# Design for agency *vs*. vulnerability by design

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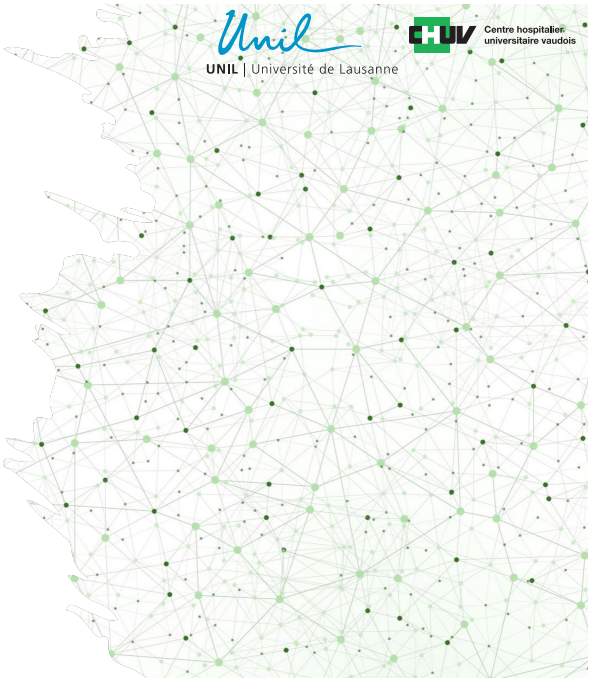


Design for Agency vs. Vulnerability by Design

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This contribution examines how digital system architectures can be designed in order both to reduce the vulnerability of data owners and to promote the accountability of data users. We will come back to these concepts during the presentation.

The results we discuss are based on a case that unrolled in Swiss agriculture between 2017 and 2019, and was the subject of an ethnographic fieldwork leading to my [Léa Stiefel] PhD thesis.

Swiss agriculture experienced its first "datafication" at the end of the 19th century, when the Swiss Farmers' Union, threatened by the rural exodus and the disappearance of peasantry, gradually introduced financial bookkeeping to farmers under the leadership of its director, Ernst Laur.

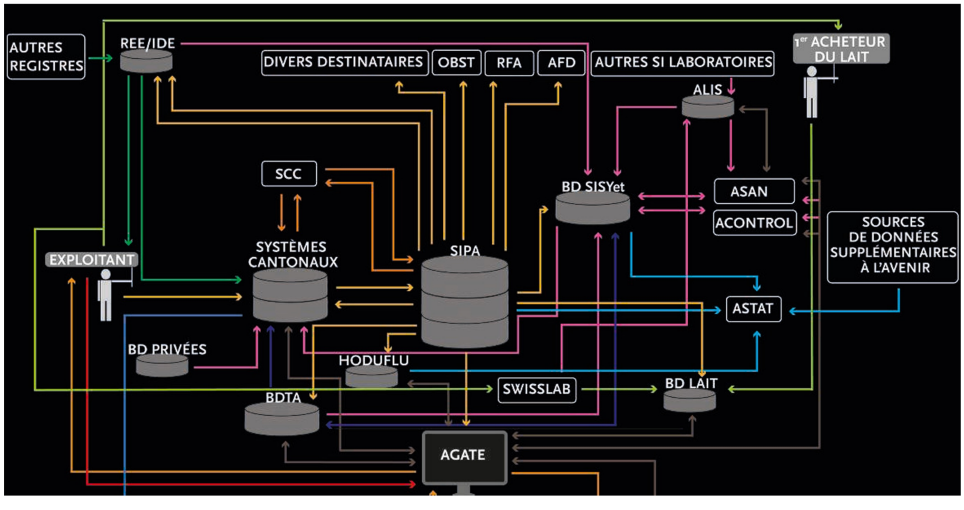
Data collection made it possible to trace costs and income, debts, interest and wages, profits, and the financial value of land. Aggregated data enabled to identify trends and provided a scientific basis for public policies and trade agreements supported by the union. Data was used to consolidate the latter's position and to counter critics and dissidents within the peasant movement. While their leadership used data to modernize agriculture and make it governable, farmers saw it as a means to improve farm management, gain in productivity, participate in modernization, and benefit from collective action.

Although Swiss administrations had been collecting data since the 1850s, the Farmers' Union dominated the field of agricultural data because of the qualitative and quantitative scope of its data. In the 1990s, however, the situation changed when the government abandoned its price support policy following the Uruguay round agreements in Marrakesh in 1994.

In line with these agreements and with growing concerns on environmental and animal issues, the government introduced an income policy based on so-called *direct payments*. It was intended to support a multifunctional agriculture which would no longer only produce food, but also contribute to "the preservation of the natural environment, the maintenance of the rural landscape and the decentralized use of the territory" (as stated in Article 104 of the Federal Constitution).

The development was supported by the use of large amounts of data, which were collected and managed under the responsibility of the Confederation and the cantons: data on farm organization, workforce, land, and animals, and on contributions to food security, biodiversity, resource efficiency, landscape, cultural heritage, etc.

Initially provided by farmers on paper-forms and typed into public administrations' information systems by dedicated agents, the data became gradually supplied by the farmers themselves using personal computers and the Internet. This "digitisation" was a dream-opportunity for public administrations, allowing them to shift the burden of data-entry to the farmers.



As long as pen and paper were the backbone of information management in agriculture, the effort required to collect and manage data refrained institutional actors from developing policies and practices that required the collection of detailed information on farms. Within a few years-time, information and communication technologies made it possible for organizations and service providers to collect a wide range of digital data directly from every farm.

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> « We have seen this with the 2014 agricultural policy, with all the related projects and programmes that have been grafted onto the surface areas. We said, anyway, we have digitalisation, we have geodata, so we can afford to increase the number of programmes every year. » [Civil servant - 17 July 2018]

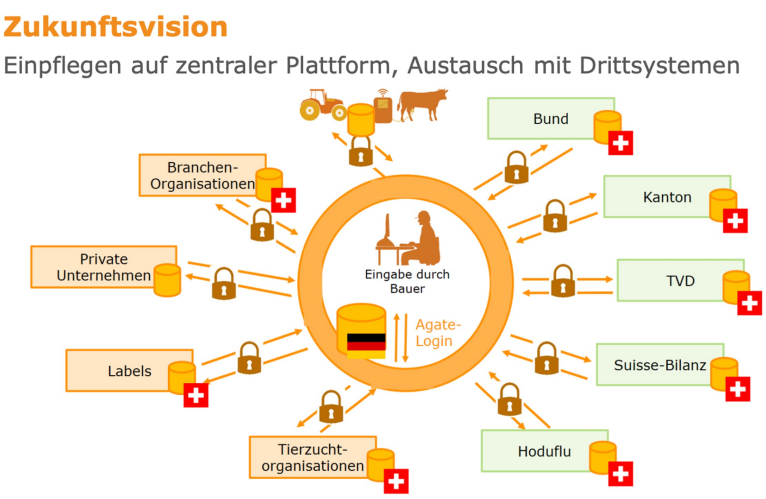
The data can be used for operational purposes (to support resource planning on the farm, or to remotely manage the genetic-pool of their livestock, for example). But it can also be used for the implementation and control of regulations and of contracts: farmers receive subsidies from public authorities in exchange for services to society. They also receive premiums on their products from label organizations for the application of specific production modes (for example, organic, integrated, or traditional), the geographical origin of products, the specificity of crop varieties or of animal breeds, etc., all of which are

defined in contracts. The data declared by the farmer or collected during controls is used to monitor and assess compliance. Discrepancies can lead to penalties or sanctions.

But at the source of the data, farmers have had difficulties to follow up. The multiplicity, heterogeneity, and complexity of data requirements from too many actors has led to administrative burdens, risks, and growing dissatisfaction.


Private approach to the problem

In 2015, a group of private actors floated the idea that efficiency would be improved if *all of the sector's data* were centralized *in a single database* (which they proposed to operate). To realize this idea, they launched a project called Barto.




At the time of the case study, Barto had evolved into a service platform (architecturally similar to Uber or Facebook) that would offer *smart-farming* modules in addition to the basic data-management functionalities for farmers and application programming interfaces for organizations.

Farmers were inhabited with a sense of helplessness. They welcomed the idea of simplifying their administrative work without questioning the feasibility of the proposed solution, but feared the consequences of centralization. Rather than the promise of simplification by an additional IT system, they would have preferred a reduction of administrative measures and controls. The fieldwork also revealed some deeper concerns of farmers and organizations. Let's develop three of these concerns shortly.

First, Barto's stakeholders included the largest agricultural cooperative in Switzerland, *Fenaco*, both the main supplier and a major buyer of products for farms. A European software development company, *365FarmNet*, linked to *Fenaco* through the German machinery manufacturer, *Claas*, and two publicly controlled key organizations *Identitas* and *Agridea* completed the core of shareholders.


Farmers were concerned that the project was backed by a conglomerate of powerful private players. The centralized database would be able to provide a complete picture of what was happening on all farms, on a daily basis. Combined with its own private decision-support tools, the database would enable the cooperative to drive the demand for inputs and the supply of agricultural products, and to influence market and supply prices. Farmers perceived a high risk of "vertical integration".

Meanwhile, they would retain the burden of debt and production risks (such as losses due to weather or disease). They would *pay* to use "services" developed on the basis of *their* data and would be contractually held *liable* for its quality, while all profits would go to the database owners.

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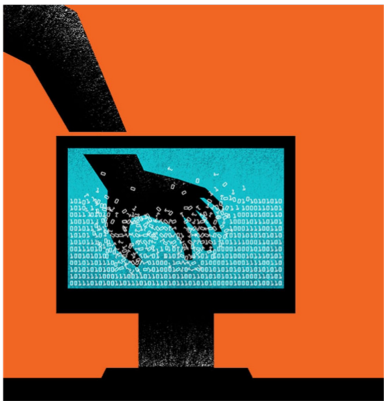
« So you see, you have a company called X. It buys the pigs, transports them and takes them to the slaughterhouse. At the same time it has access to all the information about the farm. X can find out to the day how many pigs the farmer has and how much they weigh. If X knows this for a large number of farms, what happens? He controls the supply. And if X controls these farms, he can say to the farmer: "Tomorrow at 4 o'clock I'll come with the lorry and we'll take your 50 pigs, numbers 27 to 32, and so on. And the farmer practically becomes one of X's employees. What's more, the same company will tell him: "We're delivering this feed to fatten your pigs. » [Member of the Swiss Farmers' Union - 11 March 2019].

Second, it was unclear how data would flow between organizations connected to the centralized database. Without control over the flow of their data, farmers were vulnerable. For example, if data was inadvertently sent to a government agency, showing high nitrogen levels in one field, the farm could lose subsidies, even if they were compensated in another field (which can happen on any farm).

« Data that circulates without you really being aware of it is a bit problematic... We often cheat a little. In other words, all the administrative controls that are carried out are just useless. I mean, it's administrative, so we present nice declarations that are in order, but... you know. » [Farmer - 17 December 2018]



If data from a government inspection showing an animal health problem was inadvertently passed on to a trader, the farm and its neighbours could be side-lined (what actually happened to a whole village because of one sick animal) for fear of the disease spreading from a shipment to the slaughterhouse.

Third, organizations would have to "log on" to the central database to access the data they needed, which had previously been provided to them directly by the farmers. There was no guarantee that they would actually be allowed to access the data in the contents and formats, and at the time, they needed to carry out their duties, nor was there any indication of the price they would have to pay. Centralization promised to undermine the autonomy of the organizations, to the point of threatening their very existence.

> « There are times during the year when this data is considered valid. They have been recognised, published and plotted. The moment when they are open for writing is clearly defined. For those receiving direct payments, it's once in September to register for the programmes. After that, we organise the controls. Then, in the spring, the farms enter their data. If we received data all the time... our plausibility lists too, which we work with, I mean, we wouldn't be able to do our calculations and our controls. » [Civil servant - 18 June 2018]

To summarize: data concerning farms is maintained in dispersed databases operated by independent organizations. These actors are the data *users*. Each organization defines procedures (in particular, when the data is collected and processed) and data formats (how information is digitized) according to its own needs (what it does with the information). To prevent sanctions and other negative consequences of false interpretations, farmers (who are the data *owners*) need to control what information goes where, when and in what form.

## Collective approach to the problem

In response to Barto and to the problems and threats data-owners and data-users in the sector perceived, a project called ADA was set up by professional organizations. The opposition between ADA and Barto became viral.

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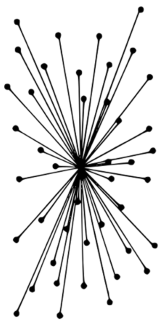

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barto ≠ ada eda

Qu'est-ce que Barto ?

Qu'est-ce qu'Ada ?

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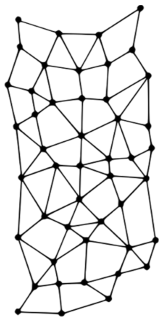

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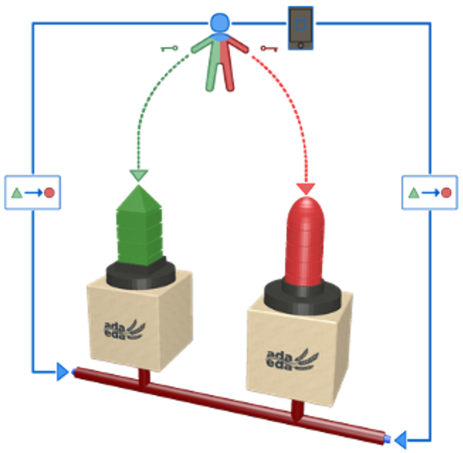
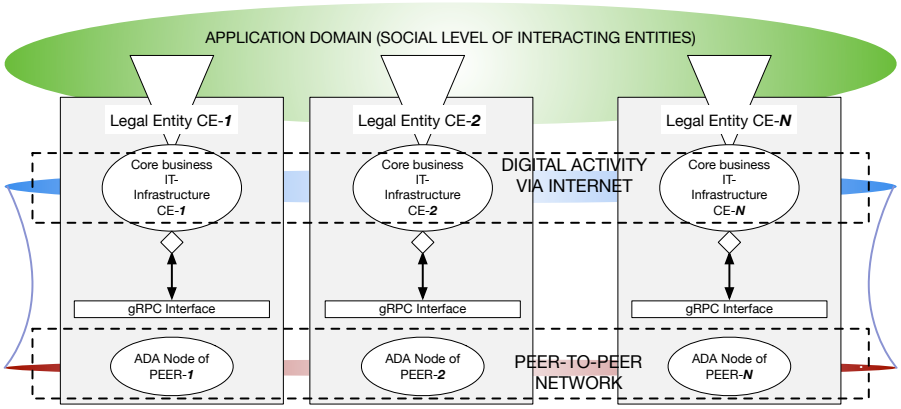
ADA was not a commercial product, nor was the project an attempt to *take over* the information infrastructure of Swiss agriculture. ADA's *proposed* alternative to Barto's approach was to provide an *interoperability* platform for the sector (on the model of TCP/IP, but in the application layer of the Internet) that farmers and organizations could freely use to improve data management and potentially reduce costs, inconsistencies, and redundancies where it was meaningful. From the architectural perspective, ADA was not "more of the same", which would not have been an alternative.

The technical solution was a peer-to-peer platform, where the peers were organizations (data-users with their own database), each operating a *node* (which it would fully control) to which it would connect its information system via an API which it would also control.



The platform, scalable in the number of nodes and composed at any time of the operational nodes of participating peers, would be neither proprietary nor centrally controlled. Its only (core shared) functionalities were: *a*) for a data-owner to grant and manage authorizations; and *b*) for two data-users (*i.e.*, two organizations operating sensitive data) to exchange data, if authorization had been granted by the owner, and if and when both agreed to do so. In short: tripartite authorization (a) and bilateral authorized transmission of data (b). The platform would be *fully* distributed: it would have no central component and all roles would be *symmetrical* (what one peer could do, every peer could do, with the same constraints). Within its scope, the architecture of the platform would preserve the autonomy of each peer and guarantee freedom of association, equal treatment, and symmetry among peers.




Peer autonomy meant that **the platform** could not compromise the integrity of the peers and, in particular, that no peer could be accused of having broken a rule without controlling all the means necessary to exculpate itself if it had not done so. An authorization and subsequent transmissions were logged locally on both nodes concerned, in a consistent manner and traces could not be forged (though they could be deleted).

ADA did not compromise the agency of peers (in particular, the ability to enforce their legal responsibilities on their own), which may seem paradoxical when considering data management over the Internet, but was of paramount importance to public administrations which are accountable for the correct implementation of regulation.

The platform was distributed, and not only decentralized (like a blockchain).

Although the question why not to use a blockchain to implement functionalities a) and b) was recurrent (both by developers and users), the technology was not an option for the backbone of the functional architecture. Sovereignty of administrations, scalability of the system, and the need-to-know principle, as well as the limited and public scope of global states of the system considered were good enough reasons.

More generally, blockchain technology is sensitive to network partitioning or transaction exclusion, which are problems related to its basic requirement of ordered consensus of data blocks, and can feed dependencies back up to users and impair their agency.

The logical centralization that is implied by the introduction of a decentralized backbone (for example of a blockchain for the exchange of agricultural data) would have led to risks and temporal dependencies of organizations towards ADA not so different from those feared of Barto.

## Conclusion

The envelope of all the data circulating on each individual farm contains sufficient information to make the farmer directly *vulnerable* to an actor who would have access to this data. If that actor additionally had access to all the data on all the farms, it would be able to gain such an advantage as to steer the market. Additionally, it would be able to control other actors who depend on the data to fulfill their legal responsibilities, and basically take over the sector.

Farmers' agency through data had evolved from a situation in which data (bookkeeping) was directly beneficial to them and politically beneficial to their profession (end of the 19th, first half of 20th century), to a situation of dependency on public policies through the exchange of data for subsidies (end of the 20th century), to yet more dependencies on public and private organizations for the promise of market benefits, and finally to complete vulnerability if some actor took control of all the data.

On the other hand, ADA promised to re-store agency to the farmers. But we don't have time today to discuss how this can be envisioned, and with what legal mechanisms (say, data cooperatives).

Contrary to a common perception of distributed architectures as preventing the enforcement of accountability (as in peer-to-peer file-sharing systems), whereas blockchain or centralized technologies would enable it, our case shows that accountability on a digital platform, particularly in relation to the management of sensitive data, is realizable using a distributed architecture.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« The architecture of distributed applications makes it difficult or impossible to identify the parties and the information circulating. The practice of law is to determine responsibilities, rights, duties, prohibitions and conditions between fixed natural or legal persons and in specific or localised jurisdictions. »
[M. Dulong de Rosnay on Liability]

But agency and accountability have limits, related to the functionality of the system rather than simply to centralization, decentralization or distribution.

Synchronizing legally distributed actors (as in inter-bank transfers) requires logical centralization, whichever the chosen architecture. The best that can be achieved is to embed functional requirements (necessary conditions) into the underlying architecture in such a way that they cannot be circumvented at the technical level, but must be overruled at the social level of the platform users.

These are the topics we propose to develop in our paper for the conference proceedings.

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