Public information instead of vertical integration – Exploring "recommended variety lists" in the Swiss maize seed market

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Abstract

Institutional economists have suggested vertical integration as a solution in cases of high asset specificity, frequency, and uncertainty. Although asset specificity and uncertainty are major issues in the seed market, vertical integration is not an option because farmers and breeders work by different organizational patterns. This study hypothesises that the public provision of information can be an alternative to vertical integration and illustrates this with the "list of recommended maize varieties" in Switzerland issued in a private-public partnership based on data generated by the public administration. A survey of maize growers and contractors shows that contractors and farmers in regions ideal for maize production rely strongly on these lists. For users who rely less on maize

production, past experience is the most important guide for the choice of variety. It can be concluded that this intervention in the market generates value added for farmers and saves transaction costs.
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1. Introduction

In our market economy, private goods are mostly traded between private entities, and government intervention in such cases may easily cause misallocations (Sadeh et al., 2020). However, this may be different if the public intervention consists in information about the traded goods. While the government's provision of information is sometimes justified as a necessity (eg. Ding, 2014), there is little evidence about the impact that such public engagement may have.

The Swiss seed market offers a case study that may shed some light on this question. Public authorities, in collaboration with partners from the sector, issue lists that recommend certain varieties of cereals, soybeans, potatoes, rapeseed, feed crops and maize, called recommended variety lists (RVLs). As Switzerland follows one of the most protectionist agricultural policies in the world (Nguyen et al., 2021; Huber et al., 2023), it is easy to consider this unusual practice as another case for misallocation (see Salvatore, 1993, for an extensive debate on the relationship between misallocation and protectionism).

As we know from Ciliberti et al. (2024) that farmers do not always find technical assistance helpful, it is the objective of this paper to evaluate whether the RVL meets any demand by its potential users. Do farmers benefit from the work done by public authorities by selecting varieties according to their benefit for agronomical and technical use compared to others (being not recommended)? Is the RVL an important source of information for maize producers? And does this apply to innovative farmers more than to others? These questions are novel, as scholars in the past (Turner and Bishaw, 2016; Mariani, 2021; Yang et al., 2024) have mostly described the procedures how new varieties are released to the market, but not critically evaluated them. We use a survey among maize growers to understand the users' perspective of the maize RVL as an important element of dealing with maize varieties.

Section 2 sets the empirical and theoretical frame by describing the role of RVLs and by exploring transaction cost economics as a potential reason for public intervention. Section 3 then introduces the methodology to add empirical evidence of the acceptance of RVLs, and Section 4 presents the results. The conclusions are drawn in Section 5.

2. Framework

2.1 Case study description

Every year, research groups of Switzerland's agriculture research station, Agroscope, in collaboration with national sector organisations and local partners carry out field experiments with new varieties or candidate varieties of Switzerland's main arable crops, based on which they evaluate the value of cultivation (e.g. yield, ripening behaviour, and tolerances/resistances to pests, diseases and lodging) and use (e.g. digestibility of maize, oil quality of rapeseed, rheological properties of wheat) of single varieties and eventually make suggestions on a selection of varieties that offer a sufficient degree of added value for Swiss arable farmers and the rest of the value chain. The sector organisation then invites representatives of farmers and other parts of the value chain to discuss the results, to make suggestions and make adaptations, after which the "recommended variety lists" (RVL) are published prior to the subsequent growing season. This practice distinguishes Switzerland from countries that solely decide whether a new variety is sufficiently distinct from the old ones to qualify as a variety of its own but do not interfere in the market beyond that (e.g. Heidt et al., 2025). Only few other countries like Ireland (Department of Agriculture, Food, and the Marine, 2024) have decided to recommend certain varieties to their farmers, but to the authors' knowledge, these lists were never part of a critical evaluation.

One of the RVL contains varieties for maize, which is the RVL chosen as our case study. Maize is one of the most important arable crops in Switzerland, mostly for the feed market, covering approximately 20% of the arable land (FOAG, 2023) but with a high variability between the different cantons due to climatic differences. There are two main target groups for maize RVL:

- Farmers growing maize (and deciding themselves which variety they want to grow);

- Contractors sowing maize for farmers, who delegate the choice of variety to them.

Additionally, the RVL is also used by extension officers, either from private companies or at agricultural schools.

2.2 Theoretical background

The "good" that Switzerland's government (supported by private partners) provides for free is an informational good. Several economists have examined the market for information. This is a market that is complex due to the intangibility and complexity of information, and undoubtedly one of the most difficult issues in economics. Information has been described as a global public good (Stiglitz, 1999), which implies that it should be provided by governments. It has also been described as a fully private good that can easily be marketed and therefore can be fully left to the market (Kastl et al., 2018). If they are taken as "absolute" answers, both stances are oversimplistic. There is no doubt that ignorance, i.e. the absence of information, can entail high costs on societies (McCoy, 1995), so that information has certainly aspects of public goods. Stiglitz and Kosenko (2024) have shown that it can be taken for granted that governments improve welfare if they prevent disinformation through fraud laws and disclosure requirements. On the other hand, the literature on intellectual property rights has shown how legal protection concentrates (Benkler, 2002) and improves (Fang et al., 2017) the production of information. This underlines the aspect of private goods that information undoubtedly has as well.

A key to a better understanding of public intervention is transaction cost economics. In particular, Williamson (1971, 1979) was first to bring asset specificity, the frequency of transactions and uncertainty into the centre of the institutional discourse, arguing that a high degree of asset specificity and uncertainty and a high frequency of transactions would push companies to organise labour rather in a hierarchical way instead of buying it in the marketplace, leading to vertical integration. It is worthwhile to reflect on whether these conditions apply to the seed market, as presented below.

Asset specificity has been explored in depth by institutional economists (Meirelles des Souza Filho and Varella Miranda 2019; Richman 2019; Cao 2022; Grindal 2022). Is maize seed a specific asset? Dallago (2001), for example, defined asset specificity as the degree to which a good is system-

specific. Maize seed, for example, is only useful for the production of maize and is therefore very system-specific, even more so since there are sub-markets like maize for biogas or maize for non-food-uses with specific requirements. Developing a somewhat stricter definition, Lonsdale (2001) defined specificity as "the extent to which the investments made to support a particular transaction have a higher value to that transaction than it would have if they were redeployed for any other purpose". This definition sets limits to the degree of specificity: indeed, maize seed is only of use for farmers willing to grow maize. However, there is a major number of maize growers; therefore, we should refer to a high relative specificity of a seed, not of absolute specificity, as there is a demand for the seed in a small societal niche with several potential buyers.

Regarding frequency, Crook et al. (2013) emphasised that occasional transactions can easily be governed through contracts, whereas contracts for frequent transactions can cause high transaction costs. In this respect, the seed market is unexceptional. Most farmers need seed in spring before sowing, and usually it is part of a crop rotation where this applies every year, so that maize seed is usually traded once per year, except for the few regions where two harvests are possible (McKenzie and Pede 2005). With such a frequency, maize seed is situated between goods like staple food which may be bought daily and a house that is maybe bought once per lifetime.

Uncertainty, however, is a major issue when selecting seeds, aiming for (typically) high yields and a good quality of the crop. The seed market is dynamic. The average life cycle of a specific maize variety in Switzerland, to return to this example again, averages around four years. This does not leave ample room for farmers to collect experiences regarding the variety's characteristics. However, these characteristics are crucial for farmers. They need to know which variety is adapted to the soils and climate of their region, to which diseases the varieties are less susceptible, and which yields and quality to expect. None of these questions can easily be addressed by looking at the product itself. Thus, it is always necessary to rely on the information provided.

Transaction cost economists would therefore most likely recommend that the market for maize seed be integrated (Klüppel, 2021; Boykin, 2023); on a first sight, this may seem as a promising pathway. While currently breeders usually sell their seed to a cooperative or a private trader from which it is then bought by farmers, a joint company for breeders and farmers has the potential to save transaction

costs. However, there are important geographic and organisational obstacles that prevent such an option, at least under current production technologies. The breeding of arable crops is an oligopolistic market in which large multinational companies select and produce in a few places in the world (Zhang 2018). The process of concentration continues (Bonny 2017). Growers, by contrast, are very decentralised and often small enterprises, technologically usually much more diversified and equipped with entirely different technologies as compared to breeders (e.g. Kiriti-Nganga 2012), and seed is only one of the many inputs they need. This also applies to Switzerland, the country in which the RVLs are issued and one characterised by family farms with an average size of 20 hectares (Lakner et al. 2018). As a company can hardly integrate central structures with such decentral structures, vertical integration is not an option.

The impossibility of vertical integration leads farm managers and contractors who sow maize to choose between very high transaction costs or suboptimal decisions. Hence, farmers can either rely on past experiences (which they often do according to Haden et al., 2012) or word-of-mouth from their social network (another recurrent behavioural pattern according to Ma et al., 2022). This strategy will often lead to a less-than-optimal variety choice. Or they can undergo major efforts gathering information from competing breeders and perhaps colleagues elsewhere who tested the reliability of the company's information.

This is where public involvement that treats information as a public good can help by lowering transaction costs for approximately 20,000 farm managers who grow arable crops in Switzerland. If the federal research station that issues the RVLs is perceived as a credible source, farmers that consider themselves innovators will particularly benefit from the list as a transaction cost-saving tool; that is, it is reasonable to assume that the usefulness of the RVLs can be measured by the demand for it. This leads to the following two hypotheses:

H1: RVLs are the most important source of information for the choice of maize varieties among farm managers and contractors.

H2: Actors who rely on innovation place a higher value on the RVLs than actors who rely on their previous experience.

3. Methods

The two hypotheses require the knowledge about the perceptions of farmers and contractors, so that it became necessary to carry out a survey. The information in the RVLs is devoted to a particular crop, and for more concrete analysis and findings, we chose the RVL of maize as a case study.

In spring 2024, we sent a survey to 2000 farm managers growing maize (using addresses provided by the Federal Office of Agriculture) and to 375 contractors (distributed by the Association of Contractors), the majority of whom were also farm managers. Reminders were sent once, and a prize draw with vouchers for Switzerland's main agricultural supplier or the Swiss railroad served as an incentive to participate. 442 questionnaires were returned, i.e. a response rate of 19 per cent was obtained (21 per cent for farm managers, 8 per cent for contractors).

The survey was designed to test the two hypotheses using variables depicted in Table 1. Two variables were used to describe the position of the RVL in the decision-making system of maize producers and contractors:

- One was the degree to which potential users were familiar with the RVL ("knowledge").
- The other ("information") was a ranking in which respondents familiar with the RVL ranked the importance in comparison with other sources of information about seed (information by breeders, information by traders, prior experience, exchange with colleagues, advice from extension officers).

For the test of the first hypothesis, it was sufficient to analyse the results of this ranking, the general knowledge of the RVL, and its use. The first was achieved by comparing the means of the six options of decision support using the Wilcoxon matched-pairs signed rank test (O'Brien and Fleming, 1987) through a descriptive evaluation of the "knowledge" variable.

It was more complex to operationalise the degree to which users were innovative in order to test the second hypothesis. For this purpose, the rank of "relying on prior experience" in choosing the maize variety was chosen, even though this may neglect important aspects of innovation such as the use of novel technologies. The underlying assumption was that prior experience was less important for innovative farmers and contractors than for farmers and contractors with a conservative orientation.

As a sub-sample of this empirical exercise, only respondents who knew about the existence of the RVL were included. As indicated in Table 1, the "importance" variable was the rank of RVL as compared to other information sources such as neighbours or previous experience. It therefore is technically dependent on the other rankings (as respondents could, for example, use rank 1 only once) and therefore could not be used as the dependent variable. Instead, the "Knowledge" variable was regressed against three information sources for maize varieties, of which one was "Experience", the other two sources used by more innovative actors. Farmers not knowing the RVL were, of course, excluded from the sample, as they would be unable to rank the importance of the RVL as an information source.

Some control variables had to be included to avoid distortions. Researchers have claimed, for example, that public actors in the breeding market have a particular responsibility to deliver and promote varieties that deliver high-quality public good characteristics, such as resistance against diseases (Mann 2013). As one of the control variables, we checked how important the resistances of a variety were for the respondents.

Most contractors specialise in arable farming (Nye 2020); if farmers contract them, they have a high motivation to choose the best and most adapted maize variety for the farmer as part of their service quality. Different to that, most farmers in Switzerland also have animals that receive a lot of attention and time; thus, they are likely to devote a smaller part of their time to maize production which is often used as feed for their own animals. Therefore, it was necessary to distinguish between the two professional groups for the analysis.

Many other analyses of the behaviour of Swiss farmers have noticed that both the age (Karali et al. 2013; Baur et al. 2014; Ferjani et al. 2015) and gender (Mann and van Aken 2021; Junquera et al. 2022) of farm managers are important predictors of variances. This made it necessary to include these sociodemographic variables in the equation. Finally, the heterogeneity of Swiss agriculture in terms of topography has also been shown to be decisive (Rossier 2012; Karali et al. 2014; Herzog et al. 2017); therefore, it had to be integrated as another control variable.

Table 1: Variables for the regression analysis explaining the degree of using RVL

Variable	Meaning	Measurement	Mean	Min	Max
Popularity variables					
Importance	Degree of using Recommended Variety List	*From 1 = most important information source to 6 = least important information source*	2.66	1	6
Independent variables					
Experience	Degree of using prior experience for choice of variety	*From 1 = most important information source to 6 = least important information source*	2.09	1	6
Exchange	Degree of using exchange with other farmers/ contractors for choice of variety	*From 1 = most important information source to 6 = least important information source*	3.95	1	6
Extension	Degree of reliance on extension officers for choice of variety	*From 1 = most important information source to 6 = least important information source*	3.84	1	6
Resistance	Importance of disease resistances	*From 1 = unnecessary to 5 = very important*	3.92	1	5
Farmer	Respondent's occupation	*0 = contractor, 1 = farmer*	0.93	0	1
Gender	Respondent's gender	*0 = female, 1 = male*	0.95	0	1
Age	Respondent's age	*No. of years*	47.8	23	75
Region	Region's suitability for maize production	*1 = excellent to 4 = marginal*	2.46	1	4

4. Results

Figure 1 and Table 2 display the numbers needed for the test of Hypothesis 1. Figure 1 indicates that the RVLs for maize were well-known and the most popular external information source. However, Table 2 shows that hypothesis 1 still needs to be rejected. Prior to the RVL, past experience guided farm managers in selecting maize varieties as the most important factor. Nevertheless, the RVL ranked second. Importantly, with the exception of the advice of extension officers and other farmers who were similarly unimportant information sources for maize varieties, there was a relatively clear hierarchy in

information sources. Farmers unequivocally preferred direct information on single varieties by breeders to indirect information provided by input dealers. However, the public information source was considered more important than the less neutral communication by the breeders themselves.

Figure 1: Distribution of answers to the variable “Knowledge”

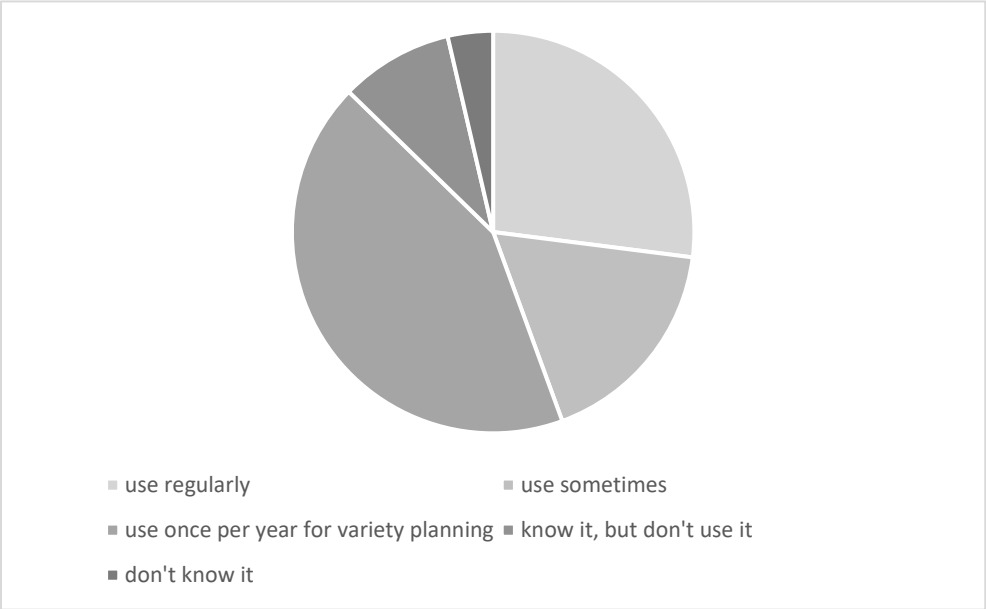

Table 2: Ranking of information sources for maize seed varieties with 1= most important and 5= least important.

Answer	Average Rank
Experience	2.08
RVL	2.66
Breeders	3.46
Extension	3.84
Colleagues	3.95
Input Dealers	4.62

Brackets between variables denote insignificant differences at the 95% level. No brackets between adjacent figures next to the table denote statistical differences at the 95 % level.

Table 3 indicates that hypothesis 2 cannot be rejected. The more farmers relied on their past experience, the less they valorised the RVL. The significance makes it clear that innovative farmers benefit more from the RVL than less innovative farm managers, if innovation can be described negatively through not orienting on last year’s variety. However, the exchange with colleagues was,

unexpectedly, an even stronger substitute for the RVL, measured by both the coefficient and the significance (even though, as indicated by Table 2, colleagues are, in general, not an important source of information). The substitution effect between the RVL and extension services was much weaker, suggesting beyond the line between innovative farmers (using the RVL) and traditional ones (preferring to relying on their experience), there was a clear distinction between farm managers who preferred horizontal information (such as exchange with their colleagues) and those who preferred sources of information that could be considered superior (such as extension officers and the RVL).

Table 3: Results of the ordered logit analysis explaining "Importance"

Variable	**Coefficient**	**z-value**
Experience	-0.351***	-3.60
Exchange	-0.396***	-5.20
Extension	-0.189*	-2.40
Resistance	-0.797	-1.17
Farmer	0.992**	2.86
Gender	-0.531	-0.77
Age	-0.014	-1.39
Region	0.335**	2.80

***p < 0.001; **p < 0.01; *p < 0.05; n = 305, pseudo R2 = 0.06

Partly based on their insignificance, the control variables showed that there was no background distortion. This included the lack of significant effects of gender, age, and the perceived importance of resistant varieties. Other control variables, however, showed a more significant impact. Contractors, for example, relied much more on the RVL than farm managers. The same applies to maize growers in arable regions well adapted to maize production. They also used the RVL more often than farmers in peripheral maize regions.

5. Discussion

The fact that Hypothesis 1 had to be rejected insofar as prior personal experience prove to be the most important information source for variety selection points to the tremendous importance of personal

knowledge. In fact, this importance has also been repeatedly emphasized by transaction costs economists like Czarniewski (2014) or Williams and Balasz (2021) and is also prominent in the literature on the behaviour of farmers in general (Gebrehivot and van der Veen, 2021; Duden et al., 2023; Ricart et al., 2023). Still, the RVL has proven to be the most important external source of information. If one takes the two findings together, it is likely that farmers combine their prior experience and the RVL, checking how happy they are with last year's choice and whether there is a more promising option on the RVL.

It must be admitted that, with an R2 of six per cent, our analysis can only explain a minor share of the differences in importance of the RVL among farmers and contractors. There are certainly soft factors that could not be measured but are of high importance, and maybe some "hard facts" have been overlooked as well. While this is a major limitation of our study, the significant variables still warrant attention. This starts with the role of existing knowledge among farmers, reflected by the "Experience" variable. Research has demonstrated the strong influence of both explicit and tacit knowledge for farm management (for a review, see Tumwebaze et al., 2024). Therefore, the diminishing role of prior experience in determining the importance of the RVL should not come as a surprise. Similarly, the "Exchange" variable reflects the role of social networks. While research clearly highlights the importance of social capital for information generation (Raudiliduniene et al., 2021), including in agriculture (Yu and Gambrah, 2024), our analysis shows how social capital reduces the need for public information. While there is also substitution between extension as a source for variety information and the importance of the RVL, as indicated by the "Extension" variable, this effect is only half as strong as for the previous two. This aligns with the views of economists who emphasize the limited impact of extension services under many circumstances (Cerdan-Infantes et al., 2008; Aker, 2011; Kasser and Alemu, 2017). Today, farmers have access to much more information sources than they used to, including social media, which may limit the added value of extension services.

The high significance of the "Farmer" variable underscores the important role of contractors in agriculture as multipliers. These individuals inform themselves using the RVL and pass their knowledge on to their customers. This aspect has been neglected in the limited body of literature on contracting in agriculture (Nye, 2020; Bachev, 2024).

As the final significant variable, it is no surprise that the RVL plays a larger role in traditional maize-growing regions, compared to, for example, the hilly region. Buzzi et al. (2021) show the vast importance of climatic factors like temperature for the productivity of maize. Again, the significance of this variable confirms that the RVL is used if maize production is of great importance for the user. From there, the knowledge trickles down to areas where maize is of less importance.

The non-significant variables do not require much further elaboration. The preference for the RVL does not depend on the importance placed on resistant varieties, nor on age or gender.

6. Conclusions

Although the maize RVLs seem to be less important for the selection of maize varieties than the farmer's prior experience, it is still a crucial tool. The results of our survey suggest that there is what Widen and Steinerova (2019) called a hierarchy of information flows. Contractors and farmers in areas highly suitable for maize consult the RVL and are, therefore, likely to transfer their knowledge to other farmers. Similar models of information diffusion in other realms of agriculture have been described by Rebaudo and Dangles (2011) and Shaijumon (2018). Invariably, we show that the maize RVL plays a more prominent role in this information flow than the information provided by the seed companies themselves. It is likely that two perceptions - that public sources have greater credibility and that they have all the information collected - control this prominent role of the RVL.

The results can also be considered as a justification for the public involvement in providing information on the seed market. On the base of our results, it is likely that using tax money for the RVL may save transaction costs on a societal level as many farmers do not have to collect the information by themselves. Therefore, the policy implications of our study are that money invested into the support of farmers in their selection of appropriate varieties is probably well-invested.

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