Designing the Future of Agri-Food Chains: Comparison of Prospective Analysis Built 40 Years Ago and Today

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ABSTRACT

Prospective methods, in their various forms, have been used to anticipate the possible evolutions of a studied system since the 50's. The so-called "scenario method" introduced by Godet is a French prospective way which provides a formal scenario-building model based on interactions with chosen prospects; it has proven to be efficient in many fields. This method was typically used for the pork value-chain in the 80's, then in 2021, in independent studies. The process itself changed over the years, and so did its application. In this paper we discuss the differences of application of the Godet method in the 80's and today. We then indicate the results obtained by applying the Godet method to the pork-value-chain then and now: we complete the analysis by showing that even though some key determinants remained unchanged, other key determinants are proper to the current value-chain.

INTRODUCTION

« The desire to unravel the mystery of the future is as old as humanity itself and only methods have changed to satisfy this desire » (Cazes, 1986 ; Scouarnec, 2008). Prospective methods emanate from the urge to be reassured in uncertain contexts (Mermet, 2004). They are indeed interdisciplinary structured methods based on discussions which mobilize collective intelligence (Barré, 2000; De Jouvenel, 1964; Scouarnec, 2008). Their objective is not to predict the future but rather to elaborate different paths, which may lead to different evolutions of the same studied organization, system or context. Those either concern certain domains such as politics, economics, etc… and they are also applied to holistic complex systems such as value-chains.

The Godet method is one of the many classic prospective methods adapted to the prospective value chains: it is participatory, so it is based on the interactions between various chosen stakeholders of a value-chain (Godet, 2008; Godet & Durance, 2001). Through the years, this method has been applied to numerous value-chains at different scales successfully: it has been used to forecast the future of the aluminum industry in the 80's (Lesourne et al., 1986), to elaborate scenarios of the development of nuclear energies in the years 2000 (Duperrin et al., 1975). It also proved successful when applied in agro-food value-chains. The main principle of this method is to design scenarios of the possible evolutions of the studied system. However, it is difficult to appreciate the validity and the capacity of such a method to anticipate future states of the system. One way of doing so is by "backcasting", as did Graham Turner (2014) when examining to which extent the *LTG World3* model results from the Meadows' report (1972) reflect reality. Another possibility is by comparing the scenarios obtained in the past and now, while taking into account that through the years the method itself and its application somehow changed.

This paper compares the scenarios used in the 80's with the ones obtained today. It first discusses the methodological and practical evolutions of the Godet method in forty years (from the 80's until today) through a case study, namely the pork value-chain. Indeed, in the project SENTINEL funded by the French National Research Agency, the pork industry is taken as a model of food chain. The purpose of this project is to improve food chemical safety along the value-chain by introducing new screening tools. It goes without saying that in order to ensure durable applications of those tools, their impact on the value-chain must be anticipated. Nevertheless, to be able to assess the impacts of those tools, a reference of comparison must be elaborated (Pesonen et al., 2000): it consists of the likely states of the pork value chain in the future (without the new tools being implemented). This explains why we must use prospective methods in order to elaborate a 'business-as-usual' scenario (Chaib et al., 2021). In addition to that, it turns out that 40 years ago, the same method was used to forsee the future of the pork value-chain in the Bretagne region in France (Broussolle et al., 1983)!

Observing that the application of the Godet method has improved during the years, in the remainder of this paper we denote as « old method » the applied Godet method used as it was fourty years ago. We talk about the « classic method » when referring to the application of the Godet method as it is described in Godet (2008) and Godet & Durance (2001). Finally, we refer to an « adapted method » since the classic Godet method had to be adapted considering the sanitary context due to the Covid-19 pandemic (Chaib et al., 2021). The « classic method » is our reference of comparison of the different applications of the Godet method.

In the following sections we will respectively situate the Godet method amidst all prospective methods, we will explain how this method was applied fourty years ago in the pork value-chain and how it is applied now, we then compare the results obtained by those two applications to then discuss them and conclude.

MATERIALS AND METHODS

The Godet scenario method amidst all prospective methods

When it comes to evaluating impacts of changes in an organization, the judgment can be made either before the
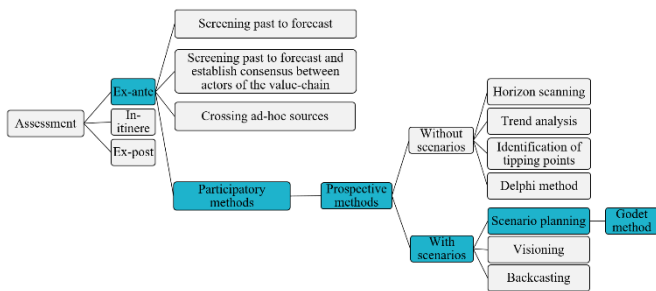
Fig 1 : The Godet method in ex-ante assessment methods

project's implementation (we talk about *ex-ante* assessment), during the project (*in itinere* assessment) or after the project's implementation for *ex-post* assessment (Macombe et al., 2015). The work done in this paper is based on *ex-ante* evaluation methods because it stems from the need to assess and evaluate essentially impacts of changes envisioned, before they are implemented in the value chain; we aim to anticipate the impacts.

Ex-ante evaluation methods can be participatory methods based on discussions with the stakeholders: they allow us to have multiple perspectives by involving several stakeholders of the value-chains, which lets us surmount any disparity between science and policy-making, leading to better and more equitable decisions (Funtowicz & Ravetz, 2003; Hirsch et al., 2010; Macombe et al., 2015; Stringer et al., 2006). Prospective methods are part of the participatory category (Fig.1). There are two main types of prospective methods: ones that do not use scenarios and ones that do. The latter interest us in the present case. Scenarios can be defined as a snapshot in time or the conditions of important variables at some particular time in the future; they can also be defined as a description of a future history or in other words the evolution from present conditions to one of several futures (Pesonen et al., 2000). We define scenarios with the second definition in this paper.

To be able to assess the changes that are likely to occur in the value chain and to be able to evaluate them, a reference of comparison is needed in order to observe if the changes have a positive or a negative impact. The reference is at least the 'business-as-usual' scenario, meaning the value-chain as it continues to evolve on the trends that are already underway. When needed -and because the likely evolutions of the situation are multiple (as is the case for pork value-chain)- it is mandatory to craft different scenarios: those scenarios are also considered as reference scenarios (without the change) before introducing the change. Creating those scenarios is possible when adopting a prospective approach. The choice of the Godet method allows us to have a systemic view of the whole value-chain; it also allows us to create new scenarios that no prospect had thought of, in addition to it setting participants in motion towards a common project.

The Godet method applied to the pork value-chain today and fourty years ago

In order to anticipate towards what the value-chain is headed, it is necessary to know its current situation. Broussolle et al. (1983) as well as Chaib et al. (2021) both started by doing so before using the Godet method.

We will be doing a chronological comparison of the old method, the classic method and the adapted method. For that

to be done we will dissect all three methods from the choice of stakeholders to the results obtained. The classic method serves as a reference of comparison. A synthetic view is given in Table 1.

Delimiting the system under study

This first phase consists of choosing the stakeholders to interview, and then interviewing them.

Choosing the stakeholders

In the classic method, there is no specific way of choosing the prospects; ideally they should come from different backgrounds and have diverse opinions. In the old method, no precisions were made when choosing the stakeholders either. However, to guarantee differences of views and beliefs, in the adapted method, the prospects are chosen according to Mitchell, Agle and Wood's classification (Mitchell et al., 1997).

Interviewing the stakeholders chosen

In the classic and the old method, the prospects are gathered in order to initiate discussions through collective sessions. In the adapted method, because of the sanitary context due to the Covid-19 pandemic, and since remote work was imposed, the collective workshops were replaced with individual semi-directive interviews (Chaib et al., 2021).

Determining the key variables and their modalities

Determining the key variables

In the classic Godet method described thoroughly in Godet (2008) and Godet & Durance (2001), the creation of reference scenarios is based on the identification of key variables (they are the ones which have influences and dependences higher than the averages). All variables are identified during the collective sessions, then after establishing consensus between all present stakeholders, the key variables are chosen. No more than 5 variables are retained.

In the old method, the variables were chosen by the researchers prior to the planned workshops. The prospects were only asked to determine influence and dependence relations between variables taken two by two. All variables were considered as key, but to various extents. They were then classified according to 3 categories: « agriculture », « agri-food industry » and « economic and social environment of the agriculture ».

Determining the modalities of the key variables

Modalities of the key variables are chosen after having unanimity between all stakeholders. They are the values which can be taken by those variables.
This issue is not addressed in the old Godet method.
In the adapted method, the modalities are chosen in the list of concepts obtained as explained in table 1 (Chaib et al., 2021). The choice of the key variables and of the modalities is then confirmed by sending a survey to all the prospects interviewed.

Elaborating the scenarios and choosing the reference ones

Elaborating the scenarios

In the classic method as well as in the adapted method, the scenarios are obtained by combining the modalities of the key variables.

However, this is not the case in the old method: there are 4 scenarios which were chosen in advance, based on the studies done by the OECD (Van Lennep, 1979) and the General Planning Commission (Lesourne, 1980):

- Scenario of slow growth
- Scenario of strong growth
- Scenario of disruptive economy : protectionism
- Scenario of other development

Those 4 scenarios are a framework for the study. The variables with their modalities are adapted to each of the scenarios, creating different pathways.

As for the adapted method, the determination of the key variables demands numerous steps as shown in table 1. They are explained in detail in Chaib et al. (2021).

Elaborating the detailed scenarios

This phase in the classic and in the adapted methods consists in describing the different pathways from different points of view whether they be economic, technical, social, organizational, etc… Those pathways take the value-chain from its current state to the selected reference scenarios.

In the old method, all four scenarios were detailed by describing meticulously all the variables and the modalities taken in each scenario.

Homogenizing the methods used forty years ago and today

Now that we presented how the Godet method was and is applied to the pork value-chain, we want to see if the highlighted determinants of the pork sector are the same now as they were forty years ago. For this purpose, we need to apply the adapted method to the structural analysis matrix done by the prospects in Broussolle et al. (1983) forty years ago. We revise the influence and dependence matrix done forty years ago the same way we would in the adapted method

(Chaib et al., 2021). The results obtained from this comparison derive from us taking the raw materials supplied by Broussolle et al. (1983) and converting them into data comparable with those obtained in Chaib et al. (2021). Indeed, the variables referred to in the 1983 study are very detailed, so we used a larger scale (used in the adapted method). As a consequence, some of Broussolle's variables were grouped together, as were the concepts in the adapted method (table 1). This was necessary in order to have comparable variables between then and now. This alignment operation allowed us to highlight similarities between the past and the current value-chain studies. This 'conversion' was all the more useful since in the 1983 study, the key variables were not used to create the various evolution scenarios (they were only used to thoroughly describe them), whereas in the adapted method they are crucial to anticipate the different possible scenarios describing the progression of the value-chain.

RESULTS

After highlighting the similarities and the differences in the approaches of the old, the classic and the adapted method, in this section we talk about the results deriving from the use of the adapted method on the old and the new value-chains.

Comparing the variables obtained

Table 2 below lists all the variables obtained by applying the adapted method to both the 1983 and 2020 value-chain.

As shown in Fig 2, variables G and K were, and still are key. The fact that they have always been key for the evolution of the value-chain shows on one hand to which extent considerable importance is granted to whether the pork sector is unattractive or if its professions are becoming attractive (variable G). On another hand, it shows that the number, the size and the localization of farmsteads (variable K) heavily weighs on the evolution of the system.

Steps	Old method	Classic method	Adapted method
Delimiting the system under study	No specific method precised to identify the prospects		Choosing the prospects to interview according to Mitchell, Agle and Wood's classification
	Collective meetings		Semi-directive interviews
Determining the key variables and their modalities	Choosing the variables to take into consideration	Discussions between all prospects	Extraction of sub-concepts
			Merging similar sub-concepts into concepts
	Indicating the influence and dependence relation between all variables in a structural analysis matrix. Then indicating the influence of each category of variables on the others.	Determining influence and dependence relations between each couple of variables	Individual cognitive maps
			Individual tables of sets of concepts
			Merging concepts to obtain variables
		Establishing consensus on which variables are key	Individual matrices of variables
			Assembled matrices of variables
	All variables are considered important	Identifying key variables (the ones which have the highest influences and dependences)	
	The modalities are defined by the researchers	Establishing consensus on which modalities are adequate	Identifying the modalities to take into consideration in the list of concepts
			Sending survey to confirm the choice of the key variables
		Choosing the modalities	
Elaborating and choosing the base scenarios	4 scenarios are chosen in advance based on the OECD report of 1979 and a study published by the general planning commission.	Elaborating the scenarios by combining the compatible modalities of the key variables	
		Establishing consensus	Discussion with project partners
		Choosing 2 reference scenarios	
Elaborating the detailed scenarios	All variables are described for each of the 4 scenarios (the modalities vary from one scenario to the other).	Description of pathways from different points of view (technical, economic, organizational) to reach selected base scenarios	

Table 1: Comparison of the steps of all three Godet methods : the old, the classic and the adapted one (Godet, 2008 ; Chaib et al, 2021 ; Broussolle et al, 1983)

Variable	Meaning
A	Social acceptability
B	Production and processing practices
C	Consumption modes
D	Production costs
E	Technical and technological progress
F	Access to the market
G	Evolution of the jobs of the pork value chain
H	Institutional support
I	Availability of Energies
J	Communication
K	Structure of the pork value chain
L	Price variations for consumers

Table 2: List of variables
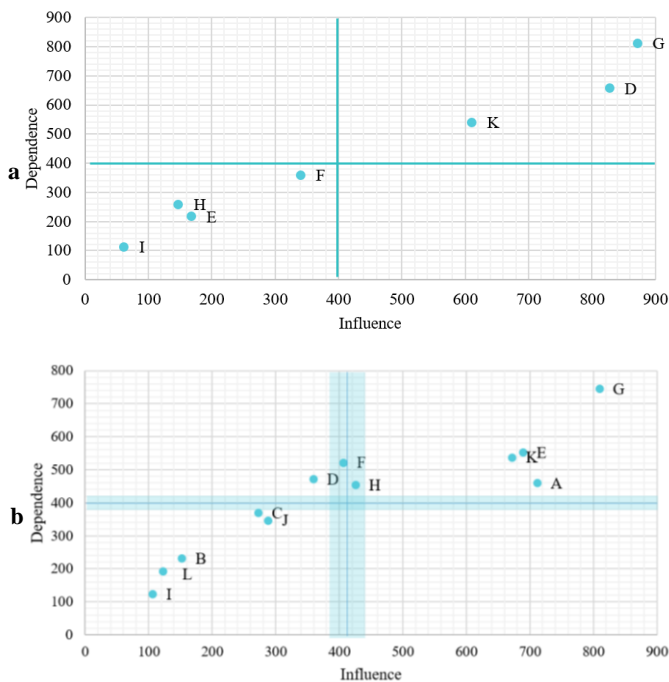
Fig 2: Results obtained after applying the adapted godet method to the 1980 (a) and 2020 (b) value-chains

Variable D however went from being key forty years ago to being an output variable today: it heavily depends on the other variables.

Variable E was not considered as key 40 years ago, whereas it is among the four key variables nowadays. This reflects the possibility of it being a last resort in a value chain where all margins of action have been restricted. The players 'believe' that progress can save their industry.

The results obtained by applying the adapted Godet method to the current pork value-chain show other novelties: the social acceptability of the pork industry is an essential factor taken into account nowadays. It covers animal welfare, health and the « environment » which, per say, is not the economic and social environment of the agriculture like in the old prospective, but rather also concerns the ecosystems, water and air pollution.

Other variables such as B, C, J and L are mentioned for the current value-chain. Although they are all excluded variables according to Fig 2.b, their mention proves the current societal concerns for more transparency on transformation processes

and final products, as well as the need for better communication between all stakeholders in order to fix decent price points.

As for variable I, it is mentioned, but neither as a very influential nor very dependent variable. We expected it would come up as a key variable considering 1.the fears of possible undersupplies, 2. higher energy prices and 3.the concerns about the environmental impacts and the image of energy sources. This could be explained by the fact that the environmental concerns of the value chain mainly concern nitrogen emissions and are therefore "included" in variables A and E. Additionally, this variable is not the first to come to mind when discussing an uncertain future where various other variables have to be taken into consideration; in fact, it could be difficult for the stakeholders to imagine how and to which extent a gas crisis could impact the pork value chain in the future.

Comparing the old scenarios with the ones created for the current value chain

As we said before, two different organisms predetermined the four scenarios presented in the old method. The first one - scenario of slow growth- corresponds to what we call the 'business-as-usual' scenario. The second one -scenario of strong growth- promotes free trades and marketization whereas the third scenario -disruptive economy- calls for the opposite. The 'other development scenario' emanates from a political will to change the system, its values and its power. The choice of those four scenarios implies the importance of certain variables. Indeed, they were elaborated as if modalities of the following variables were combined: state intervention (which corresponds to the institutional support H in the adapted method), economic growth (not mentioned as is in the adapted method) and the social acceptability (current variable A). However, those 'key' variables were not determined by using the Godet method.

As for the new scenarios, they are created based solely on the different modality combinations of the key variables determined by using the Godet method. With four key variables, and after eliminating scenarios presenting incompatible modalities, eight possible scenarios are developed: one of them is the business-as-usual scenario, another coincides with the old 'other development' scenario. As for the six other, even though some key variables resemble the ones in the old method, they are definitely more tinged with current concerns.

DISCUSSION

We note an inconsistency in the former method. The four scenarios were generated by using the variables H (Institutional support) and A (social acceptability) as well as a variable of economic growth -which has no equivalent in today's variables. If the scenarios were co-constructed from the key variables delivered by the prospects (as presented in the adapted method), they would have combined the modalities of variables G (evolution of the jobs of the pork value-chain), D (production costs) and K (structure of the value-chain).

Notwithstanding the possible bias introduced by remodeling the data provided, the results obtained still show similar tendencies of evolution of the value-chain: the attractiveness of the value chain and its structure (variables G and K) remain

key whereas other variables such as the availability of energies remain excluded. We can also confirm that the adapted method applied to the current value chain highlights a novel sensitivity of the value-chain to environmental and societal concerns. Moreover, there are newly highlighted variables such as E (technical and technological progress) and newly erased variables ("Economic growth"). This proves the illusions of the prospects interviewed as well as their perception biaised by their sensitivity to the issues of their time. Furthermore, this fact argues in favor of the addition of other methods to the scenario method, since the main objective is to anticipate possible developments.

In addition, by comparing the old scenarios to the new ones, we notice that the former ones are more radical and extreme while those developed for the current value-chain are more moderate. This may be because these old scenarios were established by companies which have proper claims and lobbies, while the new scenarios are established after the participation of very different stakeholders.

CONCLUSION

To sum up the overall work presented in this paper, we showed how the application of the prospective scenario building Godet method evolved during the years: it remains in theory based on interactions between stakeholders who determine key determinants of the future of a value-chain they belong to. Nevertheless, remote work being more and more normalized, the adapted method comes in handy to determine those key variables.

This adapted method also allows the comparison of key determinants of the value-chain now and forty years ago, which helps us better understand and perceive the future evolution of the pork value-chain. Adding to that, it is reassuring to find in part the same key variables: it means the prospective method used is reliable and interesting to use. On another hand, it is a bit frustrating falling back into the same scheme and the same problems forty years later; it highlights the fact that the collective prospective exercise is not enough to significantly improve things and raise awareness amongst stakeholders of the value-chain… An explanation maybe that the interviewed stakeholders are too influenced by the illusions of their time to strongly focus on the real issues which most probably reside in the structure of the value chain as well as the attractiveness of its jobs.

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