides.library.cornell.edu/ag-food-data-guide/ag-food-data-tools

governance structures to capture the value of data. A variety of business models are being used and developed with different value propositions to different stakeholders, ranging from established ones like those in precision farming aiming at optimizing production[2] to nascent ones such as big data analytics and digital compliance. As a result, data harvesting initiatives, in conjunction with the advent of big data in agriculture, feature prominently in agribusiness research, especially in the context of industrialised agriculture in the US, Canada and the EU.

Data-drive innovations and data harvesting initiatives are flourishing in the Netherlands. Being part of Public-Private Partnership (PPP) research programme on the transparency and traceability of agrifood chains, the authors have been involved in a number of research projects concerning data harvesting initiatives in agriculture. The recent and ongoing one, FarmDigital, is on the development of a digital compliance platform to reduce the administrative burden for growers and auditors of sustainability standards (www.farmdigital.nl). While reviewing relevant literature and observing the development process of FarmDigital to unfold, our attention was drawn to the lack of a consistent methodology to choose the most suitable governance arrangements.

The lack of methodology to analyse governance arrangements is in stark contrast to the abundance of governance issues discussed in academic and grey literature. Parallel to rapid developments in information and communication technologies (ICT) and increased data and information flows, power and economic relations among different stakeholders are undergoing visible changes. Data-driven initiatives have created new social relations characterized by old players taking on new roles and new players taking over roles traditionally played by others. These changes require new governance arrangements to be made for business models to harvest value from farm data. In this process, many have recognized that governance is a thorny issue, but few have systematically analysed governance issues. This has prompted us to develop our own analytical framework for studying governance of data harvesting initiatives in general, and digital compliance platform in particular.

In what follows, we will first present our framework based on new institutional economics (NIE) and the multiple rationalities theory to identify the key aspects and issues.

[2] See e.g. https://www.foreignaffairs.com/articles/united-states/2015-04-20/precision-agriculture-revolution)

Following this framework, we studied seven data harvesting initiatives in agrifood chains. The findings of the study are presented and discussed in Section 3.

2. Conceptual framework

In developing our conceptual framework, we draw insights from two streams of economic theories: the New Institutional Economics (NIE) and the multiple rationalities theory. This choice is based on our conceptualisation of data-driven initiatives as economic organizations that, instead of producing agricultural goods like other organizations, produce information that is of value to the users through the collection, storage, transfer and analysis of farm data. Since the data processes inevitably involve a network of actors, network features are likely to play an important role in the governance of these organizations. Governance in this respect is the use of institutions and structures of authority and collaborations, i.e., governance arrangements, to allocate resources and to coordinate and control joint action across a group or network of organizations that work together to achieve a collective goal (Provan & Kenis, 2007).

According to NIE, governance arrangements are made to align transactions or economic exchanges to their institutional environment (Williamson, 2000). A key insight from NIE is that efficient governance arrangements should reduce transaction costs, i.e., resources used to establish and maintain human exchanges. Uncertainty is an important determinant of transaction costs as governance arrangements are made essentially to cope with uncertainties in human exchanges. Uncertainties arise due to on the one hand the lack of information or asymmetric distribution of information among different stakeholders about the value of the goods to be exchanged and on the other hand the lack of control over transactions among stakeholders. Transaction costs consist of 'mundane' coordination costs (Baldwin & Clark, 2000), information costs (to obtain and process information) and negotiation costs (to make sure the same information is accepted by different parties) (Lv et al., 2012). Archetypical governance arrangements known in the literature are firms (or using hierarchy for coordination), market (using the price mechanism for coordination), and various hybrid forms (Slangen et al., 2008).

The multiple rationalities theory views rationalities as 'frameworks of giving meaning' incorporating ethical norms and values (Edwards, 1998; Snellen, 1987). Four rationalities have been identified: the political, legal, economic and scientific rationality. Each form of

rationality leads to a specific way of acting. The four rationalities can be seen as systems of criteria for responsible governance. We apply the rationalities theory to analyse the governance of the data-driven business initiatives in conjunction with NIE. In this paper economic rationality concerns whether the goal of a farm data-driven initiative is obtained in an efficient way from a micro-economic perspective. The legal rationality concerns governance according to and in compliance with the statutory laws. For example problems are tackled by applying new rules or more control and enforcing measures. Political rationality relates to issues of support and legitimacy of the initiative such as access and decision making. Whether farmers can join easily and for free is for example an issue of political rationality. Finally, scientific rationality refers to the scientific knowledge and information significant for the functioning of the initiative in relation to realizing the common outcome.

We posit that when designing the governance arrangements for data harvesting initiatives, besides their impact on transaction costs, the four rationalities should be fully reflected on to ensure its viability. More specifically, one should evaluate the extent to which governance arrangements are congruent to those rationalities. Through the lenses of transaction costs and multiple rationalities, we examine a number of known data harvesting initiatives and draw on our own extensive experience of participating in data harvesting initiatives. We use publicly available information to derive the rationalities behind these initiatives and the governance arrangements. The sources of information include company websites, news items, and a wide range of business analysis reports.

3. Results and discussion

3.1. Key features of data harvesting initiatives

Table 1 presents an overview of the data harvesting initiatives we studied. Among numerous data-harvesting initiatives that are known to us, we consider these initiatives as landmarks in the world of data business due to their conspicuous web-presence and marked differences in origin, business model, development path, and governance arrangement. Besides Farm Digital, we have chosen to study six other initiatives in order to see to what extent their governance arrangements and rationalities differ and what factors would explain the difference. These insights, we hope, would enable us to draw design implications for FarmDigital.

As shown in Table 1, besides countries of origin, the initiatives also differ in their business status, data technology used or offered, and their use of data. In terms of the ‘initiator’

of the initiatives, we observe that both large agricultural firms and start-ups are active in the data harvesting business. While large firms like Monsanto and John Deere typically adopt the strategy of acquiring start-ups to strengthen their existing position (e.g., Monsanto acquired the company Climate Corporation to provide planting advice), new start-ups continuously seek investors and funding from venture capital and large technology firms to expand their service and influence (e.g., Farmer Business Network raised funds from Google Ventures). Compared to other initiatives, FarmDigital has a rather unique niche of data harvesting business that is intimately linked to the certification industry.

To provide a common background for comparison, we have pictured the current landscape of data harvesting business in farming as a 'battle field' fought by major players in venture capital, agribusiness (like Monsanto and DuPont), ag-tech (like John Deere and Trimble), and other technology companies (like IBM and Oracle). The landscape is visualised in Figure 1, where we also show the driving force of data flows within the farming business and the main sphere of influences aiming at farming data. 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 data flows due to their demand for transparency and evidence for sustainability (Vellema & van Wijk, 2014). Standards refer to requirements on products and production processes which necessitate measurements, data transfer and data analysis.

While all initiatives perform data analysis to get information or insights, the content and natures of the insights vary from whole farm management advice 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.

3.2. Governance arrangements

Table 2 summarizes the main features of the governance arrangements. In several aspects, governance arrangements of the data-harvesting initiatives exhibit a considerable degree of diversity in organisational forms. With regard to the coordination mechanism, although the price mechanism prevails, it is almost always used in combination with mutual agreements or relational arrangements.

A feature of the data harvesting initiatives originated as start-ups is the joint creation of value with a network of actors providing data, knowledge (know-how) and tools. This could be a network of farmers sharing farm data with the platform or a network of knowledge providers sharing different data tools. For example, 365FarmNet is a consortium whose members include e.g. Allianz, Bayer, KWS, farm-equipment makers CLAAS and Amazone-Werke. The consortium has established a marketplace for agricultural information where growers can buy GPS, diagnostic, crop, fertilizer and other data from any consortium member; download it to their computers and farm equipment; and use it to take action, such as drawing up crop plans for the coming planting seasons. This networked nature of value creation implies that price alone is unlikely to be sufficient in coordinating the value creation from data. Mutual agreements must be made in addition to price mechanism.

The diversity in governance arrangements as shown in Table 2 can be explained by different features of the transactions and interactions between the suppliers of data, the supplies of data tools, knowledge and know-how, and the user/buyer of information. Price mechanisms seem to prevail when ownership of data and the value of the information are both clearly defined with regard to the actors concerned and the transactions are standard (recurring). Although there is a general consensus that farmers own their data and should have control over the access to and use of their data, it is much more complicated to assess the value of information as it is intricately linked to the value of data services and its impact on decisions. This implies that there is a high level of uncertainty with regard to the value of the ‘product’ (i.e. information) in these transactions. High transaction costs may arise when parties disagree.

Contractual relations are likely to be influenced by uncertainties about the value of information. Data harvesting business derive the value from the information they provide that is meant to improve decision-making. This value can hover be pervasive to the user/buyer as the outcome of his decision depends on numerous factors beyond the control of the decision-maker. Since the circumstances of the growers differ, customers' results may differ materially from those stated by the data harvesting initiatives.

3.3. Rationality behind the data harvesting initiatives

To understand the rationality behind the data harvesting initiatives, we examined the mission statements on the websites of the initiatives as well as announcements regarding governance issues such as the rights and liability. The results are summarized in Table 3 and elaborated below.

The urge to improve efficiency has evidently motivated all the initiatives studied. For most of them, this further translates into the improvement in productivity and profitability. For example, Farmers Edge began in 2005 with the vision to use technology to help growers become more efficient[3]. According to Farmers Edge their service assists growers to make advanced management decisions which results in higher yields and higher returns based on farm data. In 2015, with a price of $3.95 per acre for a full service package (variable rate fertilizer programs, telematics packages to manage fleets of machinery, updated satellite images every 7 to 10 days during the growing season, localized weather information) to farmers on over four million acres[4], FE with around 160 employees (GIS experts, technology specialists, data scientists, research and development team, precision agronomists, sustainability analysts, carbon specialists, laboratory technicians, and soil scientists among others[5]), could account for a turnover of almost 16 million a year. With the average farm size for 2011 in Canada of 778 acres[6], a farmer would pay around $3073 for the full service package of Farmers Edge™. That is more than 5 percent of the average net operating farm income of $59,402 for 2009-2013 in Canada[7].

Similarly to Farmers Edge, the aim of Farmers Business Network (FBN) is to help farmers to select the optimal seeding grade for their variety and their field in order to reach the maximum potential. John Deere states that its data platform will increase the productivity and efficiency of the crops and lead in the end to higher production and revenue[8]. According to Monsanto, FieldScripts help farmers to get the most out of every acre. FieldScripts

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[3] Source: http://www.nutrientstewardship.com/partners/products-and-services/farmers-edge-precision-consulting-inc (Consulted November 14th 2015).
[4] Source: http://www.grainews.ca/2014/12/10/a-new-business-model-for-precision-ag-data-packages/ (consulted November 8th 2015).
[5] Source: http://usbusinessexecutive.com/agriculture/case-studies/farmers-edge-growing-more-precisely-through-manitoba-based-farm-data (Consulted November 8th 2015).
[6] Source: http://www.statcan.gc.ca/pub/96-325-x/2014001/article/11905-eng.htm#a4 (Consulted November 14th 2015).
[7] Source: Agriculture and Agri-Food Canada. 2015. Canadian Agriculture Outlook. See: http://www.cahrc-ccrha.ca/sites/default/files/AAFC%202015%20Canadian%20Agriculturual%20Outlook%20%20AAFCAAC-%23101147675-v1-12325E_-_2015_Canadian_Agricultural_Outlook_0.pdf
[8] Source: https://datafloq.com/read/john-deere-revolutionizing-farming-big-data/511 (consulted October 15th 2015).

maximize productivity, allow farmers to minimize risks and realize higher yields[9]. As stated by 365FarmNet, its responsibility is to provide and cleverly cross-link agricultural know how in the form of a single software. Farmers and contractors are able to combine partner applications on a modular basis depending on their needs.

Besides improving the efficiency in agricultural production, the initiatives also aim to improve the efficiency in using data for producing information and insights-their core business-by providing tools for easy collection, storage, integration and analysis of data. For example, Farmobile sells a simple data collection tool that centralises grower's agronomic data from multiple systems in one electronic farm record. Farmobile standardize the data and make it easily searchable for customers who want to purchase data[10]. In the case of John Deere, all data coming from sensors at farming equipment are collected in its web portal MyJohnDeere.com and combined with historical and real-time data regarding weather prediction, soil conditions, crop features etc. in order to help farmers to run and manage all their operations. The company 365FarmNet enables the farmer to manage his entire agricultural holding for 365 days a year with one single software that is independent of manufacturers. 365FarmNet states that it saves time and makes data usable for the farmer.

The political rationality is assessed from the perspective of access and decision-making. As also shown in Table 2, the access control is generally market-based with mutual agreements on value-sharing, privacy and liability issues. FBN offers benchmarking information to member farmers by collecting and analysing data from thousands of fields around the US for a membership fee of $500 per year. The data management system of Farmobile originates with a $1,250 annual subscription fee[11]. If farmers opt to share their data through Farmobile, they will get 50 percent of revenue derived from selling the data[12]. Monsanto charges $10 per acre[13].

Legal rationality is mostly reflected in the 'terms of use' articles and subscription agreements concerning ownership, privacy and liability. Farmers Edge (FE) states that the agronomic and financial data of the farmer belongs to the farmer. In its contract with a farmer

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[9] Source: https://www.youtube.com/watch?v=m-pn9ytxihQ
[10] Source: http://www.croplife.com/equipment/precision-ag/farmobile-coming-online-in-2015/ (Consulted November 8th 2015).
[11] Source: Farmobile in the Press: https://www.farmobile.com/blog/news (consulted November 8th 2015).
[12] Source: https://www.fcc-fac.ca/fcc/agKnowledge/publications/agrisuccess/pdfs/agrisuccess-mar-apr-2015.pdf (consulted November 8th 2015).
[13] Source: Franklin, D. (2014). Monsanto's FieldScripts an Early Move on the Next Phase of Farming. Blueshift Research. San Francisco. US (see: http://blueshiftideas.com/reports/021405MonsantosFieldScriptsanEarlyMoveontheNextPhaseofFarming.pdf)

FE agrees not to sell the data of the farmer. And it states that it will never make profit from selling the data of farmers directly. The contract states that the data is protected. And FE does not retain the right to aggregate farmer data and use it for its own purposes[14].

Privacy is an issue addressed by all initiatives, but in different ways. These include the anonymization of data and access restriction to unauthorised users. Farmers Business Network (FBN) anonymizes the data of farmers and puts it into an aggregated pool of agronomic performance data from thousands of fields around the US. The farmer controls how its data is shared with advisers and team members on FBN. And personal information of the farmer, such as name, email address, residential address, and phone number, is never associated with the farm data when looking at aggregated performance metrics. Without permission of the farmer nobody can see the data of the farmers' fields. And when FBN will be purchased by another company, the data of the farmer will not transfer ownership to that new company. FBN does not sell the farm's data. And no one can view the farm's details without explicit consent of the farmer[15].

At Farmobile the electronic farm record (ERF) is owned by the farmer. Data is stored as long as the subscription remains active[16]. The farmer's data is housed on cloud servers of Farmobile. Farmers have the power to authorize or deny access[17]. The farmer has the control of who has access to which data sets[18]. 365FarmNet states that "we ensure the highest level of data security and data privacy by using modern high-performance servers and certified service providers. Your operating data is handled by a neutral data service provider. We have taken precautions to ensure that content partners do not have access".

John Deere collects data from the agricultural machinery of the farmer such as location of the machinery, engine hours, operational data (e.g. amount of fuel used) and diagnostic data of the machinery. The exchange of farmers' machinery data is limited to the subsidiaries of John Deere, and authorized dealers and suppliers[19]. The platform itself,

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[14] Source: http://www.grainews.ca/2014/12/10/a-new-business-model-for-precision-ag-data-packages (Consulted November 8th 2015).
[15] Source: https://faq.farmersbusinessnetwork.com/hc/en-us (Consulted November 12th 2015).
[16] Source: https://www.farmobile.com/about/our-story (consulted November 8th 2015).
[17] Source: http://www.croplife.com/equipment/precision-ag/farmobile-coming-online-in-2015/ (consulted November 8th 2015).
[18] Source: http://www.aggateway.org/News/Newsletter/2015MarchNewsletter/WelcomeNewMemberFarmobile.aspx (consulted November 8th 2015).
[19] John Deere Data Services and Subscription Data Policy Statement for the US (Consulted October 5th 2015). See also: https://www.youtube.com/watch?v=WXSEFINp3eA

however, is open to everyone free of charge[20]. Monsanto says they share farmer's business (and personal) data only with subsidiaries and business partners of FieldScripts. No data is shared, traded or sold with marketers. Monsanto may publish data related to FieldScripts but only with expressing written consent of the farmer and without disclosing the name and field location of the farmer[21]. Furthermore the agreement between FieldScripts and the farmer states that in no event Monsanto and seed dealer agents are liable for any incidental, consequential, special or punitive damages resulting from the use of FieldScripts[22].

To perform the services of 365FarmNet, the farmer provides data on its company including employees, and data on contractual partners of the farmer, in particular data on the development of business cooperation. 365FarmNet states that it uses the data provided only for data processing for the performance of his services and not for his own purposes. After finishing the agreement 365FarmNet will hand over to the farmer all documents received and created and all results derived from processing. And 365FarmNet only provides information to third parties subject to prior written approval from the farmer[23].

All initiatives except FarmDigital appeal to scientific rationality by providing data-driven decision support. Scientific rationality is however most evident among technology start-ups like Farmers Edge[24] and Farmobile. Compared to more business-like style of 365FarmNet and Farmers Business Network, the websites of Farmers Edge and Farmobile radiate an allure of science and technology. In particular, the Farmers Edge team boasts experienced agronomists, GIS specialist, soil scientists and research scientists.

[20] Source: https://www.youtube.com/watch?v=GtwCoMvI8GA
[21] Farmer Privacy Commitment, 2014, FieldScripts, Monsanto.
[22] Monsanto FieldScripts Agreement.
[23] Data Protection Agreement as Annex to the Terms of Use for 365FarmNet.
[24] http://www.farmersedge.ca/technology/farmcommand (consulted November 15th 2015).

Table 1. An overview of the basic elements of the initiatives

No	Initiatives	Country	Business status	Type of initiator	Data-technology	Type of data	Source of data	Use of data
1	Farmers Edge (FE)	Canada (Global)	Running (founded in 2005, now 150 employees)	Tech-start up	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
2	Farmers Business Network (FBN)	US	Running (founded in 2014)	Data-start up	Data streaming, data sharing, data analysis	Farm data (soils, seeds, fertilizers, chemicals, yields, economic and weather)	Provided by farmer and peers	Performance feedback and advice
3	Farmobile	US	Running (founded in 2013)	Tech-start up	Data collection device, data integration, data analysis	Machine-generated data, farm data	Collected by farmer and peers	Data driven decisions, precision agriculture
4	John Deere (JD)	Global	Running (founded in 1837, since 2011 into data-business)	Ag Tech	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
5	Monsanto	Global	Running (originally founded in 1901)	Ag Business	FieldScripts, Climate FieldView™ platform	Seed information, soil information, yield data, weather data	Provided by farmer + platform	Planting tool and yield management
6	365FarmNet	Germany	Running (founded in 2013)	Data-start up	Web-based software	All farm data (plant, animal, feed, etc.)	Provided by farmer and peers	Decision support for farm management
7	FarmDigital	The Netherlands	Start up (started in 2015)	NGO/Data tech	Digital platform, web service	Compliance data	Provided by farmer	Compliance/Auditing

Figure 1: Positioning of data harvesting initiatives based on their connection to agriculture, technology and capital market

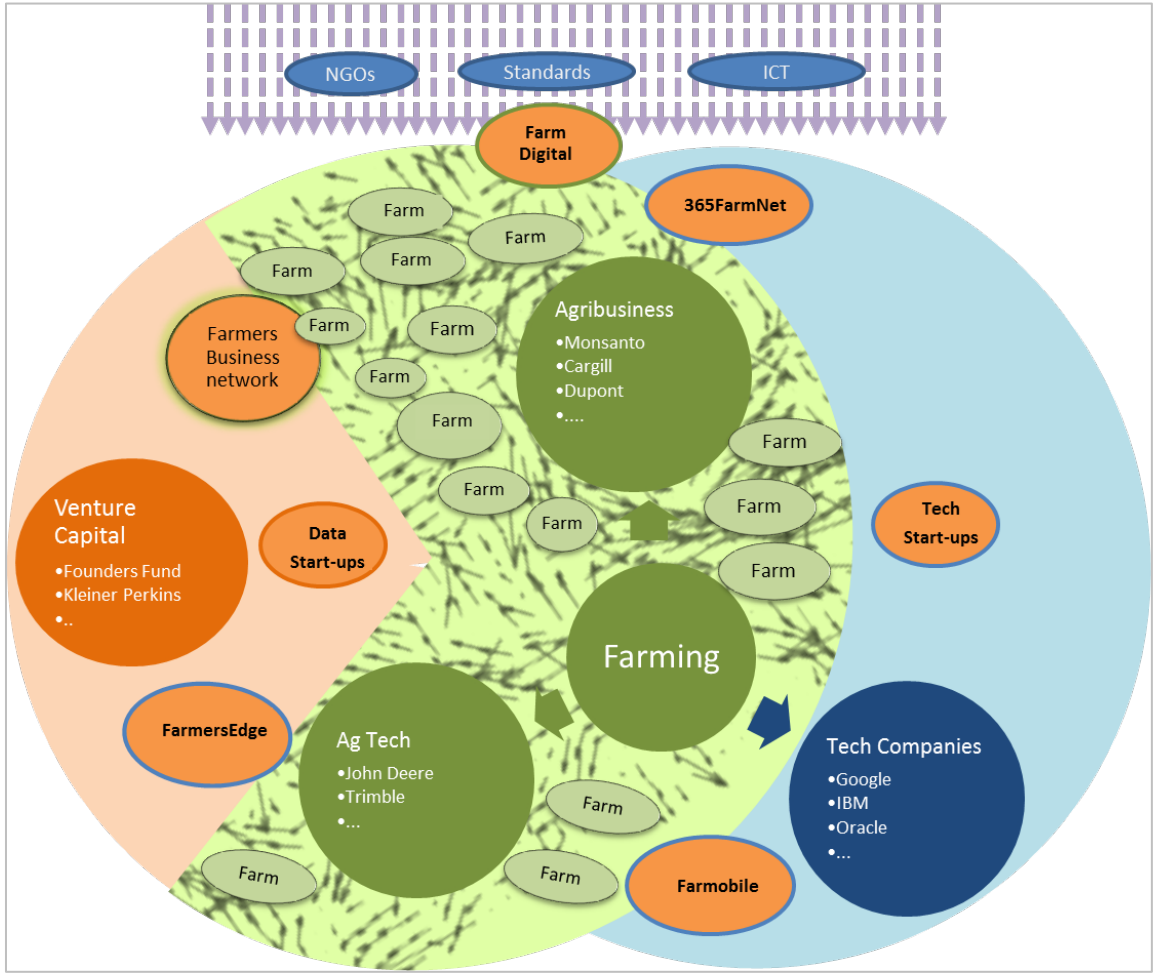

Table 2. Main features of the governance arrangements of the initiatives

Initiatives	**Main features of governance arrangements**					
	Organisational form	Inter-party relationships	Transactional complexity/Asset specificity	Uncertainty	Frequency of transaction among parties	Coordination mechanism
Farmers Edge (FE)	Firm/Corporate	Buyer-seller (Software as a Service)	Low/High	Low (low dependency on other farmers)	Standard	Price
Farmers Business Network (FBN)	Network	Platform-Membership	High/High	High (dependency on other farmers)	Non-standard	Price/Relational
Farmobile	Network	Platform-Membership	Low/Low	Low	Standard	Price/Agreements
John Deere (JD)	Corporate	Buyer-Seller-platform	Low/High	Low	Standard	Price
Monsanto	Corporate	Buyer-Seller	Low/High	Low	Standard	Price
365FarmNet	Partnership	Platform-Supplier-User	High/High	High (dependency on other actors)	Non-standard	Price/Relational agreements (terms of use)
FarmDigital	To be determined	Platform-Supplier-User	High/High	High (dependency on other actors)	Non-standard	Price/Agreements/Relational

Table 3: An overview of the presence of different rationalities

Initiatives	Economic rationality: (Based on mission statements)	Legal rationality: (Based on data ownership, privacy and liability arrangements)	Political rationality: (Based on access control and decision making)	Scientific rationality: (Based on use of data and science)
Farmers Edge	Helping farmers become more efficient and maximising their fields.	Data belongs to the farmers.	Access by payment: $3.95 per acre.	Presence of scientists in team, strong technological foundation
Farmers Business Network	Making data useful for optimal seeding grade to reach maximum potential.	No data sharing with anybody. Anonymous aggregated data.	Access by payment: $500 per year. Not tight to any company. Independent. Community of farmers.	Capturing as much data as possible for decision making
Farmobile	Making data collection simple, easier.	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.	Data collection and real-time access, enable precision agriculture
John Deere	Increase productivity and efficiency, higher production and revenue.	Only access to data for the trusted partners.	It is open for everybody. It is free of charge.	Evaluation of performance data.
Monsanto	Maximize productivity, minimize risks, higher yields	Data is only shared with subsidiaries and business partners.	Access by payment: $10 per acre.	Combining data of different sources for better knowledge.
365FarmNet	Makes paper works of the farmers easier so have more time free.	Data is only provided to third parties with approval of farmer. Certified service providers guarantee data security.	Varies per module.	11 vendors of agricultural technology and services contribute with data.
FarmDigital	Making compliance processes and data sharing processes more efficient	Growers own their data and decides with whom they share their data	Independent, open for all growers	Based on standards

3.4. Discussion on governance arrangements and rationality

Studying the governance arrangements from the perspective of NIE generates insights into the interplay between transactional factors and the choice of organisational form and coordination mechanisms. Factors such as asset specificity, uncertainty and frequency of transaction are known in the NIE to influence the choice of governance forms (Gereffi et al., 2005). Our findings on these factors are generally in line with theoretical expectations. Due to the limited availability of publicly available information, however, our treatment on these factors have been rather cursive. More empirical studies are needed for more in-depth analysis.

In all the data harvesting initiatives we studied, economic rationality prevails. The value propositions are primarily focussed on improving efficiency (in production and data management), productivity, and profitability. This dominancy of economic rationality is in line with the nature of data harvesting as primarily an economic activity. A notable feature in the efficiency argument is that efficiency improvement in data management is mostly considered a mean to achieve economic rationality rather than an end. Farm Digital is likely to be an exception in this respect as whose value proposition seems to be primarily the efficiency gain in data management for compliance purposes (obtaining certification). Although efficiency improvement in data management obviously has value, pricing such value is tricky due to the lack of a unified reference situation and the elusive impact of certification on economic performance of the grower.

The presence of political rationality, as evidence by the attention to access and control issues, can be explained by the networked nature of the value-creation process in which data are generated and collected from different sources with different owners. It is precisely the distributed ownership of data, technology and information that complicates the governance of data harvesting initiatives. When the number of actors increases, this will likely result in high transaction costs as in ‘mundane’ coordination (Gereffi et al., 2005). This is a point of attention for initiatives like Farm Digital that by the very nature of its value proposition must deal with many different types of stakeholders with potentially antagonistic values and views.

4. Concluding remarks

Data harvesting initiatives in agrifood chains have drawn considerable attention in research and policy. Few studies, however, have been focussed on their governance models. Viewing

data harvesting initiatives as economic organisations producing value of information through data sharing and exchange, New institutional economics and the theory of multiple rationalities prove to a useful framework for studying their governance arrangements and the rationale behind different choices.

Our studies on seven data harvesting initiatives have shown that, while all rationalities are present in data harvesting initiatives, the discussion so far has primarily been focused on economic rationality. The implications of other rationalities for governance arrangements have yet to be studied. Furthermore, there is a compelling need for clear institutional arrangements on privacy protection and data security. Uncertainties in such arrangements may create high transaction costs for new data harvesting initiatives.

Data harvesting initiatives, as well as other data-driven innovations in agriculture, are at present a phenomenon primarily observed in the developed world. It is however expected that the developing countries will catch up and even overtake (Kshetri, 2014). As noted by many authors in the literature, governance issues are likely to be more challenging in the developing world than in the developed world due to uncertainties in the institutional environment and the important role of smallholders in agriculture. Future studies on data harvesting initiatives should therefore address these governance issues in the context of developing countries.

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