Breaking with the assumption of centralization: an attempt to set up a peer-to-peer digital network for sharing agricultural data

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Introduction

Withdrawing a technology that is well embedded in society is a complex process [Goulet & Vinck, 2012]. Withdrawing a technology when it has not yet materialized and become embedded in routines, on the other hand, should be easy. As long as it remained only a future technology, it should not be necessary to undo its attachments one by one. It would be sufficient not to pursue its development. However, this article shows that the issue is sometimes more delicate. Technological visions or beliefs are sometimes so well established and mobilizing that their detachment can be a necessary condition for the emergence of alternative solutions. In this paper, we examine the journey and difficulties of a digital project, a peer-to-peer network launched with the aim of defeating another project for the centralization of data[1]. We argue that the withdrawal of what is a technological promise [van Lente & Rip, 1998] might also require an effort of detachment. The withdrawal of this promise posed a challenge in the face of the widely established paradigm of centralized data management[2].

This study is based on fieldwork [Beaud & Weber, 1997]. It focuses on the attempt to set up a peer-to-peer network, whose design was initiated in 2017 and was successfully implemented in 2019, for public and private organizations in the Swiss agricultural sector. The fieldwork, conducted between 2018 and 2019, consisted of following the project leader as he worked with his teams, sponsors, and potential investors to develop a technological alternative to the centralizing project and present it to the organizations that would be its future users. In our analysis, we employed a range of materials from the fieldwork: documents and press clippings associated with the project, interviews conducted with the project leader, and field journal entries related to public presentations of the project.

The first section presents the context of the emergence of the digital data centralization project. The second section traces the journey of the peer-to-peer network project in its intertwined dynamics with the centralization project. The final discussion returns to the processes of detachment from a well-established technological paradigm (centralization) in light of the work on withdrawal.

Sharing data: a challenge for administrative simplification

In 2015, a project to centralize data is launched in the Swiss agricultural sector. Farmers' administrative burden is the issue at the heart of the debate [Droz & al., 2014]. The sector's position seems unanimous: the number of databases nourished by farmers for the benefit of the organizations controlling their production and activities is disproportionate and generates too heavy a burden. Farmers are said to be tired of "entering the same data over and over again on the different platforms" of the organizations in the sector, whether they are administrations, producer or certification organizations, or large-scale distributors.

Each of these organizations needs data to carry out its responsibilities. Take for example the public administration, in this case the Federal Office for Agriculture (FOAG), which manages direct payments to farms and the compilation of statistics necessary for the evaluation and

[1] On the opposition of distribution versus centralization and its sociopolitical issues, see in particular [Musiani, 2017], and for a good synthetic overview, [Schollmeier, 2001].
[2] See [Sutherland & Jarrahi, 2018], and for agriculture in particular, [Royer & al., 2020].

development of agricultural policy. For its own needs, the FOAG operates a set of information systems. SIPA collects "register" data on persons and types of farms, "structure" data on plots, animals, and labor, and data related to "direct payments and ecological services" that concerns financial incentives for the cultivated landscape, food supply security, biodiversity, landscape quality, efficient use of resources, and special crops. In addition to SIPA, the FOAG manages, in collaboration with other public or private actors, "Acontrol" for the management of control data in the fields of primary plant and animal production, "Bdlait" for the volumes and qualities of milk production, "BDTA" for animal traffic, and "HODUFLU" for farm fertilizer flows.

On the other hand, sustainable production certification bodies need data on the farm (people and types of farms), its animal production (numbers of animals, holding conditions, feed, treatment, traffic), its plant production (surface areas, varieties, inputs, waste, and by-products), and its buildings and equipment. Each of these organizations manages independently and vertically, i.e., by taking care of the farmers that concern it, all the data that it deems necessary to exercise its prerogatives. The data requirements are sometimes similar from one organization to another although their formatting and input interfaces differ.

Some data can be exchanged between organizations. For example, the SIPA information system is fed by the information from the cantons' systems (five information systems for 26 cantons), and the BDTA transmits some of its data to private organizations, as regulations permit. These exchanges avoid certain redundancies in data entry and collection. However, they rely on client-server models, "rigid" formats (XML), and web interfaces (JSON). A "master" system defines the contents and the authorized times of transmission, which the Confederation determines for the public administration and by the transmitting system for private organizations. This mode of transmission is particularly costly in terms of maintenance because each time the data format is updated or modified, a realignment of the interface of each "slave" system is necessary. It implies the homogenization and synchronization of actors and tends to be limited to public information systems whose metadata catalogs are made visible, transparent, and accessible by law. Therefore, private organizations that manage data tend to require from farmers that they supply the data directly.

The data centralization project intends to remedy this situation arising from the number of systems that collect abundant and redundant data. Its proposal is to create a single data warehouse for the entire agricultural [3] sector. For many actors (private and public), centralization is the default modality for data management, with databases, ERPs, and CRMs[4] positioned at the heart of their organization's management (organization of controls, inseminations, monitoring and planning of agricultural production, sale of inputs, etc.). Various actors are willing to project this model on the scale of Swiss agriculture, seeing it as an inevitable or even desirable horizon—maintaining a multiplicity of systems, whether sectoral, cantonal, or federal, is doomed to become too costly— but hampered by "political obstacles."

Withdraw the idea of centralization

A centralized data warehouse for the entire agricultural sector

By the end of 2015, two well-known organizations from the agricultural sector, a national extension service and a company in which the Swiss government is majority shareholder, unite

[3] Industrial companies faced similar problems with different and sometimes incompatible IT systems from one department to another, which led to the introduction of enterprise resource planning (ERP) systems structured around single, centralized databases [Vinck & Benz, 2008].

[4] *Customer Relationship Management* software, designed to collect and process data on customers and potential customers (expectations, purchases, etc.) to manage the relationship with these customers (sales or service plan, *marketing*) and build loyalty. These CRMs are associated with ERP systems.

and incorporate a simple company[5] that we will call Cortex. At the beginning of 2016, they publicly present the project to create a data warehouse. It would be a unique opportunity to simplify farmers' administrative work if the main Swiss producers' association, which we will call ProTerra, representing 30% of farmers, agreed to entrust its members' data and their management to Cortex.

Worried about such a proposal, ProTerra decides to call upon a consultant in strategy, engineering, and information systems architecture already solicited in the past in similar circumstances of "their IT resources being put under pressure." The consultant, Michel[6], a 54-year-old entrepreneur, graduate of the Lausanne Federal Technical Institute, with a PhD in distributed computing, former chief technology officer (1996-2000) of the FOAG, and having notably deployed SIPA, designs a counterattack to the centralized data warehouse project. The first analyses are presented in summer 2016 during a meeting organized between ProTerra and the FOAG.

Convincing of the unfeasibility and dangers of centralization

Michel, appointed spokesperson for ProTerra, explains that a centralized data warehouse for the entire Swiss agricultural sector would not be justified i) in terms of "business" (i.e., in relation to the application domain), ii) in relation to IT and technical security, iii) financially and commercially, or iv) legally.

In "business" terms, it would be impossible for a single "information system" or "database" to sustainably meet the data and management needs of all the public and private actors in the agricultural sector. A centralized system would require the homogeneity and synchronization of actors who are disparate, independent, and sometimes even competing. *In terms of computer and technical security*, a centralized system would constitute a "single point of failure," ultimately posing a problem of control or sovereignty over the data. If the system were to be attacked or if the company that managed it were to go bankrupt, what would happen of the data on which the entire sector depended? *In financial and commercial terms*, the development, operation, and maintenance costs of such a centralized solution would be exorbitant. Cortex, which has since become a public limited company[7], has invested five to ten million Swiss francs[8] in this project for the period 2018-2024 even though it only had 100,000 francs in shares until the end of 2021, and farmers would pay between 300 and 450 francs per farm per year for the solution. To cover this investment, depending on the assumptions made, 22 to 56% of farmers would have to adopt the solution, which is an optimistic scenario, sufficient to present the risk of bankruptcy by over-indebtedness. Moreover, this solution would risk making producers captive to large supplier distributors who, having a precise and complete view of the market thanks to this single database covering the whole of agriculture, could vertically integrate the farmers, who would then become employees of large companies. *In legal terms*, this project, in the hands of a few actors, namely the companies that make up Cortex, indirectly supported by the Confederation, would constitute a violation of the equal treatment of private actors active in the market. In short, the project would be illegal.

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[5] A legal form of company provided for under Swiss law, concluded between natural or legal persons to achieve a common goal, whether profit-making or not. As it has no legal personality, it cannot bear a name, act, be sued, or be entered in the Commercial Register. However, its owners are jointly and severally liable for its commercial commitments regarding their personal assets.

[6] Pseudonym.

[7] A legal form of limited liability company. It is suitable for large companies, as it allows them to raise capital from many investors who can only bear losses up to the amount of their contributions. The shareholders' identities can be anonymous.

[8] 1 Swiss franc was roughly equivalent to 1.09 USD.

On this critical basis, ProTerra rejects the idea of a single, centralized database and hopes the Confederation will abandon it. Nevertheless, it expresses its motivation to provide a more suitable answer to the problem of administrative simplification and proposes an alternative concept: "if the Confederation advocated an open approach to data exchange in the agricultural sector, based on open-source software, [... ProTerra] would be ready, on behalf of the FOAG, to develop the open concept and to publish it."

From a centralized data warehouse to a smart farming platform

In late 2016/early 2017, the data warehouse project seems to have been forgotten. ProTerra therefore resumes its regular activities. But in the summer, and at the advent of a large public event organized by the FOAG, under the aegis of the Federal Councilor in charge of the economy, the Cortex project reappears in the spotlight, with the same name but transformed for the occasion into a *smart farming*[9] *platform.*

Cortex plans to welcome new shareholders, including a national umbrella organization, a national federation of agricultural cooperatives active in input trading and a major buyer of agricultural products, and a foreign company specializing in agricultural software development. The platform, although centralized, promises to have "open to all" interfaces for data acquisition and the development of third-party modules (decision support tools), which would allow farmers to increase their productivity and competitiveness. A first productive version of the platform is expected in March 2018, adorned with two initial modules: a "manure flow balance" module and an "animal transport" module. Surprised by this return of a centralized solution and once again worried, ProTerra goes back to work despite the lack of support from the Confederation, deemed to be entangled in its self-interested biases. Michel is invited to resume his critical work and to design and develop an alternative solution. Once an advisor, Michel becomes a project manager.

In December 2017 an early 2018, several meetings are organized by the "alternative solution" project: producer federations, certification organizations, leading companies in the field (animal, plant, dairy), national, cantonal, or regional umbrella organizations, and cantonal and federal administrations. In his PowerPoint® presentations, Michel points out that the centralizing project is just a smokescreen. Cortex may produce many speeches and "functional" promises, supported by large communication budgets, but is basically nothing else than a mashup of buzzwords with no conceptual basis or technical solution.

According to Michel, Cortex is a collection of real or supposed shareholders, with divergent objectives and interests and a control structure (distribution of powers, competencies, and responsibilities) that is not transparent. How could one align the objectives of a public administration to outsource its expenses[10], of a company to avoid bankruptcy, of a federation of cooperatives to prepare for the breaking point or the programmed end of the Swiss peasantry under the weight of free trade agreements, and of an umbrella organization that seeks to prevent this breaking point from happening? *Without a conceptual basis or a technical solution*, that is, with no blueprint, architecture, or definition of the how and the what of the platform. The solution is considered not only to be opaque but also to lack the iterations necessary for risk management in software development (feasibility and suitability). The slideshow states it is "a platform with national and sectoral coverage, intended to open up all of agriculture to 4.0 production methods (data-driven production). Never seen before in any sector of the economy ... so no one knows what could happen based on current products and technologies."

[9] For an introduction to "smart farming," see [Tardieu, 2017].
[10] Like its animal traffic database, the new module of the centralized platform, whose transfer is however illegal.

The criticism leads to a large public event in the winter of 2018, which is organized by a producers' federation, where ProTerra's alternative solution is invited to showcase itself against Cortex's centralized solution.

Conceptualization of a credible alternative

> When you want to strategically occupy a position, you have to take it. There's no point in politely knocking on the door and asking, "Can I come on stage? Because I'd like to …" Okay, you go. Finally, you walk into the middle of a play. You see the reactions that this can cause (Michel).

February 2018, Bern. Michel goes on stage in front of an audience of about 100 people, representatives of various organizations in the sector. He brings up the "open concept" proposed to the FOAG in the summer of 2016 and now called an open *data bus*[11] for the exchange of agricultural data between service providers, organizations, and administrations in the agricultural sector. It is said to be an alternative solution and not a competing "ERP" to the *smart-farming* platform, described as a "monopolistic threat to the agricultural data market." The proposed form of data exchange, the bus, aims to "avoid *certain* redundancies" and represents an alternative to the "one-stop shop" (centralized warehouse or platform) deemed unfeasible.

According to Michel, one of the alternative project's objectives is to reduce the costs of data entry, collection, and control while ensuring that each actor could retain their full legal autonomy. The service providers, organizations, and administrations could keep their socio-technical systems for data collection. Farmers could control the flow of their data between systems via a mobile application connected to the bus to manage authorizations. The second objective is to foster the development of digitization and innovation in the agricultural sector in a competitive and non-cartelized free data market. The ultimate goal is to enable the development of innovative services, based on data, chosen by farmers and in support of the quality of their production or the traceability of their products[12] using the bus. The alternative project promises to deliver a bus i) open to all, non-profit, and free of charge for the farmer; ii) that transmits data if desired and when the participants deem it necessary and possible, and iii) that is capable of supporting an automated, secure, traced, and farmer-authorized data exchange. The bus is to be delivered by summer 2019, and four operational prototypes are to run on the bus by that time.

To highlight the originality of this alternative to centralization, Michel draws a parallel with another bus, Sedex, well known to administrations and intended for the exchange of data between "public registers." The data bus he proposes goes further, opening up to private partners without forcing actors to share data models or data structures. He metaphorically compares these two solutions: "Sedex is like a railroad network, it is hyper-formatted, with strong structural constraints; our bus is like a road network: there are traffic rules, but you can go anywhere with any (approved) vehicle."

To free themselves from the constraint of a predefined structure for all, he proposes to make a *blockchain* technology available to participating organizations. Equipped with a "distributed ledger," it would allow each participant to share publicly the descriptions[13] of the data they are willing to send or receive according to a structure of their own choice. Made to solve the

[11] A data bus is a device that allows for the physical transmission of data between a computer system's components, such as memory and CPU, or between two computers. It is used here as an abstract entity, with the components referring by analogy to the data infrastructures of agricultural organizations.

[12] Whether it's the products he consumes—including those he feeds to his livestock—whose origins he wants to be sure of or those he produces for which he wants to make sure the consumer has proof that they came from him and his effective work practices.

[13] That is, the metadata.

problem of "ordered consensus" between participants, the *blockchain's* role would be limited to making transparent the supply and demand of data. The actual exchange of data items would be operationalized through "bilateral transactions" between actors, authorized by the farmer but traced and made persistent for the sending and receiving participants. This bilateralism would ensure that farmers have an informed reading of data flows (for informed authorizations). Traced and persisted transactions would allow for the sanctioning of malicious acts, such as data exchanges across the bus that the farmer did not authorize or illicit use after an authorized transfer.

In addition to presenting an alternative, conceptually elaborate solution, Michel announces that the first phase of its realization, the development of a data bus, with its *blockchain* and authorization *app*, would cost six to eight times less than the centralizing platform and entail a much faster development.

The promise of a distributed solution, an alternative to centralization, comes as a relief to some of the actors concerned and convinces others. The challenge is to quickly consolidate the detachment from the Cortex project and strengthen the attachment to the alternative project.

From opposition to the possibility of a rapprochement

As of 2018, the clear opposition that previously structured the debates between the centralized and the distributed solutions is changing. In the meantime, both solutions have evolved. The former has moved from a "single alternative" data warehouse to a *smart farming* platform with "open to all" interfaces. The latter has gone from an open concept to a "credible alternative" bus. The press clippings on the subject attest to this. A "collaboration" emerges, "possible, even judicious," between the two approaches, presented as "complementary." Public administrations and umbrella organizations specifically advocate this rapprochement, considering it a necessary condition for their enrollment. Behind the scenes, however, the alternative solution is rejected by the promoters of the centralized solution, who repeatedly express their intention to build the data bus themselves. Michel sees this as a sign that the distributed solution is gaining legitimacy. From his perspective, a rapprochement would not be excluded: "It is better to have strong allies whose interests are known and who can provide the project with resources and credibility than to see them spoil an alternative solution because they do not understand it or do not adhere to it." In addition, there would be a way to weaken the centralized solution, which, once integrated with the distributed solution, could lose its central place. In other words, the projects could come together and become complementary, taking advantage of each other's attachments to form a single whole. But this rapprochement would risk compromising the socio-technical ideal of the centralized solution, which, once integrated into the distributed solution, would become only one more database solution among others, local and potentially marginalized. The socio-technical ideal of the distributed solution would remain intact, except in the case in which all the actors would only receive and/or send data to the centralizer, or of a similar constraining network topology[14].

From a data bus to a fully distributed system

> When this person modifies, updates a value in one app and he has authorized the transmission, then he automatically sees it updated in the second app (Michel).

In 2018, on one side the distributed alternative project to centralization is launched, while on the other the foreign company specializing in agricultural software development and the national federation of agricultural cooperatives confirm their participation in Cortex. The

[14] For an introduction to network topologies, see [Cardon, 2019].

umbrella organization announces that it is withdrawing from the latter project due to the controversial nature of the national federation of agricultural cooperatives' participation. The distributed alternative project launches reflections on its strategic organization and simultaneously initiates the first specification and development *sprints.* To act quickly, the team launches three tracks in parallel: strategy, development, and specification, the latter to be used, after evaluation, to drive the development of a second consolidated phase. Within the framework of a constrained budget, the aim is to exhibit the alternative, demonstrate its feasibility, strengthen its links, and prevent the centralizing project from continuing to enlist actors and eventually impose itself. In the fall, these developments lead to a new information day, with some a hundred attendees, representatives of various organizations, including those attached to the centralization project. The alternative is then alone on the stage. A prototype of the *front-end*[15] for the management of data exchange authorizations is presented. The project, once described as a data bus, is now a *fully distributed system.*

The prototype is meant to be simple and shows only the authorization and transmission functionalities on basic data types. It is partly visible to the users and provides a *front-end* downloadable directly to their smartphone. An authorization application and three applications, A, B, and C, made for demonstration purposes present two structured sets of "farm" and "person" data. For example, if a user wanted to transmit the "personal address" entered in application A to application B, they would enter the authorizing application and open the "latch" for a transmission from A to B of the "person" data. After entering or updating the "personal address" in A, the user would see that the address has been updated accordingly in application B.

The "administrative simplification" is thus demonstrated by the sharing of data updates between the applications supplied by various providers, administrations, and/or organizations participating in the project.

Although "simple" for the user, the prototype is nevertheless based on a "complex" *back-end* structure *under construction.* This complexity is presented as specific to the domain of "distributed systems" and their requirements of i) the participants' symmetry so they can indistinctly play the role of sender and/or receiver and ii) support for asynchronous exchanges so the participants can send and/or receive data if and when they wish. Although complex in its structure, the distributed system in question would nevertheless require little development effort on the part of the project participants, who could benefit from the use of "open standard" software and a commodity hardware infrastructure, server clusters with adequate security, storage capacity, and *monitoring*, should the availability of this infrastructure prove useful or profitable for them. In any case, its software and hardware infrastructure would remain under the legal and operational responsibility of each participant and would not involve any intrusion into their own productive data infrastructure.

To explain the new alternative, which is difficult to imagine, Michel evokes the Internet and, more precisely, the end-to-end principle that characterizes it. Like the Internet and its TCP/IP protocols[16], the system is a "peer-to-peer network" in which the "peers" would be the partner organizations, service providers, and administrations that participate in the project[17]. The

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[15] The *front-end is* the part visible to the user, what is displayed on his screen.

[s] Protocols located on layers 3 and 4 of the ISO OSI model, where the system is located on layer 7 of the model.

[17] Technically, each of the "peers" in the computer network refers only to a network component, called a "cube", consisting of a set of servers in which a local copy of the software developed by the project runs. This "cube" will be connected to the peer's data infrastructure via a standard interface (API) independent of the data structure. Each of these cubes will be certified to ensure the device's quality and security and operated under the responsibility of the peer concerned.

system has no central component that could serve as a single point of control or failure. It is fully distributed, physically, operationally, and legally among the peers in the network.

Against proprietary centralization that was created *ex-nihilo*, the project thus presents itself as a "common" alternative [Stiefel & Sandoz, 2021] capable of redistributing data flows between existing actors in the agricultural sector who are willing to exchange, and "under the authority of the farmers." The collaborative base would not prevent "peers," or partner organizations, from competing in the field of digitization and innovation, but the "network" would provide them with an *a priori* market open to competition [van Schewick, 2012].

Both solutions have gained equal visibility in the press and through public presentations of the projects (winter and then fall 2018). However, by the end of 2018, the centralizing solution has rallied a significant part of the animal and dairy sector while the alternative solution struggles to recruit new allies apart from one canton and a large control coordination organization already linked in business and IT terms to ProTerra and in the hands of the plant production sector (producers of cereal, fruits and vegetables, potatoes, etc.).

From a fully distributed system to a collaborative platform

> You are in the middle of a huge and promising development with fantastic possibilities yet to be discovered, especially compared to 50 years ago. You are also in a phase of development where it can happen that people who have nothing to do with agriculture have all the relevant data because they are simply running a platform that allows a large part of the added value from agriculture to be recovered (Angela Merkel's [former federal chancellor of Germany] speech during International Green Week, January 18, 2019, in Berlin, echoed by Michel).

In summer 2019, a new information day for the alternative project is organized by its sponsors, again in front of about 100 people representing the various organizations from the sector. Michel announces that the project has reached the end of its first phase and is ready to go into production[18] based on the demonstrators' announcement the previous winter, with a starting potential of nearly 35,000 farmers (equivalent to the farmer base represented by the control coordination organization, newly enrolled in the project). Organizations interested in designing and developing their own demonstrator are cordially invited to apply. The second phase of the project concerns the deployment of the solution in the *open-source* community as an open standard, which would allow participants to read, modify, and extend the source code collectively according to their needs. After some recaps as well as feedback on the developments and their status, Michel invites the audience to a discussion on technical questions and use cases based on the participants' interest.

The questions and answers go on for over an hour. Where exactly are the authorizations defined, and where are they stored? Are they verified before each transmission? How is the farmer identified, and how do peers X and Y know they are talking about the same farmer? What data, exactly, is made public? How exactly does the transmission take place? What exactly do the demonstrators show? Will they be only temporary? Has the project established contacts with software vendors, such as farm management systems? Will some systems, perhaps not technically state of the art, be able to integrate into the network or, in the newly coined term, the "collaboration platform"? What exactly are the network nodes (called "cubes" in reference to the underlying technology) made of, and how much do they cost to build or lease? Do the project's sponsors plan to do anything with the federal government? Etc.

[18] To be deployed with the production databases of agricultural organizations.

During the session, a representative from the "demonstrator" canton explains his motivation to participate in the project. The solution would be "a very good, open, and transparent platform." It would ensure that the farmer "keep[s] control of his data." A representative of the Confederation confirms that a prototype with the collaboration platform is under discussion, which would allow for the testing of the efficient transmission of data between the Confederation, a canton, and Cortex.

Some initial possible uses for the system are explored. One partner organization could, for example, propose an application to collect data from the tractor's GPS, sensors installed on the farm, or barcodes placed on input cans. A second organization could propose a field notebook. Thanks to the network, the farmer could benefit from the data being entered in the first application directly into his field book without a double entry. By multiplying the number of interacting applications—a service provider's field book with the application of a cantonal administration or a certification body—it would require only one step toward administrative simplification and a new offer of innovative services, such as consulting on the farm or traceability in the food chain.

For Michel, the project's primary objectives have been achieved; the centralizing project in its original form of *a data warehouse* has been abandoned, and the distributed approach has become a credible alternative in the eyes of significant actors. After the session, several actors express their interest in joining the project, including several cantons and part of the crop production sector. These actors no longer have any doubt that centralization represents a danger to be offset, regardless of whether a public entity or a large private company has centralized the data. Some farmers and organizations confirm this position.

However, the distributed project, the collaboration platform, has not been able to eliminate the centralizer. *The smart farming platform* (the second form the centralizer project took) has continued to develop and has seen its first modules enter the market, counting 2600 farmer users, according to Cortex's latest announcements, while the alternative solution is only at the productive-prototype stage and now in search of investor-participants for its second phase.

Some actors are reluctant to invest in the distributed solution, having experienced or already engaged in projects to connect systems perceived as similar and that ended in failure. Others fear the lack of business opportunities. "The collaboration platform is not a product. Even if many players are waiting for it, no one would really be willing to pay for it," Michel explains. What would they gain in return? The development of innovative services and traceability do not appeal to everyone. To prove itself and convince, the distributed solution has to be able to rely on the data infrastructures of organizations that are willing to exchange data. Some organizations are not used to "testing" new things and tend to stick to what they know: centralized databases and interfaces in the client-server paradigm.

Discussion

Work on withdrawal usually focuses on technologies or products that are well entrenched in society. Sometimes the entrenchment occurs due to institutions that must be weakened and challenged. Regarding technologies that are not yet established in a sector of society, it seems obvious that talking about withdrawal or detachment does not make sense because the attachments are not yet formed.

However, the study we have presented challenges this assumption. The fact that a technology is not yet deployed or anchored in socio-technical systems does not imply that preventing its arrival is easy or that it can easily be gotten rid of by nipping it in the bud. The study shows that before becoming a socio-material reality, some technologies already exist, installed in people's minds and functioning as something obvious whose materialization could easily occur.

This was the case with the promise of a data warehouse, which would function as a "one-stop shop" and solve many problems, including the administrative burden on farmers. We report on the attempt to introduce an alternative solution, a peer-to-peer network, to a solution that existed only in people's minds. It shows that it is not easy to introduce a technology, even one that tangible initial results support, when it clashes with a fictitious technology that functions as a "mobilizing rational myth" [Hatchuel, 1998] and refers to such a well-established paradigm as centralization for data management.

Withdrawal implies a paradigm shift that the alternative project attempts to trigger by arguing that the data warehouse project, in its fantasized form—a single system for all data and for all actors in the agricultural sector—is doomed to fail. Some of these arguments seem convincing but do not have the desired effect: the data warehouse returns in a revisited form, that of a (centralized) *smart-farming* platform that enrolls new actors. The alternative project then strives to produce, in addition to arguments, tangible proof of the distributed model's feasibility. Having reached the productive-prototype stage, it succeeds in attracting important new actors without, however, managing to detach the actors already involved in the centralized solution. The latter benefits from important investments promising to accelerate its development and its entry into the market (even if the promise of simplification and increase in farms' competitiveness will probably never come true).

This case represents a detachment process whose outcome is uncertain. Its success will probably depend on its ability to strengthen its attachments to "not completely convinced" but very supportive actors by demonstrating its feasibility and scope. It will probably still need its opponents to demonstrate that its realization as a well-established paradigm would introduce and reinforce strong asymmetries between actors while the distributed model would preserve the balance of power [Benkler, 2016].