



Refresh

Socio-economic implications of food waste: Business behavioural typologies and interrelationships



REFRESH is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement no. 641933. The contents of this document are the sole responsibility of REFRESH and can in no way be taken to reflect the views of the European Union

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Manuscript completed in June, 2016

This document is available on the Internet at: <http://eu-refresh.org/>

Document title	Business behavioural typologies and interrelationships. Implications for food waste
Work Package	WP4
Document Type	Deliverable D1.4b
Date	June 29 th , 2016
Document Status	Draft version 6

Acknowledgments & Disclaimer

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 641933.

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ISBN 978-94-6257-990-3

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List of abbreviations

ABM	Agent-based Model
AIS	Agricultural Innovation System
CSR	Corporate Social Responsibility
D	Deliverable
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
FUSIONS	Food Use for Social Innovation by Optimising waste prevention Strategies
IPO	Initial Public Offering
KIDS	Keep It Descriptive, Stupid
KISS	Keep It Simple, Stupid
LEI	Landbouw Economisch Instituut (Agricultural Economics Institute)
R&D	Research and Development
REFRESH	Resource Efficient Food and dRink for the Entire Supply cHain
UK	United Kingdom
UR	University and Research
US	United States of America
VCN	Values, Beliefs and Norms
WP	Work Package

1 Executive summary

This report, elaborated within the framework of EU REFRESH Sub-task 4.1.3, aims at identifying the most important behavioural economic interrelationships and typologies influencing the adoption of innovations by businesses. The most important typologies identified will be included within an Agent-Based Model (ABM) in order to assess the propensity of food businesses to create or adopt innovations aimed at preventing (or reducing) food waste.

Standard economic theory postulates that economic agents are rational, selfish, and are not affected by social relations when making decisions. Within this framework, businesses adopt innovations if these allow them to maximise their financial payoff. Eventual social benefits granted by innovations targeting food waste do not increase businesses' propensity to adopt them. Behavioural economics provides convincing evidence that real-world businesses deviate from the predictions of standard economic theory. Behavioural typologies indicate specific psychological factors that may affect, either as a driver or as a barrier, the adoption of innovation by food companies. Interrelationships are exchanges of opinions, imitation, coordination schemes, etc., that take place in the framework of networks, alliances, and clusters.

A literature review was systematically carried out in order to identify the main business behavioural typologies and interrelationships. These were, then, classified into three main categories, depending on the specific assumption of standard economic theory they challenge: that of rationality of the economic agents, of their selfishness, or of irrelevance of the social environment where they operate. For each category, a number of subcategories were identified, and the main stylized facts described.

Non-rational firms show limited foresight and, therefore, adaptive expectations, are systematically biased in their process of information processing, react to uncertainty and risk according to the assumptions of prospect theory, and are time-inconsistent. Non-selfish businesses implement satisficing behaviours rather than standard profit maximisation, are influenced by values (such as pro-environmental values), beliefs, and norms, and act pro-socially (altruistically), since they care about the well-being of others. Relevance of the social environment implies that businesses tend to trust or distrust, are concerned about the fairness of decisions and distributional outcomes, assess their position relative to peers, implement reciprocal behaviours, try to build a positive reputation, and coordinate among them, e.g. through alliances or networks.

Overall, it emerges that the adoption of innovations aimed at addressing food waste is a multidimensional phenomenon, and implies high uncertainty. The behaviour of single businesses results from their idiosyncratic characteristics, their structural and managerial features, and the environment where they operate. Uncertainty may be addressed by sharing information, and through inter-firm coordination.

Focusing on food processing and retail, it emerges that behavioural typologies correspond roughly to structural typologies. Two structural typologies can be identified: large businesses (e.g., stock exchange processors, large-scale retailers) implement indirect reciprocity, favour formal coordination schemes, and tend to innovate, or to be early adopters; small firms (e.g., local processors, family businesses, traditional shops) resort to satisficing behaviour and prefer to imitate the innovation patterns of their most successful peers, thus complying later or partially with food regulations.

2 Background, objectives, relevance

2.1 Background

The overall objective of REFRESH Work Package 4 (WP4) is to develop an in-depth understanding of food waste related business and consumer behaviour. With reference to the behavioural economics and decision theories, WP4 will identify the main socio-economic drivers, and unrevealed economic agents' decisional processes affecting food waste, will integrate evidences across the project to ascertain the most cost-effective mechanisms to reduce food waste, and will provide a decision support tool to allow economic agents and policymakers to simulate the outcome of different technological and policy options on food waste phenomena at EU and national levels. The latter objective will be achieved by means of an Agent-Based Model (ABM), elaborated within the framework of Task 4.2 "Model framework definition". In turn, the ABM will provide inputs for Task 3.3 "developing recommendations for improving the policy framework" and Task 6.4 "Modelling and assessment of selected valorisation approaches".

The specific objectives of Working Package 4 include:

Obj. 1: Measuring the effects of major tangible socio-economic factors on food waste, and identifying hidden/emerging profiles of consumer and business behaviours implying waste generation and reduction.

Obj. 2: Developing a simulation model to ex-post and ex-ante analyse – on a multi-scale level – the impacts that socio-economic conditions, consumer and business behaviours, technological and social innovations and policy measures determine on food waste.

Obj. 3: Enhancing the performances of the food systems, and supporting the enforcement of consumer-oriented measures and close-to-the market interventions.

The present report (D4.1b) is part of Task 4.1 "Socio-economic implications of food waste", which is aimed at the identification of the causal factors that link the major socio-economic conditions, the economic agents' choices, and the creation/reduction of food waste. D4.1b wants to identify and discuss business behavioural economic interrelationships and typologies within the food supply chain at processing and retail level.

2.2 Introduction

Estimates suggest that, in the EU-28, annual food waste amounts to 88 million tonnes, i.e. 173 kilograms per person (Stenmarck *et al.* 2016). The drivers behind these levels of waste are complex, interdependent, and diverse along the stages of the food chain. Apart from pricing, logistical and storage

issues, the literature emphasizes that many of these drivers are also associated with individual consumer and business decisions that lead to the generation of food waste (Thyberg and Tonjes 2016; Adam 2015; FAO 2011; Canali *et al.* 2014). This suggests a need to investigate why apparently rational consumers and business operators waste so much food. This report addresses the issue by studying the factors influencing business decision whether to invest in innovation (above all, waste-avoiding innovations) from the perspective of behavioural economics.

Why Behavioural Economics? Standard Economic theory assumes that individual decision-makers are rational, and take their decisions in isolation, considering only their own wellbeing. Under such assumptions, businesses take efficient investment decisions by considering all relevant economic information and by weighting all their future consequences correctly. Furthermore, within the strict assumptions of the standard theory, no consideration is given to the consequences of decisions on other people's welfare. However, investment decisions of real companies are taken by human beings, who are not fully rational, whose capacity of maximizing profit is bounded, and whose interrelations are seldom completely anonymous. *Behavioural economics* is a heterogeneous body of literature developed in order to understand, and take into account the complex factors influencing *real* economic decisions. It investigates the consequences of social, psychological and cognitive factors on economic behaviour. Instead of starting from abstract principles, behavioural economics uses laboratory and field experiments (Del-laVigna 2009) and observes real behaviour of people, that does not always concur with standard theory. Adopting this approach, behavioural economics attempts to change the perception of economists about individual preferences and choices.

By providing insights on individual decision-making processes, behavioural economics may help improve policy decisions. However, rather than combining their efforts, neoclassical and behavioural economists often tend to challenge each other, showing the inconsistency of their respective theories. Chetty (2015) considers that incorporating behavioural elements within economic models should be seen as a pragmatic rather than philosophical decision, and suggests to treat such elements as part of the standard economic toolkit, rather than as a separate subfield. The creation of a unified economic theory could have positive implications in three domains. First, it provides new policy tools for influencing agents' behaviours (e.g., better framing economic incentives); second, it generates better predictions of the effects of current policies; third, it generates new welfare implications, derived from the differences (due to behavioural biases) between agents' experienced utility and decision utility.

By allowing to develop more realistic model and to better assess the impact of policy levers on welfare, behavioural economics is an effective working tool to analyse and mitigate the problem of food waste. Behavioural economics literature may be broadly classified based on which of the three main assumptions of the standard economic theory it challenges: the assumptions of rationality and of selfishness of the economic agents (they maximize their profits), and the assumption of irrelevance of the social envi-

ronment where these agents operate, respectively. This grouping is reflected in the present report.

A relevant part of food waste derives from decisions taken by companies – privately-owned organizations involved in the provision of goods and/or services to consumers in exchange for money – at different stages of the supply chain. Therefore, it is of fundamental importance to understand the factors influencing their decisions, even if they depart from the classical prescription of the company as a rational, selfish and isolated profit-maximizing entity. One of the most important opportunities to decrease the levels of food waste generated by companies is through the introduction of innovations. This report deals with the behavioural factors that affect business decision-making with respect to their choice to invest (or not to invest) in innovations, with particular attention to innovations aimed at preventing or reducing food waste.

The concept of innovation is broad, and can refer to any change in business organization, production process (technology), production output, or marketing strategy. Innovations generally require sizeable investments, i.e. immediate expenditures (in kind or money) in exchange for future returns. Innovations can be broadly divided between technological and organizational innovations. While the former imply the introduction of new artefacts in the company, the latter imply the adoption of new methods of business management, e.g. in the workplace, or in the external relations. This report considers both types of innovation, however organizational innovations are considered only for their impact on the external decisions of companies, avoiding a detailed description of business internal processes leading to them. Whichever their types, innovations can both increase the demand of the involved products (either by arising consumers' utilities, or by reducing the unit prices), thus benefitting the innovator, and cause significant positive externalities on the overall society. A detailed account of innovation types and of the economic factors affecting the adoption of innovations by businesses to prevent and reduce food waste is reported in D4.1c "Socio-economic implications of food waste: Economics of innovation".

Business behaviour is in itself a complex system, and its degree of complexity increases when the economic environment is analysed at a meso- and macro-scale. In particular, networks, alliances and clusters can generate or influence a number of agents' interrelationships, like exchange of opinions, imitation, and coordination schemes that affect the decision-making process. It derives that innovations are introduced only if certain circumstances occur; then, they propagate with various dynamics and intensities, influenced by behavioural and organizational factors. For instance, there are well documented cases of beneficial innovations that do not spread in the market despite their cost-effectiveness (Jaffe and Stavins 1995), or that do it along time-delayed or heterogeneous propagation paths (narrow channels, isolated clusters, networks and alliances, etc.).

Indeed, individual entrepreneurs and organizations cannot choose their innovation strategies exclusively through rational calculations of expected profits and revenues when their beliefs about other agents, the interactions

among them, and the very nature of agents surrounding them changes continuously as a result of these interactions. Such condition, denominated «ontological uncertainty» (Lane and Maxfield 2005), is common in today's markets, making it impossible to study companies' investment decisions with the sole tool of standard economic theory.

Within this report we identify different business profiles and patterns of innovation adoption, and we correlate them with behavioural typologies, and with the patterns of interactions among firms.

How to read this report? In order for the wide public to overcome the difficulties due to the use of economic jargon, it is recommended to consult the glossary of socio-economic terms provided at the end of the report. While the detailed results of the literature review are illustrated within chapter 4, the summaries of the main findings may be found within the boxes at the end of each paragraph of chapter 4. It is suggested to read the contents of the boxes jointly with the short introductions to each paragraph.

2.3 Objectives

This report aims at identifying and measuring the major socio-economic conditions and driving factors that influence business and consumer choice in the creation or reduction of food waste. The final objective is to assess the impact of these behavioural typologies and interrelationships on the business attitude to invest – or not to invest – in innovations. This report also aims at providing a framework enabling a reinterpretation of food waste drivers considered by the recent literature (Canali *et al.* 2014) from the point of view of behavioural economics. Such characteristics will be then considered within Task 4.2 “Model framework definition” while modelling the behaviour of businesses concerning the adoption of innovations related to food waste reduction and valorisation.

What is this report dealing with? In order to focus the report, a number of limits and priorities are set. First, the types of behaviours considered are only those impacting the adoption of innovations affecting the economic results of companies. Second, as for the economic sectors, both food processing and manufacturing, and food retail (large or small-scale) are analysed. As for the purpose of innovation, those interventions aimed at addressing (directly or indirectly) the issue of food waste are included with priority. However, given the lack of literature on this specific subject, any link between the behavioural drivers and innovation adoption in general is included into the report. Finally, as for the geographical focus, a particular emphasis is put on the four EU countries where pilot studies are implemented, plus the United Kingdom; hence, business behaviour in the EU, and the related literature, is given prominence, although also studies on developing and emerging countries are included.

What is not included in this report? Given the aforementioned limitations, a number of issues are outside of the scope of this report. Organizational innovations, such as changes in the interpersonal relations within the business,

are not considered *per se*, since in this report the firm is treated as a homogeneous entity with a single will. The outcomes of such innovations are assessed only for what concerns their impact on company investment decisions. Concerning the food supply chain, agriculture, transports, wholesale, as well as the consumption side are excluded from the analysis. However, some papers on the farming sector are also considered, as long as their results can be generalized. Finally, behavioural typologies that are common among non-EU firms (e.g., customs deriving from the belonging to specific ethnic or religious groups), but are not relevant in the European panorama are not considered.

This report is neither an inventory of the types of innovation (which are discussed in D4.1c “Socio-economic implications of food waste: Economics of innovation”), nor an assessment of the causal relationships between the types of innovation adopted and the resulting variation in the level of food waste, nor it aims at quantifying the amount of food waste produced as a result of introducing/non-introducing a specific innovation. Instead, the focus is on the relations between specific behavioural typologies and interrelationships, and the propensity of businesses to invest in, or to introduce, innovations aimed at preventing or reducing food waste. Moreover, the interactions among different behavioural typologies within the same business, and of these typologies with the propensity of businesses to coordinate in order to innovate is also studied.

2.4 Business behavioural typologies & interrelationships: a definition

This report describes “business behavioural typologies and interrelationships”. The term “typology” refers to a specific psychological factor, identified by behavioural economics, that may potentially affect (either as a driver or as a barrier) the adoption of technological innovations. The term “interrelationship” is used for referring to exchange of opinions, imitation, coordination schemes, etc., which take place in the framework of networks, alliances and clusters. The term “interaction” is used, instead, for indicating the relationships among several behavioural typologies that characterize a single agent (and that generate a different outcome in terms of business decisions from the case when observed separately).

2.5 Relevance of the study

The final goal of this report is to provide inputs for an ABM aimed at assessing the impact of business behaviour on food waste. ABMs are abductive simulation models that combine assumption and implications based on empirical findings. They allow to combine large sets of data, including stylized facts, and case studies. They follow four steps: the model setting, based on the available empirical knowledge; the model run, and the comparison of its results with empirical data in order to restrict the range of parameters; the

classification of its results (of underlying regularities); the use of the range of parameters to derive policy implications (Brenner and Werker 2009). Abductive simulation models may help identify effective economic policies. However, since their elaboration is time-consuming, the cost of time should be compared with the cost of policy failure (that is anyway possible). Hence, Brenner and Werker (2009) suggest to follow two strategies: KISS (“keep it simple, stupid”) during the model design, and KIDS (“keep it descriptive, stupid”) for deriving well-founded policy implications. Following these advices, a limited number of behavioural typologies and interrelationships needs to be identified, in order to inform the model.

The business ABM will be integrated with models of consumers’ waste, whose characteristics are identified within D4.1a “Socio-economic implications of food waste: Consumers behavioural economic interrelationships and typologies”. However, while some empirical data on consumers’ food waste behaviour are starting being available at an appreciable level of detail, there is an absence of evidence concerning some specific business behaviours. Thus, the characterization of the business behaviour necessarily uses the available literature as a starting point. The results of the literature review will be, then, integrated with qualitative interviews and case studies carried out within the framework of WP2 “Business engagement – Framework for action”. The analysis of the literature provides researchers with the essential characterization of the relations between business behavioural typologies and interrelationships, and their propensity to innovate. The most important typologies emerging from this analysis will be selected and included in the ABM to be designed within the framework of Task 4.2 “Model framework definition”.

The modelling effort will start by focusing on the retail phase of the food supply chain, then it will be extended to the food processing sector. The choice of separating the retail market from food processing allows a clearer understanding of the incentive structure of the two sectors, and of the consequences of interaction among individual incentives and behavioural typologies. The initial focus on the retail market further allows considering a simpler economic sector compared to food processing. Indeed, on the one side the retail sector is polarized between large and small actors, and on the other side it directly faces the consumption phase of the food market, which is arguably easier to model in a simplified manner. Furthermore, retailers lack a real production process, which makes agents’ design simpler and, in turn, enables a focus on the behavioural types and on their interrelationships.

Finally, in order to understand the relevance of this study it is useful to keep in mind some characteristics of both retailers and food processing sectors:

- 1 the market operates in a condition of imperfect competition, where large-scale retailers act as price leaders, while smaller actors are essentially price-takers.
- 2 prices are set as a mark-up on unitary costs of production, with the size of the mark-up depends on the level of competition;

- 3 competition is focused on quantities, as increased quantities lower unitary costs of production;
- 4 food products are essentially homogenous, at least at a first degree of approximation.

3 Research methodology

In order to identify business behavioural typologies and interrelationships, and to select those which may be successfully considered within the ABM, a literature review was systematically carried out, based on the following steps:

- 1 Definition of the general search terms (e.g., business behaviour, innovation, food waste, etc.);
- 2 Research within relevant datasets (Scopus and Science Direct) based on the general terminology identified in the previous point;
- 3 Classification of the literature found thanks to the general keywords, in order to identify the most relevant behavioural typologies and interrelationships;
- 4 Identification of a number of specific keywords for every business behavioural typology and interrelationship (e.g.: bounded rationality, profit maximization, limited foresight, and selfishness for "bounded rationality"; cognitive bias, status quo bias, salience, loss aversion, rule-of-thumb, heuristics, and imitation for "systematic cognitive biases"; etc.);
- 5 New literature search based on the specific keywords;
- 6 Classification of the newly found literature according to the behavioural typologies and interrelationships identified in point (3);
- 7 In-depth reading of the literature, and elaboration of a list of summaries;
- 8 Re-elaboration of the summaries in order to identify, for each behavioural typology and interrelationship, the main stylized facts – which represent the corpus of chapter 4 of this report;
- 9 Identification, for each behavioural typology and interrelationship, of the "interactions" (see 4.1) with the other typologies and interrelationships, of a number of policy implications, and of a list of take-outs;
- 10 Selection of a limited number of relevant behavioural typologies and interrelationships, including the stylized facts regarding them, to be included within the ABM.

General keywords. Business, firm, company¹, (technological, process, product, organizational) innovation, food waste (prevention, reduction), (business) behaviour, (food) retailer(s), (food) processor(s), food supply chain, behavioural economics, game theory.

Specific keywords. (Bounded) rationality, (profit) maximization, (limited) foresight, selfishness, cognitive bias, status quo bias, salience, loss aver-

¹ The terms business, firm and company are used interchangeably throughout the text.

sion, rule-of-thumb, heuristics, imitation, risk (aversion), uncertainty (aversion), prospect theory, time inconsistency, sunk-cost fallacy, commitment, satisficing (behaviour), pro-social (behaviour), anti-social (behaviour), deviant (behaviour), philanthropy, (food) donation, altruism, other-regarding (behaviour), egoism, ethics, (business) corporate social responsibility, empathy, value(s), belief(s), pro-environmental (behaviour), sustainability, (social, individual) norm(s), familiness, cognitive dissonance, betrayal (aversion), (business) loyalty, (business) honesty, reciprocity, reputation, fairness, inequality (aversion), (distributional) justice, (business) dishonesty, distrust, trust, position (relative to peers), (business) coordination, collaboration, alliance, cooperation, competition, network(s) and networking.

4 Results of the literature review

The neoclassical economic theory assumes that economic agents are rational individuals maximizing their monetary utility. For companies, this corresponds to profit maximization. Under these assumptions, innovations are adopted only if they result in increased revenues (e.g., by raising the unitary price of a product, reducing its unitary cost, or increasing the quantity sold). Eventual social benefits do not result in an increased propensity of adoption. Innovations aimed at reducing food waste frequently suffer from this dilemma, thus leading to the question whether introducing them in a market system is feasible.

Behavioural economics points out that the utility framework does not fully reflect the real behaviour of economic agents, and that there are additional psychological, sociological and institutional factors affecting business investment decisions. Within this report, such factors are called “behavioural typologies and interrelationships”. Typologies and interrelationships can be grouped into three broad categories, depending on the type of deviation from the standard economic theory they arise from. The *first* group arises from the relaxation of the *rationality* assumption: businesses may deviate from full rationality either because they implement progressive learning, since they have a limited foresight, because they cannot properly process information (being affected by cognitive biases) and risk, or because they are time-inconsistent. The *second* group of typologies relates to the relaxation of the *selfishness* assumption: rather than simply maximizing their profit, businesses may adopt other decision strategies, or be influenced by idiosyncratic (or socially shared) values, beliefs, and norms (VBN), including pro-environmental concerns. Finally, their utility may be affected by the utility of other agents: in this case, they show either pro-social or anti-social behaviours, like altruism. The *third* group of behavioural factors derives from the fact that inter-business relations are *not anonymous*. First, issues such as trust, honesty, and inequality aversion (preference for fair decisions and outcomes), and their implications for business interrelationships are described; then, the impact of reciprocity, reputation, and of business position relative to their peers is analysed. Finally, networks, and other forms of cooperation which arise from these business characteristics are considered.

The overall behaviour of a single business results from the interactions of several behavioural factors.

Specific behavioural typologies and interrelationships need not being understood as mutually exclusive: the overall behaviour of a single agent (business) results from the interactions of several factors, which may be more or less accentuated, representing its individual psychological characteristics. By taking into account these behavioural factors, policymakers can carry out a more precise assessment of the market situation, and of market causal nexuses, thus being able to better target their policies, and to assure that they reach the expected outcome.

Overall, considering behavioural characteristics in economic agents, Baxter (1993) notices the emerging of several stylized facts:

- 1 Decision-making is strongly influenced by agents' personal characteristics, both in the goals they pursue, and in the ways they try to achieve them. This implies that, even in identical circumstances (economic and/or non-economic), each individual may behave differently.
- 2 The processes of internal decision-making of the firms shape their external behaviour. Indeed, the goals of businesses are likely to be strongly influenced by the personal goals of their managers.
- 3 Evidence shows that even a majority of largest firms frequently resort to simplifying decision rules, since uncertainty make it impossible for them to have at their disposal all information required for the sort of maximizing behaviour envisaged in standard economic theory. Such a behaviour is even more pronounced when companies are dealing with the choice among investment projects.

4.1 Businesses' decisions & innovation adoption

In both behavioural economics and standard economic theory (see REFRESH D4.1c Socio-economic implications of food waste: Economics of innovation), it is a safe baseline to assume that firms innovate if they are able to commercialize the resulting products at a profit, i.e. depending on the degree to which they can capture the rent granted by an innovation. Teece (1986), cited by Karantininis *et al.* (2010), introduces the concept of "appropriability regime" to refer to the degree to which business are able to capture these rents. Inter-business relations and appropriability regimes are closely related, and depend on the structure of an industry. Peneder (2007), cited by Karantininis *et al.* (2010), argues that, in the agri-food industry, market conditions are such that appropriability conditions are low compared to other sectors in the EU (e.g., because of inelastic demand, entry barriers, etc.). Hence, knowledge is accumulating slowly, and the intensity of innovation is intermediate-to-low. Moreover, the price-cost advantages of innovations are not lasting forever, but once an innovation is introduced within the economy, other firms can reproduce it until it becomes obsolete, thus reducing the innovator's profit margins (Iwai 2000).

Finally, innovation can also be "incremental", i.e. incorporate product improvements (characteristics, price, process, benefits, etc.) into existing technologies targeting existing markets. Managers are more likely to start commercializing a risky product-development project if this project is really new, rather than if it is less innovative. Overall, moderately innovative products tend to be less successful than either high or low innovative ones (Garcia and Calantone 2002).

Box 1: Take-outs – Business innovation economics

- Firms innovate if they can appropriate a proportion of the rents deriving from innovation.

4.2 Relaxing of the rationality assumption

The classical economic literature assumes that economic agents have rational preferences (Mas-Colell *et al.* 1995), rational expectations about future events (Muth 1961), and that they assess uncertain situations in accordance with the expected utility theorem (Von Neumann and Morgenstern 1953). Actual individual behaviour, however, deviates from such assumptions. Indeed, economic agents are limited in their capacity of elaborating information (Simon 1957), they are systematically biased in their behaviour (Loewenstein 2000), and tend to misrepresent risks and opportunities (Hey 1995). This section analyses the literature addressing the deviations from rational behaviour in these directions.

4.3.1. Bounded rationality

The complexity of modern economic markets, characterized by continuous structural changes, makes it difficult for companies to form correct expectations about the future, in particular concerning the consequences of their investment decisions. Indeed, modern economic markets are characterized by continuous changes in relevant agents and interactions. In such conditions, interpretative practices emerge to help agents make sense of the evolution of their relationships (Lane and Maxfield 1995).

The complexity of the foresight horizon, together with the limitation of businesses' capacity of acquiring and processing information, implies that their decisions are effectively taken with "bounded rationality". This concept dates back to the work of Simon (1957), and affirms that decision-making processes are constrained by the way information is processed by the individuals – with limited computational capacities – that effectively take those decisions. Companies facing difficulties in defining optimal choices in a complex landscape of possibilities often recur to shortcuts to take their decisions (Selten 2001), such as the adoption of adaptive expectations (Haruvy *et al.* 2007), or of satisficing behaviour (Harrison and Pelletier 1997). Methodologically, these deviations from rationality can be tested using behavioural game theory, a mathematical and experimental approach aimed at observing and modelling agents' actual behaviour by analysing the strategic decisions they take while interacting.

Real-world businesses adjust their strategies of technology adoption according to new evaluations made at different stages of the investment process. Hence, they show limited foresight and adaptive expectations. Time impacts on the patterns of technology adoption also through the learning process, which can be considered its main endogenous driving force. The costs of adoption decrease as long as the experience in using a technology accumu-

lates and, when decision makers are boundedly rational, adoption paths can be highly non-trivial and context-dependent.

The literature on bounded rationality of companies evolves along two different topics: the formation of adaptive expectations, and the adoption of decisions in a context of satisficing behaviour (see 4.4.1).

The concept of adaptive expectations refers to the situation in which expectations about the future are slowly and incompletely adapted to new information or new market conditions. Haruvy *et al.* (2007) enquire the effect of individual beliefs about future prices within repeated experimental markets. If traders can predict the price trajectories over all future periods and update their predictions after each period, several stylized facts are observed:

- as long as traders gain more experience, market bubbles shrink and prices get closer to the efficient equilibrium;
- inexperienced businesses initially expect transaction prices to be constant along the entire remaining life of the asset;
- long-term predictions reflect a prosecution of past trends based on current and past markets;
- as long as markets are repeated, price biases decrease;
- overall, price changes tend to be constantly underestimated: indeed, individual short-term expectations tend to be a continuation of current trends into the next period.

By influencing the economic behaviour of companies, adaptive expectations impact on different aspects of the economy, especially market structure and prices, as well as on the propensity of companies to innovate.

The adaptiveness of expectations may impact on price levels within a market system, as showed by Nerlove (1958). His model enquires the impact of adaptive expectations on the cobweb² phenomenon [first introduced by Kaldor (1934), and Mordecai (1938)], finding that the range of price instability reduces if the distinction between long and short-term supply schedules is taken into account. However, in absence of price support programs, instability remains in the neighbourhood of equilibrium. Following this literature, Colucci and Valori (2011) enquire the conditions under which belief coordination or disagreement emerges among bounded-rational individuals with heterogeneous expectation, and assess their impact on price stability. Authors identify two potential sources of instability: structural ones, deriving from market characteristics (such as the nature of the supply and demand curve), and

In presence of adaptive expectations, agents may have over-optimistic expectations and thus over-invest.

² The cobweb model is a classical model describing the cyclical behaviour of supply and demand in a market where companies need to decide the amount produced before the price fixation.

behavioural ones, embedded in the expectation of suppliers. They find that behavioural heterogeneity among businesses increases the probability of convergence towards long-term equilibrium prices or, at least, it generates regular oscillation of the prices around the equilibrium prices, reducing the long-term divergence of prices among group of businesses.

Concerning innovation adoption, if businesses form their expectations based on past information (Wende 2009) agents may have over-optimistic expectations and, thus over-invest. Such behaviour, in turn, creates boom-and-burst cycles in a Real Business Cycle model.

In presence of innovation the economy keeps generating positive profits even in a competitive market.

Bounded-rational enterprises operating in innovative markets may reduce their uncertainty by imitating other players' behaviour, if that behaviour yields higher payoffs compared to their current one. This effectively shapes the market, especially in terms of prices structure. Iwai (2000) studies the relationship between imitation and innovation within an evolutionary

model: while the former pushes the technological level of an industry towards uniformity, innovations disrupt the path towards equilibrium. The co-evolution of these two opposite pressures induces persistent dispersion in prices and in relative efficiencies also in the long-run. As a consequence, the economy will keep generating positive profits even in a competitive setup.

Although the Iwai model can be adapted to both competitive and monopolistic setups, several sectors of the food market are dominated by relatively few large players with significant market power, thus being de-facto oligopolistic. In the context of these markets, Andaluz and Jarne (2015) analyse the dynamics of the duopolies of Cournot (competition on quantities) and Bertrand (competition on prices) under bounded rationality and adaptive expectations. They find that, if businesses compete on quantities (as in the case of the large retailer sector), increasing product differentiation – or the adjustment speed of preferences – pushes the market away from the Nash equilibrium, while it is not the case when businesses compete on prices. In both cases, however, if the speed of adjustment of business expectations is sufficiently low, and initial strategies were only partially diverging, then the local adjustment process still converges to Nash equilibrium. Hence, the effects of the adjustment speed, and of consumer preferences on the market equilibrium are independent from product differentiation, competition type, and degree of heterogeneity of firms' expectations. Increased adjustment speed causes a qualitative change in the structure of the attractors, so that the result of a game starting from a clear initial strategy set is barely determinable, and the Nash equilibrium may not be achieved.

Limited foresight impacts strongly on company decisions to invest in costly innovation. As noted by Chen and Ma (2014), less farsighted firms tend to adopt more efficient technologies later. Symmetrically, a relatively high learning rate amplifies foresight, fostering innovation, although such effect decreases as long as foresight increases. From the modelling point of view, it is important to notice that, in presence of limited foresight, path depend-

ency and potential bifurcation in adoption rates may emerge, with small initial differences becoming progressively larger.

Finally, limited foresight has some peculiar influence on the decision-making of firms operating in food-related sectors. The limited literature on these topics focuses on food safety and hygiene innovation. Indeed, since food safety is an issue of paramount importance for people, businesses tend to answer to food safety legislation rapidly and to adopt the relative innovations faster. Loader and Hobbs (1999) find that, internally, firms place food safety issues and quality management at the core of their activity, thus influencing all other elements of their production process, and look for food chain partners who share the same positions on the issue. As for the adoption of innovations in the food sector, size seems to matter, as small firms tend to react more slowly. Such result is comforted by Holt and Henson (2000), who observe a large gap between the technical managers of large businesses, and the owner-managers of family firms. The latter are much less aware of the existence of audited standards of hygiene at the EU-level, and are thus slower in adopting them. As for small businesses, the adoption of innovations is positively influenced by the presence of internal (qualified personnel) or external informers. Due to the lack of financial resources, small firms must rely on informal channels, like inter-business relationships; otherwise, they may be provided inaccurate information by low-level consultants.

In presence of limited foresight, path dependency in innovation adoption may emerge.

Relations with other typologies

- 1 In presence of a limited number of alternatives considered, imitation is used (Berg 2014), potentially introducing a bias in companies' behaviour (4.3.2).
- 2 Complete information on preference relations can help overcome the status quo bias (Gerasimou 2016) (4.3.2).
- 3 When making complex decisions, companies may abandon the profit maximization strategy for their investments, favouring a satisficing choice among a limited set of options (4.4.1).
- 4 Small companies rely on informal ties to acquire information on innovations (Holt and Henson 2000), using their networks of similarly-minded partners (4.5.3).

4.3.2. Systematic cognitive biases

Rational economic agents are assumed to take decisions by correctly and objectively weighing all relevant information. However, behavioural and experimental economics uncovered a long list of biases affecting economic choices. When weighing alternative options, economic agents tend to systematically over-estimate certain aspects, neglecting others. Such systematic biases influence economic decisions and outcomes in situations ranging

from financial markets (Barberis and Thaler 2003) to industrial organization (Grubb 2015).

Among the systematic biases that affect business behaviour are: salience, status quo bias, choice deferral, endowment effect and the confirmation bias, as well as overconfidence, optimism, and distrust. This section discusses the impact on market outcomes of intrinsic biases in the business decision-making process. The identity of the individual who takes the decisions, or how the process takes place within the black box of the company are not discussed, except for their connections with the decision taken.

Experimental evidence shows that when people are not forced to choose, they often³ avoid doing so, unless an option totally or partially dominates the alternatives. Such behaviour may take the form of either *status quo* (or default) bias, or *choice deferral*. The former is observed if the decision-maker finds himself in a "specific status quo" (e.g., he has already implemented an innovation aiming at reducing food waste and can choose to switch to another type of innovation) and he chooses more often a feasible option when it corresponds with his status quo than when it does not (Gerasimou 2016, 296). Choice deferral is observed when the decision-maker finds himself in a "non-specific status quo" (e.g., he has not implemented any innovation and is presented a set of potential ones), and chooses none of the available options (*Ibid*). These biases can be avoided if one of the options dominates the others, which happens if a complete set of preference relations (information) is available. Status quo bias is, instead, reinforced in presence of confirmation bias, i.e. when beliefs are sometimes not updated correctly as a consequence of new information (Rabin and Schrag 1999).

When people are not forced to choose, they often avoid doing so.

The status quo bias implies a preference for the current state, and is thus linked to the *endowment effect*. The latter emerges when people demand much more to renounce to an object, than what they would pay to acquire it. The consequence of such bias is a reduction in the propensity to both sell and buy an object. The endowment effect is instantaneous, and emerges right after people have obtained the object. As for business behaviour, the endowment effect causes firms to over-evaluate a good if they already own it. It has been observed that market experience can reduce this bias (Armstrong and Huck 2010). Moreover, the endowment effect may be a significant drag in business investment decisions, as it may reduce the value of an innovation to be acquired and impede the diffusion of an innovation when its owner over-evaluates it.

There can be interaction effects between different types of bias and the probability of company survival. This issue is addressed by Gudmundsson and Lechner (2013) who focus on overconfidence, optimism, and distrust.

³ Experimental and questionnaire evidence suggests that deferral rates range between 20 and 45 percent (Gerasimou 2016, 302).

While the first can be defined as «the positive difference between confidence and accuracy» (Schaefer *et al.* 2004, 473), the second implies overrating the probability of good events and underrating that of bad ones. Empirical research shows that both optimism and overconfidence bias are negatively correlated to firm survival, while some distrust may have a positive impact on company survivability. Entrepreneurs tend to be overconfident and, thus, opportunity-oriented, but they accompany this trait with either optimism or distrust. In the first case they will adopt a “*laissez-faire*” style of management, while, in the second case, they will tend to delegate, and to associate less. Over-optimism in decision-making can emerge as a bias for selection reasons, since optimist people are more likely to assume leading positions within firms, or because their principals reward them with distorting incentives (Armstrong and Huck 2010).

The presence of systematic cognitive biases is frequently encountered together with the use of heuristics in the process of decision-making. According to Kahneman (2011, 98) a heuristic is «a simple procedure that helps find adequate, though often imperfect, answers to difficult questions». Heuristics may lead either to good outcomes, or to erroneous judgments. Examples of the use of heuristics are the cases when people assess the likelihood of an event according to the easiness of recalling a similar one (salience, Tversky and Kahneman 1973), or when they retain previous decisions in the face of new information. Another simple form of heuristic is imitation (Di Maggio and Powell 1983).

Heuristics strengthen the capacity of business to adapt and innovate in an evolving economic context.

Heuristics are effective decision-making tools when the possibility of implementing a systematic analytical approach is limited or impossible. Guercini *et al.* (2014) examine the interaction between cognition and behaviour in the relationship among buyers and sellers in business-to-business markets, finding that heuristics as an “adaptive toolbox” play a fundamental role. Heuristics are more effective in producing strategically relevant business behaviours than fixed rules, because they strengthen the capacity of business to adapt and innovate in an evolving economic context. The “heuristics toolbox” refers to the aggregation (non-cumulative) of the decision-making mechanisms that individuals within a business use, share and exchange. It allows the adaptation of the organization to market perturbations, and to changes of agents’ characteristics and skills. As such, this portfolio is of paramount importance for business performance, and needs to be cultivated and maintained over time.

Deciding to invest into a new technology implies considerable risk taking. This makes imitation of the behaviour of others a powerful and widely used heuristics. Imitation is driven by uncertainty, i.e. by «the need of business managers to reassure themselves by copying the practices of respected peer firms» (Andrews and Johnson 2016). Managers evaluate potential efficiency gains of the innovation adoption, and learn from prior adopters’ experience using two main heuristics: “imitate the majority” and “imitate the successful” (Gigerenzer and Selten 2001). Companies, however, adopt

technologies with different timings, which essentially depend on the framing both of the imitation itself, and of the innovation either as a threat or as an opportunity (Nikolaeva 2015). The categorization of the issue is also not static, since managers frame it through social learning. Overall, given these two framing processes, four business profiles emerge:

- Those who perceive both the innovation (e.g. starting selling biological products) and imitation as opportunities: such firms tend to imitate the successful, and tend to be within the early adopters.
- Those who perceive both the innovation and imitation as a threat: they imitate the majority, and are late adopter.
- Those who perceive the innovation as an opportunity and imitation as a threat: their behaviour is more complex, as they use both heuristics, and are average middle to late adopters.
- Those who perceive the innovation adoption as a threat and imitation as an opportunity: such companies imitate mostly the successful, and the timing of their adoption changes widely.

From a market system perspective, imitation impacts on firm heterogeneity, as the adoption of others' behaviours, technologies, and values makes organizations progressively more similar to one another (Di Maggio and Powell 1983). The imitation process takes place at universal level, since production technologies, ideas and models are diffused unintentionally, by transfer of employees and turnover, or explicitly, through consulting firms and trade associations. Di Maggio and Powell (1983) identify a number of organizational and field-level predictors of isomorphism. Among the former are the dependence of an organization on another (e.g., supplier or distributor), the centralization of resource supply, uncertainty of the relationship between means and ends, ambiguity of organizational goals, reliance on academic credential in choosing managerial and staff personnel, and the participation of managers in trade and professional associations. The latter include the dependence of the sector upon a single (or similar) source of support for vital resources, the frequency of transactions with state agencies, the limited number of alternative organizational models, technological uncertainty or goal ambiguity, the level of professionalization, and the level of structuration of the sector.

Finally, when social payoffs are more relevant than individual ones, heuristics are also used as an alternative to payoff-oriented strategies in order to set network ties (Harmsen-van Hout *et al.* 2016). The heuristics consists in the fact that individuals take into account the most accessible (salient) characteristics of alternative options, and they link the payoffs with these attributes used as a proxy, favouring qualitative rather than quantitative relations. This heuristic behaviour implies that, in the context of networking, the options which imply a deviation from the status quo (actively creating or deleting links rather than doing nothing) are evaluated less, and that the number of direct linkages of a potential partner is a proxy of successful payoffs. However, in presence of value transferability, individuals are less likely to link with highly connected neighbours, since the high number of

connections increases unpredictability of the value transferred through the linkage. Links are, instead, more likely to be formed with less connected individuals (reversed status quo bias).

Relations with other typologies

- 1 Bougheas *et al.* (2015) find a “reverse confirmation bias” when individuals are allowed to share information among each other in a situation of risk (4.3.3).
- 2 Patterns of network formation (4.5.3) depend on the use of heuristics (Harmsen-van Hout *et al.* 2016).
- 3 Entrepreneurs tend to be overconfident and, thus, opportunity-oriented (Gudmundsson and Lechner 2013), but they accompany this trait with either optimism or distrust (4.5.1): in the first case, they adopt a “laissez-faire” style of management, while in the second case, they tend to delegate and associate less. This influences their patterns of interaction (4.5.3).

4.3.3. Non-rational behaviour related to risk

The theory of rational choice under risk (Mas-Colell *et al.* 1995) is based on the assumption that economic agents assess risky alternatives according to the expected utility theorem, i.e. by equally weighing the costs and the benefits of uncertain options. Kahneman and Tversky (1979) elaborated a model alternative to the expected utility theory, called prospect theory, which is now sustained by strong empirical (Camerer 2004) and experimental (Tversky and Kahneman 1992) evidence. Prospect theory studies the perception of prospects, the judgement of gains and losses, as well as the weighing of uncertain outcomes. The impact of several behavioural typologies has been uncovered by this theory. Indeed, it has been observed that, in uncertain situations, decreases in probabilities tend to be overweighed (*certainty effect*) while increases tend to be underweighted, so that decision makers show risk-seeking behaviour in the domain of gains and risk aversion in the domain of losses. Moreover, «judgements are comparative and changes in the framing can affect decisions» (DellaVigna 2009) even without affecting the economic stakes. Indeed, people tend to discard the elements of decisions that are included among all prospects under consideration (*isolation effect*), so that a small change in the formulation of a problem may have a marked effect on the final decision. Indeed, according to prospect theory, decisions are influenced by both the location of the reference point (the outcome against which the other options are compared), and by the way choice problems are framed. For example, when gains and losses are framed with respect to an expectation or an aspiration level different from the status quo, a negative translation of the choice problem – as well as a failure to adapt to losses or to attain an expected outcome – may increase risk seeking. Instead, when a person formulates a decision in terms of final assets rather than gains or losses, risk seeking is reduced. From the modelling point of view, and differently from the expected utility

theory, prospect theory allows different weighing functions for gains and losses if decisions are taken under risk (Tversky and Kahneman 1992).

In groups facing a common risk, agents place more weight on signals different from their own.

Beside prospect theory, decisions may be influenced also by other factors, such as the communication patterns within groups of decision-makers. Bougheas *et al.* (2015) find that, in groups facing a common risk, individual decisions are characterized by both a “reverse confirmation bias” (agents place more weight on signals different from their own), and by a high degree of consensus. Such situation is very relevant for decision-making about investments, where a single person has to take a decision on behalf of the group. The level of consensus that a group expresses is strongly linked to the patterns of communication within the group. People tend to respond intuitively to the information they receive privately, but if they are left free to communicate, a systematic bias towards changing their decisions in the direction opposite to the one suggested by private signals emerges.

Relations with other typologies

- 1 In presence of limited foresight (4.3.1) and uncertain technological learning, uncertainty about the success of an innovation can cause convergence in the rate of adoption, as most businesses tend to postpone the adoption.
- 2 A number of cognitive biases (4.3.2) are observed when decisions under risk or uncertainty are taken: framing effect (preferences are systematically different based on how options are framed), non-linear preferences, source dependence, risk seeking, and loss aversion.
- 3 When taking decisions under uncertainty, people use computational shortcuts (heuristics) (4.3.2), like eliminating common components, or discarding non-essential differences of alternative options.
- 4 Patterns of communication within a group influence decision-making under risk by affecting the degree of consensus that can be achieved (4.5.3).

4.3.4. Time inconsistency

A particular type of non-rational behaviour is the inconsistency of individual preferences over time, or time inconsistency (Loewenstein 1988; O’Donoghue and Rabin 2006). This type of bias is observed when individuals have preferences whose ordering changes, becoming inconsistent between points in time. Unlike rational agents, time-inconsistent individuals change their behaviour depending on when they are asked to take a decision. This section discusses the implications of time inconsistency for business behaviour.

Time-inconsistency violates the hypothesis of invariance of preferences over time. Time-inconsistent individuals tend to choose a different combination of

vices (small immediate reward in exchange for a high delayed cost) and virtues (small immediate costs for a large delayed reward) depending on whether the choices are made simultaneously or sequentially. Indeed, diversification heuristics (diversifying one's portfolio for reducing risk) and the immediacy effect cause them to change their mind in the direction of vices as the moment of consumption approaches (dynamic inconsistency). Read *et al.* (1999) find that, when choosing sequentially, individuals prefer less variety, favouring vices all times. Instead, if they choose simultaneously, they take into account the interactions among the goods they choose, thus favouring virtues at any time apart from the first. Also, diversification is more pronounced when the alternatives are grouped into clearly bounded categories. An implication for the food chain is that firms are more likely to implement food-saving investments if they take this choice simultaneously with less environmentally-concerned ones, and if the investment cannot be recovered as the moment of the payment approaches.

Time inconsistency may also explain the difficulty of people in implementing dynamic utility maximization (Strotz 1956). This happens because individuals tend to "over-evaluate" more proximate satisfactions compared to distant ones, so that their optimal plan at present is one that they would not choose in the future. If an individual does not recognize this inconsistency, he will be a spendthrift. Otherwise, he may try to solve this issue by regimenting his economic behaviour. In such framework, even the concept of consumer sovereignty has no meaning.

Individuals incur in sunk-cost fallacy if they take irrelevant information into account when making a decision.

Time inconsistency is strictly linked to the sunk-cost fallacy (Arkes and Blumer 1985), i.e. the inefficient allocation of resources due to the use of information which is irrelevant to the decision being made. Individuals incur in sunk-cost fallacy if they take sunk costs into account when making a decision. Accord-

ing to the rational decision-making theory, sunk costs are irrelevant, as they cannot be recovered. Sunk-cost fallacy leads businesses to keep investing in a project (e.g., an innovation) even if it is economically unviable, in order not to lose their previous investment. In this sense, it is strongly linked to loss aversion. However, McAfee *et al.* (2010) find that this behaviour can be rational for three main reasons. First, due to uncertainty, past costs are informative of future prospects (the amount of money needed to complete a project). Second, a business's propensity to invest depends on others': managers may want to build a reputation through commitment, especially if joint investments are concerned. Third, past expenditures reduce the possibility to spend in the future due to budget constraints, and also reduce the time left to make new investments. A business can be influenced by sunk costs even if it is not advantageous in that specific case, if its past experience proves that, on average, it is (salience effect).

Analysing investment decisions of US nuclear power plants, De Bondt and Makhija (1988) find little empirical evidence of a powerful sunk-cost effect. They rather try to reconcile this phenomenon with older theories on investment decision-making, like the concepts of "aspiration level" and of "target

returns” (and the risk not to obtain them). However, the conditions of the energy sector are too specific to extend their conclusions. Instead, while enquiring the market mechanisms to give a price to corporate social performance, Jia and Zhang (2014) find evidence of sunk-cost fallacy when managers are optimistic about the post-IPO success of their investments. Finally, Atal *et al.* (2016) find evidence of sunk-cost fallacy when firms are confronted with several alternative investment projects. Overall, sunk-cost fallacy may lead businesses of the food sector to either keep investing in unviable innovations, or not to invest in new ones because of past unsuccessful investments.

Pre-commitment is an effective strategy to address business time-inconsistency. Commitments represents a set of «moral obligations of the units of a system of social interaction to maintain the integrity of a value-pattern and to strive toward its implementation in action through combination with non-value factors» (Parsons 1968, 135). The stability of commitment is a necessary condition to grant functional social relations. Read *et al.* (1999) find that individuals choose virtues over vices if they are induced to make an irreversible pre-commitment. Strotz (1956) argues that pre-commitment (forcing oneself irrevocably, or setting penalties for misbehaving) and consistent planning (rejecting any plan one is not going to abide by) may favour thrift, and the regimentation of one’s economic behaviour.

There are two main forms of commitment: of the business towards the external environment (other businesses, or intangible values), and of employees and managers towards the business as an organization (organizational commitment). While the former favours inter-business cooperation, the latter is necessary in order to support the former. Value commitment may foster the sense of responsibility towards the society in general. MacDonald and She (2015) find that it strengthens the likelihood of firms to engage in behaviour aimed at solving environmental problems.

The positive effect of commitment in alliances among businesses at the same level of the supply chain, or in vertical relations, derives from the fact that it leads firms to respect their engagements. Shah and Swaminathan (2008) find that, when selecting a partner, businesses evaluate the level of their projected satisfaction with their choice based on four factors, among which commitment (i.e. partners’ will to contribute to the alliance’s tangible inputs). Commitment is the most important factor if process manageability of the alliance (the degree of interaction that the initiating partner perceives as necessary in order to implement and sustain it) is low, and outcome interpretability (the degree of difficulty of interpreting and understanding its outcomes) high. Instead, when both these dimensions are high, financial payoffs, trust and commitment appear to be equally important.

Pesämaa *et al.* (2013) find that trust and reciprocity based on personal interrelationships play a paramount role in fostering interpersonal and inter-organizational commitment within cooperatives of small businesses, helping them systematically

Trust and reciprocity based foster interpersonal and inter-organizational commitment.

cope with risk and uncertainty. Luo (2005) argues that the performance of a cooperative alliance is strongly linked to the level of shared procedural justice as perceived by their chief managers, especially when there is cultural distance among the partners, or when a sector faces structural uncertainty. Shared procedural justice is a proxy of mutual commitment. According to Gyau *et al.* (2011), the quality of relationship between German dairy firms and their milk suppliers depends on a mix of trust, satisfaction, and commitment. E.g., price satisfaction results from a complex psychological interaction between expectations and perceptions. Behavioural factors (regularly sharing information and communications, carrying out regular negotiations, granting a transparent process of price determination, restraining from the use of power, and solving the conflicts through friendly and informal mechanisms) are much more important than price levels in fostering firm commitment. Crespo *et al.* (2014) identify trust and collective commitment as two key components of social capital within a community, and argue that they may favour collective action.

As for organizational commitment, according to Meyer and Allen (1991) it has three components: affective, continuation, and normative. Lapointe and Vandenberghe (2015) call the second “sacrifice” commitment, and link it to individual benefits. Affective commitment develops thanks to working experience, which creates a feeling of comfort and individual competence. The second is motivated by the costs (and risks) associated with leaving a firm. The third represents an obligation generated by the internalization of a loyalty norm, or by the desire to repay a favour. Especially this last one may motivate food-saving behaviours. A manager’s servant leadership may strengthen these forms of commitments which, in turn, foster employees’ voice behaviour (i.e. their tendency to be proactive in making suggestions for improving the organization) and reduce their anti-social (or deviant) behaviour (*Ibid*). In particular, anti-social behaviour is negatively associated with normative commitment (*Ibid*). As for family businesses, Hatak *et al.* (2015) find that they are able to convert their innovation into successful performance when family commitment is either low or very high. Finally, an interesting dynamic is observed by Paolillo *et al.* (2015) while analysing Italian firms. Authors find a negative relationship between continuance commitment to change, and perceived justice within the organization and optimism, as these generate the perception that not supporting changes is less costly. Authors define commitment to change as «a force (mind-set) that binds an individual to a course of action deemed necessary for the successful implementation of a change initiative» (*Ibid*, 1698). Organizational procedural justice refers to a combination of fair output-allocation procedures and outcome distribution, while optimism indicates a belief of being able to succeed in the present and in the future.

Finally, as showed by Atal *et al.* (2016) a strong commitment may also have negative effects on innovation, since it leads a business that confronts a set of projects which cannot be simultaneously implemented to avoid selecting new ones until the current one ends (especially if project abandonment implies high costs).

Which role for policies? Given the inconsistency of individual and business preferences over time, the best strategy to make people choose virtues over vices is to induce them to make irreversible pre-commitments (Read *et al.* 1999). E.g., firms are more likely to implement food-saving investments if they make this decision simultaneously with less environmentally-concerned (profit-targeted) ones, and the investment cannot be recovered as the moment of the payment approaches.

Relations with other typologies

- 1 Time inconsistency is driven by cognitive biases (immediacy effect, and diversification heuristics) (4.3.2).
- 2 Sunk-cost fallacy is driven by cognitive biases (loss aversion, and over-optimism) (4.3.2), uncertainty and risk aversion (4.3.3), and reputational concerns (4.5.2).
- 3 Commitment is strengthened either by individual values (e.g. pro-environmental concerns) (4.4.2), inequality aversion (a desire of fairness and procedural justice) (4.5.1), risk aversion (continuation commitment) (4.3.3), and perceived reciprocity (4.5.2).
- 4 Commitment is fundamental in order to achieve successful cooperation (4.5.3), and is associated to both trust (4.5.1) and reciprocity (4.5.2).

Box 2: Take-outs – behavioural typologies from relaxing the rationality assumption

- Limited foresight impacts strongly on business decisions to invest in costly innovation: costly but more efficient technologies are adopted later by firms with shorter foresight periods; learning reduces adoption times.
- Due to the presence of adaptive expectations, past behaviour and information is an important determinant of companies' beliefs.
- When decisions involve options that are difficult to rank, then status quo bias tend to emerge.
- Over-optimism and over-confidence are negatively correlated to firms' survival, while some distrust may have a positive impact on companies' survivability.
- "Imitate the majority" and "imitate the successful" are two key heuristics used to decide whether to introduce an innovation or not. The companies' perception of imitation and of the innovation adoption as a threat or as a potential gain are the determinants of the timing of innovation adoption and of the decision of the type of heuristics to be used.
- Imitation is a more successful strategy when small investment projects are concerned; instead, large firms gain more from originality, although the success of their investment decisions is affected by chance.
- Larger companies (in the food sector) tend to acquire information about innovations from experts or using the internal personnel resources. Small companies on the other side rely more on informal channels, such as business interrelationships.
- The framing of problems is important for decisions under uncertainty, as it influences the reference point of individuals and thus their choices: the same investment choice can be

perceived differently in different situations.

- In uncertain situations, small reductions of probabilities tend to be overweighed while small increases of probabilities tend to be underweighed.
- Due to time inconsistency when choices between vices and virtues are concerned, firms are more likely to start food-saving investments if they take this decision simultaneously with others through a pre-commitment, and if the investment cannot be recovered as the moment of the payment approaches, due to an irreversible pre-commitment (having set penalties for misbehaviours).
- Irrelevant information can lead to sunk-costs. Sunk-cost fallacy may lead businesses of the food sector to either keep investing in unviable innovations (in order not to lose the investment: loss aversion), or not to invest in new ones because of past unsuccessful investments.
- Firms who are already implementing a project, although economically unviable, are less likely to start an additional more viable project, since there is a limit in the number of projects they can manage at the same time.
- Behavioural factors, such as regularly sharing information and communications, carrying out regular negotiations, transparency of the process of price determination, restraining from the use of power, and solving the conflicts through friendly and informal mechanisms, are more important than price levels in fostering commitment of small firms.
- Affective commitment increases with time; normative commitment is higher if the employee (or the firm) perceives that there is a favour to repay.

4.3 Relaxing of the selfishness assumption

The assumption of individual selfishness is the cornerstone of the economic discipline and literature. Most economic choices have a strong component of self-interest. Indeed, Adam Smith famously wrote that «It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest». (Smith 1776, book 1, chapter 2). The importance of selfishness in economic decisions led the classical literature to produce predictions under the restrictive assumption that self-interested maximizing behaviour is the only thing that matters in economic decisions (Arrow and Debreu 1954; Mas-Colell *et al.* 1995). When this is true, individuals are concerned only about their own payoff, which they try to make «as large as possible» (Mas-Colell 1992).

Behavioural economics challenges and relaxes the assumption of selfishness, basing its models on the empirical and experimental observation of individuals' actual behaviour. Experimental evidence shows that both individuals and businesses forgo profit opportunities once they have achieved a sufficiently high welfare (Dixon 2001), engaging in the so-called satisficing behaviour. Moreover, economic decisions are not taken with only material concerns in mind but are, instead, highly influenced by rooted values and beliefs about what is right or wrong (Lincoln *et al.* 1982). Finally, individuals are concerned about the welfare of other people, both in relative and absolute terms (Engelmann and Strobel 2004). The presence of non-profit objectives is likely to affect the competitive interactions regardless of the reason for the firms to hold them (Armstrong and Huck 2010). The deviations from

the pure selfishness assumption are described in this section with a view to identifying those to be considered when modelling the food waste behaviour of firms.

4.4.1. Satisficing behaviour

Traditional economics assumes that individuals maximize a payoff, described by a clearly defined utility function (Castagnoli and LiCalzi 1996). However, in a complex world, characterized by poorly defined boundaries of what is relevant and what is not for economic decisions, maximizing behaviour is frequently out of reach. An alternative behavioural model introduces satisficing behaviour, which Reber (1995, 701) define as «accepting a choice or judgment as one that is good enough, one that satisfies». As for businesses, satisficing behaviour translates into the acceptance of a profit level that is satisfactory (or “aspiration level”) instead of maximal (Dixon 2001). The concept – introduced by Simon (1956) – is implemented in utilitarian economics by framing firms’ decisions as a choice among a limited number of options. This is made by introducing in the model also the cost of finding a solution to the optimization problem. In its simplest form, the utility function of a firm has, thus, only two values: good-enough or not-good-enough (Armstrong and Huck 2010). This section summarizes the literature on non-maximizing decision-making.

Satisficing is adopted by individual agents in a number of situations: when policymakers want to obtain enough votes to achieve re-election (Davidson *et al.* 1992); when students have to fill a large number of questionnaires (Barge and Gehlbach 2012); when firms have to decide whether to engage in new business ventures (Selby *et al.* 2011); when businesses have to choose a new location (Berg 2014); when producers and processors carry out price negotiations (Gyau *et al.* 2011); when producers have to decide whether and how far to comply with food safety regulations (Henson and Heasman 1998), at least until the adoption of the 2002 EU food law and the subsequent national regulations; when choosing alliance partners (Shah and Swaminathan 2008).

Most individual agents resort to simple heuristics that match the environment where they are located.

Correspondingly, the reasons for engaging in satisficing behaviour are also diverse. The maximization problem could be simply too hard because of uncertainty, so that the complex strategies needed to maximize profits are rarely observed; or maximization can occur, but with alternative aims to profit maximization, or on the basis of mistaken beliefs (a manager may maximize his profit with respect to his peers, or be over-optimistic on the profitability of an innovation), or for reasons of ignorance and “easy life” (Armstrong and Huck 2010). Also, the number of alternatives to choose, or activities to perform may be simply too large (Barge and Gehlbach 2012; Berg 2014; Shah and Swaminathan 2008). Finally, small businesses may prefer to remain as independent as possible from the market, look for lifestyle regards rather than financial gains, or show resistance to opportunity-seeking (Selby *et al.* 2011).

Satisfaction may be achieved through a number of strategies. As for businesses, the strategy chosen may depend on their typology, size, sector, or on market situation. The strategies identified by Barge and Gehlbach (2012) among university students may be extended to businesses: early termination of a project, skipping items (reducing the number of variables considered), rushing (giving unthoughtful answers to all issues), and non-differentiation (giving the same answer to similar problems). However, most individual agents resort to simple heuristics that match the environment where they are located. According to Berg (2014), these include considering only a small set of alternatives, whose size is static rather than adjusted along the process (he finds that the modal value among firms that have to choose a location is three); imitating fellow firms; or using proxies (e.g., art as a proxy of a favourable local development). Imitation is a more successful strategy for small investment projects, while large firms gain more from originality; indeed, chance plays also a fundamental role in the final decision. As for the number of alternatives, the database used by the businesses seems to be censored *ab initio*. Also in the two-stage model of choice behaviour elaborated by Tyson (2015), satisficing is used in the second phase because the alternatives selected in the first are a limited number. The choice is then affected by salience (a specific alternative can draw the decision-maker's attention), positive action (giving favourable treatment to specific groups), and surface features rather than hidden ones. Armstrong and Huck (2010) confirm the role of imitation (called "mimic irrational behaviour"), while another simple heuristic consists of changing strategy only when profits fall below an acceptable threshold, rather than making explicit complex calculations. A third feasible strategy, identified by Iwai (2000) among firms that had to define their innovation, imitation and growth policies, consists of following fixed organizational routines. Overall, it is important to point out that the level of profit a firm considers "satisfactory" is likely to depend on its historical returns, as well as on the performance of its peers and the economy as a whole (Armstrong and Huck 2010).

The level of profit that a firm considers "satisfactory" is likely to depend on its historical returns and on those of its peers.

Small and socially-oriented businesses tend to adopt satisficing behaviour more often than their counterparts. Analysing the propensity of Finnish micro-firms from the tourism sector located in national parks to engage in new business ventures, Selby *et al.* (2011) find that a majority of them adopts satisficing behaviours, since they want to remain as independent as possible from the market, and seek lifestyle regards rather than financial gains (business growth). Henson and Heasman (1998) find that the most important determinant of the decision of businesses to comply with new food safety regulations is their size: small ones tend either to conform at a later stage, or to choose partial or non-compliance as a strategic reaction; hence, large firms hold a comparative advantage. Santos (2012), cited by Agafonow (2014), argues that social enterprises, differently from commercial ones, maximize on value creation, while adopting satisficing as for value capture.

As for the position of the firm in the supply chain, and its market situation, buyers and sellers may choose to adopt satisficing behaviour if they hold a stronger market position, in order not to cause a deterioration of their relationships with their counterparts. While enquiring the determinants of the quality of relations between German dairy firms and their milk suppliers, Gyau *et al.* (2011) find that this is influenced by a composite mix of trust, satisfaction, and commitment. Price satisfaction results from a complex psychological interaction between expectations and perceptions; regular and transparent negotiations can have a stronger positive impact on it than paying higher prices *tout court*. Finally, a situation of Bertrand duopoly (price competition) with satisficing firms may generate high competition and substantial profits if firms simply imitate their most profitable rival (Armstrong and Huck 2010).

Satisficing is adopted also by firms that have to choose their partners within cooperative alliances (Shah and Swaminathan 2008). The alliance initiator evaluates the level of projected satisfaction with its partner choice considering a limited set of alternative partners.

Finally, Melé (2010) argues that absolute rationality and satisficing are both inadequate decision models, since they neglect taking into account that the evaluation of an action with respect to human good is constitutive of the action itself. Shortly, they ignore ethics and other values. Their impact on businesses' decision-making will be taken into consideration within the next paragraph.

Which role for policies? When individuals resort to satisficing behaviours, economic incentives can fail to achieve their goals. E.g., individuals who receive an incentive to participate in projects may maximize the number of projects in which they take part. In this case, incentives are not successful in preventing people from completing these projects in a sub-optimal manner, but they rather increase the number of satisficing participants (Barge and Gehlbach 2012). Also, since the set of alternatives considered by firms when making a decision is censored *ab initio*, tax incentives are not successful in making them consider additional ones (e.g., for the purpose of developing a low-income neighbourhood by locating there). Given the role of chance in the decision of including an alternative in the list, policymakers should rather facilitate the interaction among firms, and incentive their mobility, so that they will observe alternative possibilities (Berg 2014).

Relations with other typologies

- 1 Satisficing behaviour is driven by bounded rationality (limited foresight, etc.) of the businesses (4.3.1), and by uncertainty (4.3.3), both of which prevent rational maximization.
- 2 The outcome perceived as satisfactory by a business is affected by cognitive biases (saliency) (4.3.2), and by the position of this business relative to its peers (4.5.2).
- 3 In order to choose their satisfactory profit level, businesses resort to simple heuristics, among which imitation (4.3.2).

- 4 The adoption of satisficing behaviour during the negotiations among businesses located at different levels of the supply chain increases the quality of their cooperation (4.5.3).

4.4.2. Values, beliefs, and norms

Beside material concerns, economic decisions are strongly influenced by values and beliefs of the decision-makers. Values indicate idiosyncratic characteristics of individuals, but also of businesses, or of the whole society. Some economically feasible production decisions may not be considered, since their realization would contradict rooted values (Lincoln *et al.* 1982), or vice versa. This section summarizes the literature on the impact of values on business decisions, looking in particular at issues like pro-environmental beliefs and moral or normative concerns.

Individual values may be defined as «desirable goals, varying in importance, that serve as guiding principles in people's lives» (Schwartz 1992, 21), or as «enduring beliefs that a specific mode, or conduct, or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct, or end-state of existence» (Rokeach 1973, 5). Instead, organizational values are «socially-shared cognitive representations of institutional goals and demands» (Rokeach 1979, 50). Organizational values generate the decision rules used to interpret signals within the environment where individuals are located, and may also cause the dismissal of specific issues.

Pro-environmental beliefs may be included among values. According to Kollmuss and Agyeman (2002), cited by Chen (2015, 66), pro-environmental behaviour indicates any «act intentionally reducing the negative impact that an action can have on the environment». Reducing food waste is, clearly, a pro-environmental behaviour.

Norms refer to accepted standards and conventional wisdom which, together with formal regulations, represent institutional constraints (Andrews and Johnson 2016).

Since values are latent or passive, they are not always resulting in a corresponding action, unless agents experience cognitive dissonance. This is a mismatch between cognition and action, or between individual values and behaviours (Festinger *et al.* 1956). When confronting cognitive dissonance, individuals feel the need of solving it, either by changing their behaviour in order to match their value, or vice-versa. If the first option is chosen, a concern arises, that drives action. Since commitment represents a set of «moral obligations of [individuals] to maintain the integrity of a value-pattern, and to strive toward its implementation in action» (Parsons 1968, 135), values and the resulting concerns are necessary elements to foster individual (including business) and organizational commitment.

Values are usually latent, and they result in action if agents experience cognitive dissonance.

Environmental issues are challenging, as they impact the whole collectively but in the long-term. Hence, before engaging in pro-environmental actions, people implement a process of cognitive appraisal, including demand appraisal (monitoring the events with respect to their own individual wellbeing), and resource appraisal (assessing the potential impact of their own action). If they perceive that a stressful situation may be successfully addressed, they engage in a coping behaviour. Chen (2015) finds that perceived collective efficacy (a group's conjoint ability to implement the course of action to achieve a goal) is predicting pro-environmental coping behaviour better than perceived self-efficacy. Such conclusion, valid in a collectivist, long-term-oriented society, is not necessarily true for individualistic cultures, where enhancing the perception of personal efficacy is equally important. Bansal (2003) derives four features of the individual response to environmental concerns:

- no individual responds to the issue if there are neither individual concerns, nor congruence with organizational values;
- there is a positive relation between individual concerns and the scope of the response, but individual discretion moderates this relationship;
- if the issue is in line with organizational values, the scale of response increases;
- the speed of the response is positively related to the congruence between organizational values and individual concerns.

Finally, Vlaholias *et al.* (2015) argue that pro-environmental behaviour is motivated by an evaluation of costs and benefits, and by moral and normative concerns.

MacDonald and She (2015) identify three macro-types of pro-environmental behaviour: curtailing (using less resources, e.g. food input), increasing efficiency, and political behaviours (e.g., advocacy). They list a number of cognitive concepts that affect business pro-environmental behaviour:

- their sense of responsibility (although a responsibility generated by a sense of guilt may potentially reduce the propensity to act pro-environmentally);
- the complexity of the decision-making skills needed (too much information generates anxiety and confusion; relevant information should thus be conveyed in a simple way);
- decision heuristics (which may cause erroneous judgments due to availability and affect);
- the altruism-sacrifice linkage (the perception that pro-environmental actions mean sacrifice may reduce such actions, due to heuristic association between consumption and happiness);
- trust (agents should trust their personal ability to deal with this issue, trust the environmental scientists, the potential benefits of the innovation, etc.).

Environmental concerns have an impact in several fields: they promote the adoption of sustainable innovations (Noppers *et al.* 2014; Pereira *et al.* 2016), of innovative resource management practices (Rossi Borges *et al.* 2016), of reuse behaviours (Babader *et al.* 2016), of waste prevention behaviours (Cecere *et al.* 2014), of a more efficient energy use (Andrews and Johnson 2016), and encourage food donations to redistribution organizations (Vlaholias *et al.* 2015). These concerns reinforce commitment through responsibility, which, limited to environmental problems, may be of two types: for causing, and for solving them. The former can potentially decrease pro-environmental behaviours depending on the solution adopted to solve the dissonance and the sense of guilt; the latter, if properly guided, may increase a business commitment towards the environment (MacDonald and She 2015).

Noppers *et al.* (2014) argues that the adoption of sustainable innovative products is driven by three types of characteristics of them: instrumental (they are functional), environmental (their use is likely to benefit the environment), and symbolic (they enable the owner to signal his status and identity, e.g. as a green, independent person). Environmental attributes are always an important determinant of adoption, but symbolic factors are also influential, especially when instrumental attributes are negatively evaluated, or if an innovation is visible. Pereira *et al.* (2016) found that, among Brazilian commercial beef farmers, there is a sizeable group of committed environmentalists that are likely to adopt sustainable practices and environmental technologies because of their pro-environmental values.

Personal and social beliefs have also a strong impact on business commitment to objectives different from profit maximization. Rossi Borges *et al.* (2016) underline the role of normative beliefs, represented by the influence of the family and traders (a proxy of the power relations), and of control beliefs (firms' perceived capability) in driving innovation adoption. Martínez-García *et al.* (2013) reach a similar conclusion when analysing the intention of Mexican smallholders to adopt improved grassland: these are influenced by their beliefs about the usefulness of the technology, and by social pressure of salient referents. Griffith (2010) argues that the beliefs about food safety hygiene of food handling employees and, especially, of manager (that is inversely correlated with money-saving culture) are essential in promoting the adoption of food safety practices.

At business level, subjective norms depend on the socio-cultural context. Their observance is influenced by reputational concerns, and by the relationship of a business with third parties (either individuals, or businesses). Focusing on the packaging industry, Babader *et al.* (2016) find that reuse behaviour is positively influenced by awareness of environmental issues (which may be increased though communication), by personal and social values, and by subjective norms that, in turn, are affected by community attitudes (of parents, neighbours and friends). Cecere *et al.* (2014) find that social norm pressure drives recycling behaviour, of which visibility is an important component,

Frequently, individuals take a decision based on the number of those who have already taken it.

while waste reduction is implemented mainly due to intrinsic motivations. Steg *et al.* (2014) argue that normative values are weaker when there is a widespread perception that people are violating norms. Granovetter (1978) discusses threshold models of collective behaviour, according to which individuals take a decision based on the number of those who have already taken it, weighing costs and benefits. Although individual thresholds are different from social norms, they are influenced by them and by sociological variables (background, social class, education, occupation), and change only in case of a great emotional shock. Indeed, according to Johnson (1986), it is the sharing of overlapping relations (attitudes, beliefs, interests, similar evaluation of actions, norm consensus) that causes the adoption of innovation in similar times by businesses.

Apart from specific socio-cultural norms, there are also universally-shared practices and principles, the adaptation to which generates convergence among businesses. Compliance takes place by means of coercive, mimetic and normative pressure. Coercive pressure includes «regulations, requirements and expectations imposed by government, by industry and trade associations, and by relationships with external business partners» (Andrews and Johnson 2016, 203). Mimetic pressure is driven by uncertainty and, hence, by «the need of business managers to reassure themselves by copying the practices of respected peer firms», e.g. successful innovations (*Ibid*). Universal models may be diffused unintentionally, through the transfer of employees or turnover, or explicitly, by consulting firms or trade associations. Normative pressure derives from the need of professionalization (establishing the cognitive basis and legitimate the occupational autonomy of a producer), and acts through «rules of thumb, generally used by peer professionals in similar positions», such as conventional wisdom, or universally-spread assumptions (*Ibid*). University specialists, professional networks, and the filtering of personnel contribute to it.

Hence, isomorphism among companies is due to a combination of “natural selection” (i.e. disappearance of some businesses due to competition), and elite-control. Several organizational and field-level predictors may be identified (Di Maggio and Powell 1983). Among the former are dependence from another organization (e.g., a supplier, or distributor), centralization of resource supplies, reliance on academic credentials in the choice of managers and other staff, and participation of managers in trade and professional associations. Among the latter are the dependence of the sector upon a single source of vital resources, frequent transactions with State agencies, a limited number of alternative organizational models, technological uncertainty, high professionalization, and high sector structuration.

Adherence to values and norms has a strong impact also in the interior of the firm. Indeed, organizational commitment (of employees and managers towards the firm) has a normative component, which represents an obligation generated by the internalization of a loyalty norm, or by the desire to repay a favour (Meyer and Allen 1991). In turn, business internal features affect their attitude towards the external world. For example, the adoption of renewable energy by firms is influenced by the behaviour of individual members that, in turn, depends on idiosyncratic factors (values, beliefs, and

norms), on external contextual ones (interpersonal influence, community expectations, socioeconomic and political pressure, etc.), and is shaped by formal and informal organization characteristics (Andrews and Johnson 2016).

However, abiding by social rules (e.g., following routines, and norms) may also have a negative impact. According to Guercini *et al.* (2014), behaviours based on heuristics may be more effective, as they fit both to the local context, and agents' characteristics and skills, ensuring flexibility and adaptation to different local mind sets.

"Familianness", i.e. the fact of being a family-run firm, may imply a set of values and norms deriving exactly from this specific feature. Family businesses show peculiar resources and capabilities (social capital, a small size, personalized control and, thus, coincidence between family and firm reputation), and values, which may push them to avoid dependency from external stakeholders, like financial institutions, and make cooperation with larger partners difficult. Indeed, since small firms lack the potential and the organizational capacities for reaching large markets, they risk becoming dependent on large ones. Usually, the similarity in terms of history, as well as common missions, values, and "familianness" (i.e. if all partners take their identity as a family business seriously) reduce this risk. Dekker and Hasso (2014) mention a research of Barrone *et al.* (2010), according to which public family firms in the US are more environmentally concerned and more environmentally performant than other firms. Instead, they find that private family firms in Australia have a lower environmental-performance focus than non-family ones, since environmental performance usually implies short-term costs they cannot bear. Private firms lack the stakeholders' pressure that characterizes their public counterpart. Public ones are, rather, collectivizing the financial risks of environmental investments, while privatizing reputational gains. If private family firms are embedded in their social context, they tend, instead, to place more importance upon environmental performance than public ones, due to social monitoring. Family firms are better at cooperating and at managing cooperative activities if they use the "family" as a metaphor to connect, and to preserve their independence; they tend to connect with non-competitors, rather than competitors; they install personalized relationships, and are bound together around values and philosophies which become part of the family identity, help unite its members, and may be easily spread through their multiple personal connections. They also require less monitoring by partners due to long-term tenure, and to a governance system highly adherent to family values (Goel and Rossel 2015).

Public firms can collectivize the financial risks for environmental investments while privatizing the reputational gains.

Pro-social behaviour is a consequence of values. Most factors which affect the decision of people to engage in such activity are related to opportunities, e.g. altruism, passion for the issue addressed, recognition of a local opportunity; or to pushing factors such as the lack of jobs (Braga *et al.* 2014).

Cooperation with other companies may support business activities oriented towards specific values, including the environment. Eco-innovations (i.e. innovations aimed at improving environmental performance by achieving sustainability) are stimulated by business supply networks (Roscoe *et al.* 2016). Businesses that implement eco-innovation concerning the operations of a supplier are more likely to achieve sustainable performance.

Finally, communication with neighbours helps spread pro-environmental innovations ("neighbourhood effect"). Nyblom *et al.* (2003) find that Finnish farmers start organic agriculture based on the decisions of their direct neighbours. Early adopters are "independent thinkers" driven by values, imitators are motivated by legitimacy concerns, and late adopters implement a cost-benefit analysis, since the innovation has already affirmed itself as "normal".

Which role for policies? Policymakers aiming at making individuals and/or business adopt pro-environmental behaviours and innovations should take into account whether the motivations of their policy targets are extrinsic or intrinsic. Noppers *et al.* (2014) argue that the adoption of sustainable innovations is driven more by their environmental and symbolic attributes than by instrumental ones. Hence, policies aimed at enhancing their acceptability and adoption must stress the former rather than the latter, especially during the first stages of diffusion. According to MacDonald and She (2015), since the motivation for engaging in pro-environmental behaviours is often extrinsic (derives from a reward), policymakers should try to internalize this motivation. Also, individuals overwhelmed by information can feel powerless: the necessary knowledge (industrial standards and regulations, interaction incentives, and educational feedback) needs to be conveyed in simple ways. Pereira *et al.* (2016), for example, argue that Agricultural Innovation Systems (AIS) should be adapted to their social environment, in order to be successful. Different values of different groups of producers should be taken into account to ease innovation adoption.

Being a hidden action, waste reduction is driven more by intrinsic motivations than by the search for reward. Standard economic incentives negatively affect these motivations by turning a previously non-monetary relationship into a monetary one. However, this crowding-out effect may become a crowding-in one if agents are allowed to choose between increasing their economic rewards and supporting an environmental cause. A potential fiscal strategy could be allowing people to decide how the income of a tax on waste may be used to support environmental tasks (Cecere *et al.* 2014).

Policymakers have different environmental policy instruments available in order to stimulate related innovation. Jaffe and Stavins (1995) compare market-based ones (Pigouvian taxes and adoption subsidies), preferred by the economists for the cost-effective resource allocation they favour, and regulatory ones (technology standards). They find that a subsidy of the same magnitude of an energy tax would have a significantly larger positive impact on the rate of technology diffusion. However, the perceived permanence of the tax is fundamental for its effectiveness. Instead, direct regulation seems not to have had a significant impact on adoption. Also, imperfect information

among the adopters does not have any important effects, and the adoption by others is not improving the dissemination of information. Coercive pressure includes both national standards and the regulations of use (Andrews and Johnson 2016).

Finally, the adoption of innovations may be affected by constraints external to the firm. Cruz and Catz-Gerro (2015) study the strategies adopted by Portuguese public transport firms to incite sustainable consumption practices. Although these companies are committed to change employees' or consumers' behaviour, their choices are constrained by economic factors (resource availability, and fuel markets). The policy maker is aware that its solution should fit the social and cultural context, while trying to modify it. Furthermore, they realize that they must question the concept of "consumer sovereignty".

Relations with other typologies

- 1** Values, beliefs, and norms have a collective dimension, i.e. they are shared by a community (4.5).
- 2** Individuals may experience a contradiction between values and action (cognitive dissonance), since they are affected by systematic behavioural biases (4.3.2), and by time inconsistency (4.3.4).
- 3** Values and beliefs reinforce individual (including business) and organizational commitment (4.3.4).
- 4** The decision of individuals to engage in pro-environmental behaviours may be affected by heuristic cues (4.3.2), and by trust in both their own capacity, and in collective efficacy (4.5.1).
- 5** Businesses, engage in pro-environmental behaviours because of their symbolic value, which allows reputation building (4.5.2); this is especially true for community-embedded family businesses, which are subject to social monitoring.
- 6** Optimism (belief of succeeding in the present and in the future) may prevent successful profit maximization (4.3.1).
- 7** Compliance with social norms may take place through imitation of successful models (4.3.2), or due to reputational concerns (4.5.2).
- 8** Pro-social behaviour (4.4.3) is driven by individual (idiosyncratic), or by socially-shared values.
- 9** Cooperation among businesses (4.5.3) favours the diffusion of environmental concerns and, thus, of pro-environmental innovations.

4.4.3. Pro and anti-social behaviour

Purely rational agents do not account for the consequences of their actions and decisions on the surrounding communities, except for the potential externalities on their own welfare. This is clearly not true in many relevant economic situations (Jackson 2005). Indeed, the social capital literature has

observed that individuals frequently take actions that benefit (or damage) the whole society (Putnam 1995).

Firms are embedded in communities and markets where competition is not the only force present. The tendency of companies to adopt pro-social behaviours is testified, for example, by the introduction of environmental concerns (Cropper and Oates 1992) in business decisions. This section discusses the literature on pro and anti-social behaviour of firms, as it manifests through altruistic or philanthropic behaviours. Although reciprocity and reputation building are without doubt a source of pro-social behaviour, these typologies will be described more in depth in the following.

Pro-social behaviour refers to acting kindly and helpfully towards strangers also if caregiving is not part of one's professional role (Vlaholias *et al.* 2005). It includes philanthropic and altruistic behaviours. Its contrary is anti-social (or deviant) behaviour, which refers to a negative or destructive behaviour intended at hurting an organization or its members through actions or words (Lapointe and Vandenberghe 2015). Every individual presents both altruistic and selfish tendencies. The personal level of altruism depends on the local social and ecological environment, and on how these elements interact (Trivers 1971). This attitude may be culturally transmitted through social learning, imitation, and teaching (Fehr and Fischbacher 2003). Melé (2010) argues that the evaluation of an action with respect to human good (rather than subjective or social values, or aprioristic principles) is constitutive of the action itself.

While investigating values, attitudes and motives of business food donations to food redistribution organizations, Vlaholias *et al.* (2015) identify eight mechanisms which drive pro-social behaviour: awareness of need, solicitation (being asked to give, directly or indirectly), costs (including bureaucratic obstacles) and benefits of donating (in monetary terms), altruism, reputation (e.g., being seen by others), potential psychological benefits (e.g., building one's identity as an empathetic person), values (e.g., post-materialistic political goals), and efficacy (perceiving that their contribution has a positive social effect). In a more general setting Trivers (1971) considers that altruistic tendencies are influenced by friendship, liking or disliking (individuals tend to act more altruistically towards their friends, or towards those they like), gratitude (the greater the need of the recipient, the greater his tendency to reciprocate), the practice of moralistic aggression (in order to avoid being the victim of prolonged cheating when in vulnerable positions), sense of guilt and reparation, and mimics (reproduction of the traits of altruistic individuals in order to influence others' behaviours at one's advantage), etc.

Most individuals engage in altruistic acts for egoistic goals.

Overall, two broad typologies of altruism may be identified, based on agents' motivations: "pure", and "impure". "Purely altruistic" agents pursue intrinsic objectives: they are not interested in monetary rewards or social approval, but obey only to their values and preferences. Instead, "impurely altruistic" ones are driven by extrinsic motivations (external pressure, and reward,

either in monetary or reputational terms): for them, the visibility of the altruistic action is fundamental. Enquiring the motivations of waste prevention behaviour, Cecere *et al.* (2014) find that it relies mainly on intrinsic altruistic motivations, while recyclers' green preferences are motivated by the search for visibility and, hence, by social reward. It derives that recyclers are not necessarily waste reducers, and a trade-off may exist between these two types of altruism. Also, MacDonald and She (2015), who analyse the interactions between customers and eco-producers, find that altruism may prevent pro-environmental actions, since it is often heuristically associated to sacrifice, while consumption levels are associated to happiness. Andreoni (1990) argues that purely altruistic models lack predictive power, since most individuals engage in altruistic acts for egoistic goals, like avoiding scorn of others, or receiving social recognition. Hence, he elaborates a model of "impure altruism", where the utility of the altruist person is influenced both by the overall gain of the beneficiary of his altruist act, and by the amount of his individual donation. In this framework, the donors to private providers of public goods gain utility from the act of giving. Moreover, the Author finds that the overall amount of the donations is not independent from income distribution in the society: the level of altruism of people declines as income grows, with the exception of those in the highest income classes. Also kin selection (i.e. altruistic acts directed towards individuals who share genetic ties) must not be classified as altruism, since these acts help preserve one's genetic patrimony (Trivers 1970).

This duality of altruism has important implications for the food sector. First, Vlaholias *et al.* (2015) argue that food donations may have also a negative impact on the reputation of donors: while money-donating businesses are usually perceived as successful, food donors may be perceived to have mismanaged their demand and supply; hence, they would avoid donating. Second, in the presence of altruistic preferences, strategic complementarity among businesses (they replicate the actions followed by others) is more likely to be observed. Strategic complementarity exists among retailers and consumers, while the interrelationships among retailers (quantity – Cournot – competition in imperfect markets) involve strategic substitutability (Fehr and Tyran 2005).

"Impurely altruistic" firms implement altruistic behaviours if they have the possibility of building a reputation of being altruistic, and if they can benefit of altruistic acts through reciprocity. This is important, since every individual possesses both altruistic and cheating tendencies (Trivers 1971), and altruistic and selfish individuals interact daily. In such a framework, the latter are likely to cheat (free ride), while the former are willing to punish them for preventing unfair behaviours. Cheating refers to the tendency not to reciprocate, regardless of a conscious intent or moral concerns. Gross cheating is observed when the cheater fails to reciprocate, or if the altruist act of the cheater brings less benefits than the cost of the act for the altruist; subtle cheating consists in

Impurely altruistic firms implement altruistic behaviours if they have the possibility of building a reputation of being altruistic.

giving less than the partner would give in a reversed situation. Generally, altruistic behaviours generate benefits when the advantage for the recipient is worth more than the cost of the act for the performer (Trivers 1971).

In order to prevent cheating, reciprocators implement altruistic punishment (altruistic rewarding, and norm-abiding). However, “purely altruistic” individuals tend to be strong reciprocators: differently from reciprocal altruists, they punish selfish individuals (free riders) also if it is not in their own interest. Strong reciprocators are common in different cultures. In populations with a majority of strong reciprocators, the presence of a small minority of selfish individuals is enough to make zero cooperation the only possible equilibrium. However, if there is the possibility of future interactions, and altruistic punishment is allowed, reputation building becomes fundamental, and cooperation is more likely (Fehr and Fischbacher 2003; Nowak and Sigmund 2005). The persistence of the propensity to cooperate may be fostered also through other mechanisms, among which spatial, multilevel and kin selection, which may result in the stigmatization and the social exclusion of cheaters by altruistic individuals (Rand and Nowak 2013; Kerr and Levine 2008; Kurzban and Leary 2001).

The benefits of acting altruistically expand beyond one’s social group. Indeed, reputation is transferable to other groups through gossiping or other indirect strategies (Semmann *et al.* 2005). Moreover, most altruistic acts imply transferability: they benefit not only their direct recipients, but also individuals linked to them. Hence, pro-social preferences strongly rely on availability of a full overview of their consequences: if these are unknown, social behaviours tend to become less prevalent. Individuals are less likely to reward people who have several linkages, since it increases unpredictability of the value transferred (Harmsen-van Hout *et al.* 2016).

Pro-social preferences generate a specific way of doing business: social entrepreneurship. This is «a process that involves recognition, evaluation and exploitation of opportunities resulting in social value that involve the provision of basic needs» (Braga *et al.* 2014, 12). While commercial entrepreneurs are usually motivated by extrinsic and hedonic factors, social ones favour intrinsic and eudemonic motivations: altruism, passion for the issue addressed, etc. As mentioned in the previous section, socially-oriented producers, differently from commercial ones, maximize on value creation, while adopting a satisficing behaviour as for value capture. Instead, philanthropic organizations engaged in the advocacy and redistribution camps (which provide public goods instead of creating value) either maximize their profits in order to invest in their mission, or reinforce their mission by avoiding profit maximization (Agafonow 2014). Socially-oriented businesses are more likely to punish a rival if he obtains an “unfair” share of profits (Armstrong and Huck 2010).

Strongly linked to social entrepreneurship is the concept of Corporate Social Responsibility (CSR), defined as «achieving commercial success in ways that honour ethical values and respect people, communities, and the natural environment» (Kong 2012, 323). Studying the effects of a contamination incident on agri-food businesses, Kong (2012) finds that CSR is an im-

portant determinant of investor decisions: it improves their perception of a business, and mitigates their negative reactions toward it in case of shocks.

Which role for policies? Two important policy implications may be derived from the dynamics of altruism described above. First, the model of “impure altruism” elaborated by Andreoni (1990) implies that income redistribution from less to more altruistic agents would increase the overall donations to charity, and that for any given level of tax collected, the total amount of the donations is more consistent if these are spent on subsidizing donations rather than on social grants. Second, since “pure” altruistic individuals are moved by intrinsic motivations, introducing extrinsic economic incentives might have the effect of crowding-out these drivers, rather than fostering pro-social behaviour (Cecere *et al.* 2014).

Relations with other typologies

- 1 While “pure” altruism has intrinsic motivations, “impure” altruism is motivated by reputational concerns, and by a desire of becoming the recipient of reciprocal altruistic acts (4.5.2).
- 2 The interaction among altruistic and selfish individuals affects the outcomes in terms of cooperation, or non-cooperation (4.5.3).
- 3 Altruistic individuals tend to be inequity-averse, thus preferring fair outcomes and decisions rather than unfair ones (4.5.1).
- 4 Pro-environmental values (4.4.2) may be considered a form of pro-social behaviour, and are usually observed together.
- 5 Socially-oriented businesses adopt satisficing behaviour (4.4.1) as for value capture, while maximizing on value creation.
- 6 Pro-social behaviour may be transmitted through the adoption of imitation heuristics (4.3.2).

Box 3: Take-outs – behavioural typologies from relaxing the selfishness assumption

- Micro-businesses engaged in pro-environmental activities prefer to remain as independent as possible from the markets, seek lifestyle regards rather than financial gains, or show resistance to opportunity-seeking.
- Small businesses, and socially-oriented ones tend to adopt satisficing behaviour oftener than their counterparts.
- Businesses tend to choose within a list of potential alternative choices which is censored ab initio, and whose size is static and rarely adjusted along the decision-making.
- When confronting complex regulations (e.g., food safety ones), small firms tend either to conform at a later stage compared to large ones, or to choose partial adaptation or non-compliance as a strategic reaction.
- The level of profits that a business considers “satisfactory” depends on its historical returns, the performance of its peers, its most recent profit levels (salience effect), and on

visible characteristics of the object of choice rather than hidden ones.

- Business altruistic behaviour is driven by their awareness of need, the solicitation by others, a costs-benefits analysis, and the perceived efficacy of their action.
- Recycling and, in general, reuse behaviours are motivated by reputational concerns and social normative pressure, and are thus more likely to be adopted if they are visible; instead, waste reduction behaviours are driven by intrinsic motivations (idiosyncratic characteristics of the individuals).
- While money-donating producers are perceived as successful, food donors may be perceived to have mismanaged their demand and supply, which can damage their reputation among consumers and, thus, reduce their utility; hence, many businesses choose not to display the fact that they waste.
- Socially-oriented producers, differently from commercial ones, maximize on value creation, while adopting a satisficing behaviour as for value capture.
- Self-perceived collective efficacy is predicting pro-environmental coping behaviour better than perceived self-efficacy.
- A responsibility generated by a sense of guilt reduces the propensity to act pro-environmentally, if businesses confronted with cognitive dissonance change their values rather than their behaviours.
- The environmental attributes of an innovation may be an important determinant of its adoption, but symbolic ones (which enable the owner to signal his status or identity) are also influential, especially when instrumental ones (functionality) are negatively evaluated, or when the adoption of the innovation is visible.
- Salient partners, like traders and buyers (especially in cases of monopolies, or monopsonies), and successful family members influence the beliefs of businesses and, thus, their innovation adoption pattern.
- Normative values are weaker when there is a widespread perception that other individuals are violating the norms.
- Although individual thresholds of innovation adoption are heterogeneous and affected by from social norms, they are influenced by them and by sociological variables (social class, education, occupation), and may change in case of great emotional shocks.
- Mimetic pressure among businesses is stronger in case of – among other things: dependence from a single source of vital resources and technological uncertainty.
- Family firms avoid dependency from external stakeholders, like financial institutions, and have difficulties in cooperating with larger partners, but if these are also family firms, cooperation is more likely.
- Family firms quoted on stock exchanges are more environmentally concerned and more environmentally performant than other firms; private family firms have a lower environmental performance focus than nonfamily ones, but if they are embedded in their social context, they tend to place more importance upon environmental performance due to social monitoring.
- Family firms who receive public incentives tend to collectivize financial risks of environmental investments, while privatizing the reputational gains.

4.4 The social dimension of economic relations

The *homo oeconomicus* view of human motivation theorises that people take their decisions in isolation, with the aim of maximizing their individual wellbeing. Evidence from both behavioural economics and evolutionary social sciences show that social forces, and the social environment shape attitudes and decision of economic agents (Putnam 1995; Jackson 2008). The present section focuses on the behavioural factors that represent a deviation from the hypothesis of anonymity of economic relations among businesses, hereby named “behavioural interrelationships”. The section is divided in three parts:

- the first analyses two social aspects that shape the decisions taken with respect to peers: trust, and inequity aversion, or fairness;
- the second studies the impact of the position in the social system on business decision-making, discussing issues of reputation, social standing, and reciprocity;
- the third studies the scaffolding structures that constrain and condition company decisions, such as the creation of cooperatives, networks, and alliances.

4.5.1. Trust and fairness

Businesses form linkages with partners, suppliers, clients, and even with competitors, that go beyond pure monetary bargaining. These relationships tend to be stable over time. Such stability and long-term orientation are in large part due to the emergence of trust among businesses (Suvanto 2012; Sharif *et al.* 2005), and to the adoption of a fair and reciprocal behaviour (Rabin 1993). When these aspects are considered, relationships are not anonymous anymore, and individuals must consider the potential consequences of their decisions on their social relationships with other individuals. This section discusses the implications in terms of business interrelationships of trust, and inequity aversion, or fairness concerns.

Roessl (2005), cited by Hatak and Hyslop (2015, 6), defines trust as «having sufficient levels of positive expectations regarding [a] partner’s behaviour to feel able to commit valuable resources (e.g., finance, know-how, etc.) to the cooperation with that partner, despite the risk that [it] might take (unfair) advantage of this relationship, and abuse this trust». Trust emerges through a long history of cooperation, and through building a reputation of being a reliable partner. Honesty, and a fair behaviour are two necessary features for a business to achieve the trust of its partners.

According to several authors, trust is an alternative mechanism to formal governance for reinforcing alliances. Indeed, it strengthens collective commitment within a community, favouring collective action among different types of businesses (Crespo *et al.* 2014; Pesämaa *et al.* 2013). Formal governance is introduced only when trust proved not to be reliable (Li *et al.* 2008). Sharif *et al.* (2005) define trust as a second order construct of two dimensions: credibility (cognitive) and benevolence (behavioural). Accord-

ingly, they identify six antecedents of it: three cognitive (reputation, skills, transaction-specific investments), and three behavioural (communication, coercive power, flexibility). Suvanto (2012) identifies three possible representations of trust: an operational element that allows achieving successful and stable relationships through compliance to rules and routines; a common recognition of the context as a framing element of the relationship, which allows achieving control through reputation and asymmetry; a mix of individual bonds and personal characteristics, that humanize the relationship.

The process of building trust differs depending on business size (large or small), its type of management (family or other), and the type of alliance (vertical or horizontal). Overall, small firms tend to assign a greater importance to personal interrelations, and to informal communication, while large businesses favour formal governance (Sharif *et al.* 2005; Pesämaa *et al.* 2013; Reynolds *et al.* 2009; Gyau *et al.* 2011). When businesses of different sizes are concerned, the abuse of power by large partners severely reduces the level of trust (Sharif *et al.* 2005; Reynolds *et al.* 2009; Gyau *et al.* 2011). Reputation (product, brand, and individual, i.e. of managers), followed by flexibility, has the strongest impact on the development of trust among small and medium enterprises (Sharif *et al.* 2005). Investing in the alliance has a positive impact on trust, since it creates psychological ties; instead, partners' skills do not have a great importance. Less powerful partners play a major role in determining alliance stability, since their small size is often deemed a sign of lack of competence, which needs to be compensated (Viitaharju and Lähdesmäki 2012). Trust and reciprocity, built on personal relationships, play a paramount role in fostering interpersonal and inter-organizational commitment within small business cooperatives, helping them systematically cope with risk and uncertainty (Pesämaa *et al.* 2013). Instead, large firms are able to handle communications in an interpersonal way, due to better management practices (Reynolds *et al.* 2009). A certain organizational slack on both sides (so that the partnership does not interfere too much with the long-term capacities of single businesses) reduces the risk that larger partners take advantage of the smaller (Hatak and Hyslop 2015).

Regardless of their size, family firms tend to highly evaluate trust compared to other types of businesses. The similarity among firms in terms of history, mission, values and "familiness", and their dependence from each other (i.e. if each of them provides a unique contribution to the alliance) reduces the risk of opportunistic behaviours (Hatak and Hyslop 2015). However, studying the effects of social capital on collective action in the Mexican agri-food system, Crespo *et al.* (2014) find that family networks may also have strong exclusiveness power, generating clannish behaviours, elite capture, and barriers to entry.

Family firms tend to evaluate trust more compared to other types of businesses.

In the food processing industry, hierarchical relationships are the norm due to different sizes and logistic resources, but they can work well anyway (Suvanto 2012). Reynolds *et al.* (2009) find that German agri-food business-

es consider their relationship with the main buyer, or supplier, rather sustainable. The outcome depends on which sector of the supply chain is concerned: the relationship between farmers and processors is stronger thanks to the role assigned to tradition and trust by the former compared to retailers. Gyau *et al.* (2011) find that the relationships between German dairy firms and milk suppliers depends on a composite mix of the levels of trust, satisfaction and commitment. Behavioural factors, such as a regular flow of information and communications, and a transparent process of determination of the prices, are much more relevant than paying higher prices for building trust among businesses. Behavioural factors include restraining from the use of power, and solving the conflicts through friendly and informal mechanisms. Retailers try to minimize their risk by choosing the suppliers of products that have a stable market share (Viitaharju and Lähdesmäki 2012).

Trust minimizes uncertainty, reducing opportunism. Hence, it is one of the criteria used to select alliance partners. It is the most important criterion if alliance manageability and output interpretability are both low. Instead, when both dimensions are high, financial payoffs, trust, and commitment appear to be equally important (Shah and Swaminathan 2008). The impact of trust is not limited to current alliances. Reputation of being a trustworthy firm is, indeed, transferable to other social groups through gossiping or other indirect means (Semmann *et al.* 2005).

Overall, the interaction between trust and cooperation is a complex one. On the one hand, these two behavioural typologies are mutually reinforcing (Yamagishi *et al.* 2005); on the other hand, cooperation without trust is also possible and is, in some cases, more stable (Cook *et al.* 2005). Yamagishi *et al.* (2005) show that, alone, neither trust, nor cooperation can produce individual welfare, while maximal social welfare is achieved through mutually trustful cooperation. However, in the first phases of interaction, trust emerges as a result of cooperation rather than vice versa. Hence, a risk-taking attitude (unconditional cooperation) is needed. Once the process is started, this relation is mutually reinforcing. The reciprocating strategy – defection and less trust in exchange for defection, and vice versa – is not a viable choice to achieve durable cooperation. Cook *et al.* (2005) argue that trust can work as a complement of governing institutions rather than as a substitute of them. Indeed, economic agents in developed societies use other mechanisms to secure cooperation (institutional enforcement of contracts, constant monitoring, concerns about individual reputation, etc.). Lack of trust, or even some distrust, can be more successful in generating cooperation, because it pushes people to establish institutions that promote it, thus reducing risk.

Dealing with the interaction between customers and eco-products, MacDonald and She (2015) find trust has an impact on environmental behaviour. Indeed, in order to engage in such behaviours, individuals should trust their personal ability to deal with environmental issues, environmental scientists, the potential benefits of a pro-environmental innovation, etc.

The counterpart of trust is distrust, defined as having negative expectations about the behaviour and abilities of others, and to which literature has paid less attention. If associated to high self-trust, it characterizes opportunity-oriented entrepreneurs. According to Gudmundsson and Lechner (2013), distrust is positively associated with firm survival, but also with overconfidence which, in turn, is linked with non-survival, as it generates self-reliance above one's capabilities. Distrust may develop when firms are not aware of the antecedents of trust for their partners, hindering the development of the relationship at a profound level (Viitaharju and Lähdesmäki 2012). Distrust is also generated by cheating (the tendency not to reciprocate). Hence, reciprocity is fundamental to support trust.

The utility of economic agents (either consumers or businesses) may be affected not only by the amount of resources obtained (in the case of businesses, by their profit), but also by their distribution among agents. When they prefer fair market decisions or outcomes to unfair ones, inequity aversion is observed. In these cases, they may choose to forego (potential) gains in order to prevent other agents from receiving a superior reward (Reber 1995). Inequity aversion is used here as a synonym of fairness concerns. Fairness may refer either to the internal organization of a firm, or to its relationships with other firms. Fehr and Schmidt (1999) define fairness as self-centred inequity aversion, i.e. caring about the good balance of one's own payoff relative to those of others. Fairness within a cooperative alliance is defined by Luo (2005, 696) as procedural justice, that concerns «the decision-making process, and the procedures that influence each party's gains and interests». However, it is arduous to define fairness in absolute terms. Indeed, when judging the fairness of an action, people's perception depends on whether the same issue is framed as a reduced gain, or as an actual loss: in the latter case, it is more likely to be judged as "unfair" (Kahneman *et al.* 1991).

The businesses engaged in alliances are exposed to the risk of appropriation of their knowledge and other resources by their partners. Therefore, fairness within alliances is fundamental. In order to foster it, firms adopt different strategies, among which creating equity-based governance structures, and carefully selecting their partners (Li *et al.* 2008). If prior alliances were not able to build high levels of trust, firms tend to avoid creating new alliances with their former collaborators: current partners (friends) and strangers are preferred for R&D alliances. Luo (2005) finds that the level of perceived procedural justice *shared* by alliance members has a stronger positive correlation with alliance performance than the *unilateral* perceptions of single members. Shared procedural justice is even more important in relation to performance when there is cultural distance among partners, or when a sector faces structural uncertainty. The age of an alliance has also a strong positive effect on shared procedural justice and, thus, on profitability. However, Wu *et al.* (2016) argue that businesses are not necessarily implementing alliance-specific asset investments and cooperative behaviours because of loyalty and reputational concerns, but, rather, because such investments make the exchange of partners less likely, cementing the relationship. Still,

the frequency and the length of prior inter-firm relationships remain two fundamental factors for an alliance strength.

Reputation will be dealt with in depth in the following section. Here, it is important to point out that trust is often reciprocal, and that a business must understand the perception of trust by its partners (Suvanto 2012). It derives that fairness and trust are strongly related. When answering automatically and intuitively, individuals favour cooperation based on reciprocity (Rand and Nowak 2013). However, the propensity to cooperate can decrease fast if within a group there is even a small number of selfish and, thus, untrustworthy individuals. An important instrument in order to avoid unselfish behaviours, promoting trust, is indirect (strong) reciprocity (Nowak and Sigmund 2005). Socially-oriented businesses may punish rivals if they obtain an “unfair” share of profits (Armstrong and Huck 2010). Businesses involved in several alliances would avoid exerting their power on weaker network members, in order to keep their reputation of trustworthy firms (Bae and Gargiulo 2004). Finally, in a situation where, apart from purely self-interested individual, there is even a small fraction of people moved by fairness considerations, a cooperative outcome is still possible (Fehr and Schmidt 1999).

Which role for policies? According to Rossi Borges *et al.* (2016), family businesses are often lacking confidence in their own capability of using an innovation. Hence, policymakers should provide practical demonstrations of how to use it, and explanations about its beneficial outcomes on the ground. Dissemination of information would also be beneficial.

Relations with other typologies

- 1 Fairness in a cooperative alliance implies reciprocity among its members (4.5.2).
- 2 Trust helps businesses systematically cope with risk and uncertainty, reducing them (4.3.3).
- 3 Pro-social behaviour (altruism) increases the reputation of a firm as a fair and trustworthy one (4.4.2).
- 4 The perceived fairness of an action and of its outcomes is affected by cognitive bias (loss aversion) (4.3.2).
- 5 Fairness (understood as procedural justice) is fundamental in order to achieve cooperation (4.54.3).
- 6 Trust and cooperation (4.4.3) are mutually reinforcing; however, in order to durable cooperation, an initial risk-taking attitude (cooperation without trust) is needed.
- 7 While some authors see trust as an alternative to norms (4.5.2) to achieve successful cooperation (4.5.3), other argue that it only complements institutions, but cooperation without trust is stronger.

- 8 Trust in opinion leaders and in the effectiveness of an innovation foster pro-environmental behaviours (4.4.2).
- 9 Trust is a source of (and is reinforced by) normative commitment within an organization, and of collective commitment within an alliance (4.3.4).
- 10 Trust is often reciprocal, and increases through reputation building (4.5.2).

4.5.2. Position relative to peers: reciprocity and reputation

Human cooperation shows complex patterns. Altruistic behaviours may be driven either by purely unselfish purposes (e.g., pro-social motivations), or by the expectation of a return from the recipient (direct reciprocity), or from someone else (indirect reciprocity)⁴. In addition, cultural forces, spatial frameworks (network reciprocity), and social norms largely influence the evolution of cooperation. In particular, the presence of strong reciprocators, ready to punish selfish behaviours, generates an increased collaboration within an observed population. Moreover, literature demonstrates that a co-evolutionary mechanism can operate between the cooperative act and the reputation of the involved agents: on the one hand, cooperation confers the image of a valuable community member to the donor and, on the other hand, the reputation of the donor and of the recipient allows cooperation to evolve.

This section discusses the implications – in terms of behavioural interrelationships and with reference to food waste – of the position of each business with respect to its peers. A particular focus is posed on the search for social reward/reputation, and on the responsiveness to external solicitations.

Natural selection implies competition among individuals and, in general, rewards only selfish behaviours, to the detriment of the population as a whole (Nowak 2006). Nevertheless, evolution can promote cooperative behaviours through different processes «because in the long run they benefit the organism performing them»: direct reciprocity (“reciprocal altruism”) is one of these mechanisms (Trivers 1971). This form of evolution of mutual cooperation implies reiterated and direct exchanges between individuals. The cost of the donor’s act is lower than the deriving benefit for the recipient, and the latter returns the act no matter if the two individuals/firms are unrelated. Direct reciprocity leads to a higher level of organization of the community. This mechanism works if the probability that the same two individuals meet again is higher than the cost-to-benefit ratio of the altruistic act (Rabin 1993; Falk and Fischbacher 2000; Nowak 2006).

A further instrument that contributes to the organization of human societies around unselfish behaviour and cooperative interactions is indirect reciproci-

⁴ Andreoni (1990) hypothesises that individuals are “impurely altruistic”, Trivers (1971) that reciprocal relationships may be established through altruistic act also towards enemies (competitors).

ty. Here, donor and recipient interact randomly: reciprocation can take place only through mediated relationships, where the helping act (e.g., donation to charity) is rewarded later by others (different from the recipient). Coherently with Rabin (1993), Nowak and Sigmund (2005) show that the more the actors are cooperative, the higher the chance to receive back a benefit from someone.

Two main types of indirect reciprocity were identified (Nowak and Roch 2007):

- upstream reciprocity, when a cooperative action stimulates the recipient to act, in turn, as a donor in favour of others;
- downstream reciprocity, when others are motivated by the altruistic act to reward the donor.

The indirect reciprocity mechanism promotes cooperation only if the probability of knowing someone's propensity to cooperate exceeds the cost-to-benefit ratio of the altruistic act (Nowak 2006). Hence, the main driver that may enhance the evolution of cooperation through indirect reciprocity is the reputation achieved by an individual, or by a business as a promoter of altruistic actions. Within this framework, an individual is willing to offer cooperation if the recipient is helpful, or is likely to help others: the two agents need not to interact again, but the donor can count on a probability to be rewarded by someone else (thus being the next recipient). Along this iterative mechanism, reputation plays a pivotal role: it helps the co-operator select and identify the target of the action and, in turn, the cooperative initiative builds a reputation, which makes it self-sustainable.

Indirect reciprocity promotes cooperation only if the probability of knowing someone's propensity to cooperate exceeds the cost-to-benefit ratio of the altruistic act.

Moreover, Semmann *et al.* (2005) show that reputation is transferable to other social groups through gossiping or other indirect means. Authors prove that reputation building has wider effects than in the framework of direct reciprocity and, therefore, represents an important instrument to force selfish individuals to cooperate.

Nevertheless, reputation is not the only leverage of cooperative behaviours. In fact, reciprocal behaviours can be promoted and enforced not only by means of incentives for strategic reputational building (Engelmann and Fischbacher 2009), but also through altruistic punishment of defectors (Sigmund *et al.* 2001; Fehr and Gächter 2002; Nowak 2006, Farjam *et al.* 2015) when established through preliminary communication patterns (Ostrom 2006; Poteete *et al.* 2010), as well as stigmatization and social exclusion mechanisms (Kerr and Levine 2008; Kurzban and Leary 2001).

Reputation itself can represent the expected reward from an economic interaction.

If considering cooperation as a generator of positive externalities, evidences show that reputation may depend on the agent's characteristics too, and that reputation itself can represent the expected reward. Accordingly, Dekker and Hasso (2012) find that, in general, family firms are less concerned about their environmental performance than non-family ones. However, if they are deeply embedded in their social context, thus being subject to social monitoring, they tend to be more environmentally concerned, because they care about family reputation and social legitimacy. In line with these findings, Tolbert and Zucker (1983), cited by Nikolaeva (2014), observe that reputation may become a driver of innovation deployment: early adopters look for economic and technical advantages, whereas late adopters seek the benefits of legitimacy.

Again, in terms of innovation and of position relative to peers, Johnson (1986) finds conceptual and empirical support to the argument that structurally equivalent actors tend to adopt innovation at approximately the same time. This happens since similar actors tend to share overlapping relations (attitudes, beliefs, interests, similar evaluation of actions, norm consensus), thus experiencing relative deprivation: as long as their peers intro-

Structurally equivalent actors tend to adopt innovation at approximately the same

duce an innovation, their utility of adoption declines, so that they tend to adopt it as soon as possible. However, a number of factors mediate the role of structural similarity; among them are information availability, innovation attributes (e.g., effectiveness, costs), and the perception of similarity itself.

Business position relative to peers matters (in terms of both indirect reciprocity and reputation) when referring to their decision whether to adopt food waste-oriented innovation: implications can vary in function of the activity considered.

As for retailers, the introduction of a (uneconomical) solution to prevent or reduce food waste may take the form of a cooperative behaviour whose benefitting recipients are the consumers. The deriving reputation for the innovator (donor) is expected to be rewarded from peers in terms of imitation and, then, of abatement of the investment costs, and through sharing possible revenue burden (downstream reciprocity).

Instead, as for processors, when information about an (economic) innovation adopted by a firm is made available to other processing businesses, this cooperative act benefits recipient peers, and the diffusion of the solution allows to reduce the related costs as a reward for the innovator (upstream reciprocity).

In both these circumstances, both the food supply sector and food consumers may benefit from the community enforcement of reciprocal behaviour and from the evolution of cooperation.

Both cooperating, and advertising cooperation pay. Indeed, a strategic reputational building implies receiving and offering information to orient coop-

erative initiatives towards individuals that have proved to behave pro-socially (see 4.4.3).

Finally, business position relative to peers matters as well when their actions aimed at reducing or preventing food waste are considered:

- structural differences can lead certain types of businesses (e.g. family firms, small scale retailers) to perform acts of altruism (such as lessening food waste) for the purpose of improving their reputation (the expected reward);
- structural similarity with a partner that has already adopted an innovation may influence a firm's decision to adopt the same innovation, if it closely follows its peers' decisions (imitation: see 4.5.3).

Which role for policies? The position relative to peers strongly affects business behaviour, and the consequent policy outcome. Here, two examples drawn from literature are illustrated. First, since small businesses tend to be influenced by important social referents when deciding whether to adopt innovations, policymakers should strengthen the role of these referents, including local opinion leaders, public R&D services, etc. (Martínez-García *et al.* 2013). Second, Cecere *et al.* (2014) point out that the current policy framework on waste prevention is not as developed as that on recycling, as the former is not visible and, thus, hard to stimulate. Policymakers may take advantage of the search for social reward by allowing people to choose whether increasing their economic rewards or supporting an environmental cause, e.g. by choosing how to use the income from a tax on waste.

Relations with other typologies

- 1 Reciprocal altruism implies that company decisions are inspired by values, beliefs and norms: e.g. environmental safeguard, social commitment, moral/normative concerns (4.4.2), and that they concretely produce cooperative acts and beneficial externalities (pro-social behaviour, 4.4.3).
- 2 Mutual acts of (direct or indirect) altruism among firms, and strategic reputational building involve cooperation behaviour and reciprocity networks (4.5.3).

4.5.3. Coordination: cooperatives, networks and alliances

The development of formal and informal relationships among companies implies that market relations are not limited to competition but are actually complex interactions of cooperation and competition activities. Beyond the informal interaction mechanisms generated by reciprocity (Rand and Nowak 2013), interactions among companies may result in the emergence of alliances or networks aimed at fostering a particular aspect of business activities for all members. Examples of such alliances are those aimed at increasing bargaining power (Das and Teng 1998 and

Market relations are complex interactions of cooperation and competition activities.

2000), or at sharing and reducing R&D costs (Goyal and Joshi 2003; Goyal and Moraga Gonzales 2001). This section analyses the activity of coordination among firms, and its consequences on the formation and evolution of formal and informal alliances, or networks. A reference to imitation as an important heuristic for coordination in the context of innovation diffusion within or across networks is also included.

A key factor for stimulating business interactions is a shared understanding of the rules that guide their behaviours, which according to Mouzas and Henneberg (2015) are inscribed in inter-cognitive representations, i.e. the knowledge that individual actors have of the knowledge of others. They are created through recurrent interactions, are significantly different from individual cognitive representations, and are embedded in the networks. Examples include: rules for manifesting consent, legally binding contracts (which override default rules), industry standards (a baseline valid for the whole sector), and explicit regulations. The achievement of a shared understandings of the rules is a strong mechanism of influence, but it can result in myopic herd behaviour.

As already explained in the last paragraph, interactions are facilitated also by the tendency of agents to reciprocate. Rand and Nowak (2013) suggest that the propensity to cooperate can decrease fast within a group even in presence of a small number of selfish individuals. Hence, specific mechanisms are needed in order to guarantee the persistence of cooperation over time. Authors identify five of them: direct reciprocity, indirect reciprocity, and spatial, multilevel and kin selection. E.g., if the punishment of cheaters is possible, few fairness-minded people may force a majority of selfish ones to cooperate, but the contrary is also possible (Fehr and Schmidt 1999).

Under strategic complementarity, a few irrational individuals may generate a large aggregate effects.

The external economic environment can also play a significant role. The outcome in terms of cooperation is determined by the interaction between this environment and the distribution of individual preferences in a group. Indeed, since interacting individuals may be both rational or irrational, the aggregate outcome (market equilibrium) approaches the one hypothesised under the rationality assumption depending on the strategic economic environment (Fehr and Tyran 2005). Under strategic complementarity (if agents replicate the actions of others), a few irrational individuals may generate a large aggregate effect; under strategic substitutability (agents' actions go in opposite directions), a small number of rational individuals may generate an aggregate outcome similar to the rational prediction. Strategic complementarity is observed in several cases: with imperfect competition in the product market (like in the food retail sector), with large externalities and high costs for partner search, technological externalities, preference ex-

Under strategic substitutability, a small number of rational individuals may generate an aggregate outcome similar to the rational prediction.

ternalities, unselfish preferences, etc. Strategic complementarity exists among retailers and consumers, while the relationships among retailers (quantity competition in imperfect markets) imply strategic substitutability. Innovation to avoid food waste (uneconomical) would require the setting of a compensatory high price, but rational agents would not react in the same direction; hence, innovation is expected to be adopted in collusive contexts.

The role played by the external environment is emphasized also in the work of Hitt *et al.* (2000). Authors suggest that firms in emerging markets (Mexico, Poland and Romania) and in developed ones (Canada, France and the US) select international partners of strategic alliances according to different criteria, meaning that a firm's behaviour is embedded within its political, economic and social context. Drawing from literature on resource and organizational learning, Authors assume that firms look either for partners which own resources they can leverage or that are complementary of theirs (and that they may integrate in order to create synergies), or for partners from which they may learn new capabilities. Firms from emerging markets look for technical expertise and financial capital, as well as for partners willing to share their expertise, and to help them develop their skills (due to their low absorption capacity). Instead, companies from developed markets look for partners owning unique competencies, and access and knowledge of local markets, in order to gain competitive advantages; they want to minimize their transaction costs. Overall, the transfer of tacit knowledge (informal learning) is much more valuable than formal one (seminars, written material, etc.), since the latter, available to all, cannot grant competitive advantages.

As for the distribution of preferences within the society, the concept of threshold emerges as a fundamental one. According to Granovetter's (1978) threshold model of collective behaviour, people take decisions based on the share of individuals who have already decided so (when net benefits exceed net costs). Since the aggregated outcome in terms of cooperation results from the distribution of the individual thresholds, knowing the preferences (radical to conservatives), motives, and beliefs of the single actors, which are heterogeneous, is not sufficient for predicting it: small distributional changes may generate large differences. As mentioned above (4.4.2), individual thresholds are affected by social norms or sociological variables, and change only in case of great emotional shocks. Also, they may be situation-specific, and are mediated by friendship, influence of other actors, and spatial and temporal variables. Indeed, most decisions are made in a situation of movement, and are, thus, interdependent over time (the timing of individual decisions matters). Finally, due to systematic misperceptions (ecological barriers, or wishful thinking), or inaccurate judgments (decisions are not always made public by others), individuals cannot always exactly assess the number of participants to a decision.

Valente (1996) enquires the role of social network thresholds in the adoption of innovations by firms. He defines social networks as «patterns of friendship, advice, communication, or support» (Valente 1996, 70), and distinguishes between the *overall social system* and *personal networks*, i.e.

direct ties of individuals within their social systems. Innovators and early adopters have low thresholds, late adopters and laggards, high ones. First, early adopters are strongly influenced by the social system; then, they become opinion leaders within their personal network, affecting the rate of adoption by others. External influence is important in raising the awareness about an innovation, but its adoption depends on the influence of friends and neighbours (behavioural contagion happens through *personal networks*). Hence, every individual has a specific threshold and a specific frame of reference. An important implication is that there is a lag between the exposure to innovations and their adoption, since people continue monitoring their peers' behaviour. Exposure to media and campaigns can shorten this lag.

The relative size of the population of economic agents interacting may also exert a significant effect on agent behaviour and decisions. Ashlock *et al.* (1996) argue that the outcome in terms of cooperation depends on the population size, and on the possibility of either refusing to play or defecting. Indeed, agents reduce the risk associate with cooperation through partner selection, based on the expected payoff. In large populations, defectors may jump from a group to another, avoiding the ostracism utilized by small population to protect themselves. If agents can either refuse to interact, or choose whether to cooperate or to defect, and there is path dependency due to genetic similarities, the results range from full cooperation to complete agents' isolation (in case of intolerance for defection, or if the costs of refusal are small). First, the emergence of cooperation is faster under choice or refusal than in case of round-bird selection. Second, if the refusal to interact not allowed, many populations do not evolve to cooperation, a small number of them experience full defection, and the majority reaches metastable states. Finally, in small population there is a quick loss of genetic diversity because high-ranked actors tend to keep their position and to be preferred as partners.

Alliance formation is subject to path dependency. Studying the impact of employees' mobility between organizations in Sweden, Collet and Hedström (2013) find that the emergence of new ties is contingent upon the direction of past ones (i.e., if employees have moved in a certain direction, their future movements are likely to follow the same direction), and most connections emerge at a geodesic distance of two or three. At shorter distances, the number of contacts is limited, but the exchange of information more intense; at larger distances, the number of contacts increases, but information exchange is very limited, becoming almost absent starting from four.

Alliances are often based on complementary relationship, as in the case of the agri-food sector, where vertical business linkages along the food supply chain are rather common. Studying the criteria used by businesses to select "complementary" partners for international joint ventures, Geringer (1991) finds that task-related criteria are more important than partner-related ones, especially if a firm's core market or technology is concerned. Also, the relative importance of each task-related selection criterion depends on its correlation with three variables, derived from the partner's strategic context:

- whether that dimension is critical to the venture's performance;
- the partner's competitive position with respect to fundamental areas for outperforming competitors;
- the anticipated future difficulties in achieving a competitive position on these areas (relatively more important).

Bae and Gargiulo (2004) show that a business involved in an alliance with non-substitutable partners (i.e. partners which hold fundamental resources) can strengthen its position with respect to the latter by adopting brokerage strategies, i.e. by embedding them within a network of common third-party ties. Indeed, alliances with non-substitutable partners can generate both benefits (access to resources) and costs (like uneven contributions, failure to capture the benefits, dependence, etc.). If the non-substitutable partner is involved within a thicker alliance network, he would avoid exerting its power on weaker alliance members, in order to both preserve his relations with common third parties, and keep a reputation of trustworthy business.

A business involved alliance with non-substitutable partners can strengthen its position by adopting brokerage strate-

Business relationships can take different shapes in different countries. Reynolds *et al.* (2009) enquire vertical business linkages in the German agri-food sector (pig meat and cereal supply chains), focusing on producer-processor and processor-retailer relationships. Most businesses find their relation with the main buyer or supplier rather sustainable, especially between farmers and processors, due to the role assigned to tradition and trust by the former, compared to retailers. The strong competition in the upper stages of the chain is perceived as a driver of collaboration, rather than an impediment. Mature relationships, based on a long collaboration history, are more stable, and often rely on personal knowledge ("one voice"), especially among small businesses. Instead, for young businesses, effective communication is particularly important. Finally, large companies are able to handle communication in an interpersonal way, due to better management practices. Owner-run businesses may be severely affected by the retirement of specific people, especially if these are not replaced by people culturally and socially similar to their partners. As for large-scale retailers, Authors warn that abusing of powerful market positions may severe inter-business relationships: effective communication and building of personal bonds help prevent this. Karantininis *et al.* (2010) enquire the impact of vertical integration and of network relationships on the innovation behaviour of Danish agri-food firms. Vertical integration is an important determinant of innovation adoption; downstream integration is particularly effective: a company that owns a downstream firm, or is owned by an upstream one is innovating oftener than in the opposite situation. Networks (exemplified by contractual relations), as well as market power (a larger number of buyers and sellers) have also a strongly positive impact. Business size and export orientation are two other significant determinants of innovation adoption, middle-size

firms being the most likely to innovate. The sector (fruits, pork meat, etc.) is not relevant.

Businesses engaged in R&D alliances are exposed to the risk of appropriation of their knowledge by partners.

Businesses engaged in R&D alliances are exposed to the risk of appropriation of their knowledge by partners. In order to avoid this eventuality, they adopt three different strategies: creating an equity-based governance structure, narrowing the scope of the alliance, and carefully selecting their partners. Li *et al.* (2008) classify potential partners into three groups: friends (with whom the firm has developed strong trust through previous interactions), acquaintances (a few prior interactions, semi-strong or weak levels of trust), and strangers (no prior interactions, weak trust). Authors find that partner preferences are not transitive: since prior alliances expose a firm's core knowledge, upon which its competitiveness is based, if they were not successful in building high levels of trust, their former members are avoided. Therefore, friends are favoured for R&D alliances, and strangers are preferred to the acquaintances on which the initiating firm has not enough reliable information. This is particularly true if radical innovations (implying a break of the existing paradigms, and a shift of the basis of competition) are concerned. Moreover, formal governance is introduced only when other mechanisms (trust) proved not to be reliable.

Shah and Swaminathan (2008) find that partner selection criteria are contingent on the type of alliance. In particular, alliances are initiated by a partner, who evaluates the level of projected satisfaction with his chosen partner according to four criteria: trust (that minimizes uncertainty, reducing opportunism), complementarity with that partner, commitment (tangible inputs or contribution), and financial payoffs (how much a partner can increase the alliance's financial value and provide strategic advantages). The relative importance of these factors is mediated by the alliance type, i.e. by its process manageability, and its outcome interpretability. Trust is the most important factor if both of them are low; complementarity is the main one if manageability is high, and interpretability is low; commitment is the most important if manageability is low, and interpretability high. Finally, if both dimensions are high, financial payoffs, trust and commitment are equally important.

Beckman *et al.* (2004) find that businesses choose whether to reinforce their existing networks or creating new ties based on the type of uncertainty they face. Authors distinguish two types of uncertainties: firm-specific (unique), and market-based. The former is usually more controllable, and appears when a firm enters a new market, acquires another firm, or changes a top manager; it includes also technical uncertainty (since other firms have different capabilities which allow them to address an innovation differently). Authors identify also two types of networks: interlocking directorates (stable and institutionalized), and strategic alliances. Broadening ties has *explorative* functions, reinforcing existing ties, an *exploitative* one. A firm reinforces its existing links when experiencing market uncertainty, and broadens its strategic alliances if confronted with very high firm-specific uncertainty; it ex-

plores less in all other cases. Hence, market uncertainty causes firms to «solidify and even balkanize» the existing network structure (Beckam *et al.* 2004, 272). As long as the tendency to reinforce existing links is concerned, the results are similar for both interlocks and alliances, while broadening is not influenced by firm-specific uncertainty if interlocks are concerned. Alliances are broadened only when firm-specific uncertainty is high, and market-based uncertainty low; otherwise, market-based one prevents the creation of new ties. Also, alliances are much more common than interlocks, and the latter tend to change much more slowly.

Crespo *et al.* (2014) analyse the case of a local agri-food system in Mexico, in order to assess the role of social capital in turning inherited resources and know-how into market opportunities. They study the case of a cooperative of milk producers, detecting opposite and ambivalent effects of social capital: it can either foster collective action, or generate clannish behaviours, elite capture and barriers to entry. E.g. friendship networks, although lacking the exclusiveness power of family networks, are characterized by a low level of trust and cohesiveness, so that producers have weak incentives to join.

Abrahamson and Rosenkopf (1997) enquire the motivations for which some innovations spread rapidly and extensively, while others spread only partially, or not at all. They find that the speed of adoption is affected by the structure of social networks. Most theories hypothesise a bandwagon effect: as the number of adopters increases, also the pressure to adopt the innovation increases. However, social networks may be segmented by internal boundaries (cultural, geographical, status, sectoral, centre/periphery, etc.), which prevent the diffusion. Apparently insignificant idiosyncrasies and the initial distribution of preference can have large effects in the long term. The information is channelled by the networks towards specific agents, usually belonging to core circles. Then, adoption is influenced by the threshold and the density of links of these specific agents, and by two idiosyncrasies: network pressure points (when a potential adopter has ties with many potential adopters located on the other side of a boundary, he adopts the innovation if many of the latter adopt it, allowing boundary crossing), and weaknesses at internal boundaries (if a potential adopter has a tie across a boundary, and a low adoption threshold, a single adoption is sufficient to make him adopt the innovation)⁵. This model explains why an innovation may prevail over a superior variant.

Roscoe *et al.* (2016) argue that firm networks are fundamental in order to stimulate eco-innovations. These can be either incremental (e.g. an agreed activity standard), or radical (e.g. a new renewable energy technology), and involve either the process, the product, or the organization. Distancing themselves from the supply chain approach, Authors define industrial supply networks as «all actors within an industrial sector, or between related industrial sectors, who may cooperate to add value for the consumer» (*Ibid*, 1949). Authors identify three types of network which help develop eco-

⁵ This model assumes that innovation returns are constant with respect to the time of adoption.

innovations: “tight” ones (strong ties with a few strategic suppliers), “loose” ones (multiple weak ties with suppliers), and “bridging” ones (weak ties with suppliers that bridge structural holes in the network). First, they find that firms which implement eco-innovation in the operations of a supplier are more likely to achieve sustainable performance. Second, “tight” networks favour incremental innovations (process rather than product-based), because they allow spill-overs from suppliers. Third, firms which choose “loose” or “bridging” networks are more likely to discover radical eco-innovations, usually product rather than process-based.

Imitation is an important heuristic for diffusing an innovation within or across networks. Studying the pattern of adoption of organic farming in Finland, Nyblom *et al.* (2003) find evidence of a “neighbourhood effect”. In presence of economic incentives, farmers tend to adopt innovations based on the decisions of their direct neighbours. Authors control for the effect of both a number of covariates (product characteristics, geographic suitability) and time. While the covariates do not have a significant effect, social influence (communication with neighbours) creates a strong spatio-temporal correlation in the early stages. This correlation declines over time: early adopters are “independent thinkers”, their first imitators are motivated by legitimacy concerns, and late adopters base their decision on a cost-benefit analysis, since the innovation has already become a “normal” option.

Finally, Tsai (2015) finds that performance and innovation within organizational units are affected by the relative position of this unit within the organization, its absorptive capacity, and their interaction. A central position allows accessing more information. This may be achieved through networking effort; however, maintaining such position requires intensive coordination, and administrative costs. Instead, the absorptive capacity (ability to assimilate and replicate the knowledge acquired from external sources) allows using this information for innovating.

Which role for policies? Business coordination may be stimulated by policy-makers; however, the outcome is not always satisfactory. Rossi *et al.* (2016) find that the imposition of specific requirements for a network in order to be eligible for funding has an immediate effect on the size and composition of networks, but the required behaviours are not going to persist in the following policy interventions, although additional actions are implemented.

Moreover, business coordination may have a positive effect on business wellbeing, while reducing social welfare. For example, alliances allow the bundling of products from different firms (so that consumers get a discount if buying all of them) whose prices are set non-cooperatively (autonomously by each firm). This grants equivalent profits while decreasing social and consumer welfare. According to Armstrong (2013), if such strategy is justified advancing efficiency gains, antitrust authorities should investigate if these gains could have been achieved also without it, thus detecting cases of cartel collusion. Also, Crespo *et al.* (2014, 176) warn to «take into caution the “celebratory tone” of the positive role of social capital on collective action», since small family cliques can turn its benefits towards their interests.

After analysing a case of failure of a network of milk producers in Mexico, they suggest to local policymakers to try to disseminate the benefits of collective action within the community by relying on professional networks (e.g., producers' networks), thus avoiding the pressure of family cliques.

Finally, individual thresholds to innovation adoption are affected by social norms or sociological variables, and thus they change only in case of great emotional shocks. This could make the innovation thresholds more difficult to change through policy levels.

Relations with other typologies

- 1 Cooperation can represent a tool to reduce risk and uncertainty (4.3.3).
- 2 Human beings favour cooperation based on reciprocity (pro-social behaviour, 4.4.3); however, the propensity to cooperate can decrease fast if within a group there is even a small number of selfish individuals.

Box 4: Take-outs – behavioural interrelationships (social dimension)

- The level of trust among partners increases as the duration of a cooperative alliance increases.
- If an equivalent outcome is framed as an actual loss rather than as a reduced gain, it is more likely to be judged as "unfair".
- In some circumstances, if a prior alliance was not able to build high levels of trust, its former members tend to avoid creating new linkages among each other: current partners and complete strangers are preferred to acquaintances, especially if radical innovations are concerned.
- Small businesses assign a great importance to personal interrelationships, and to informal communication; large ones favour formal governance of alliances (contracts, communication events, etc.), which is often alternative to trust.
- The abuse of their dominating position by large partners within an asymmetric alliance severely reduces the level of trust.
- The similarity of family firms in terms of history, mission, values and "familiness", their dependence from each other (i.e. if each of them provides a unique contribution), and a certain organizational slack increase trust and stability of an alliance.
- The external relationships of owner-run businesses may be severely negatively affected by the retirement of specific people.
- Retailers try to minimize their risk by choosing suppliers of products which have a stable market shares.
- If an alliance manageability is low, and its output interpretability is also low, trust among partners is a key factor of success.
- Trust and cooperation are two mutually reinforcing phenomena, but an initial risk-seeking attitude (cooperation without trust) is needed in order to start the process; instead, reciprocity (defection and reduced trust in exchange for defection) is not successful in the first phases.
- Cooperation without trust may be more stable, especially in developed countries, since it pushes people to establish well-defined institutions (e.g., network regulations) in order

to reduce risk.

- If firms are not aware of the antecedents of trust for their partners, trust cannot be truly reciprocal, and distrust is generated.
- Socially-oriented business may punish other businesses if they judge that they obtained an “unfair” share of profits.
- Large businesses, and those holding a powerful market position would avoid exerting their power on weaker alliance members, e.g. by adopting satisficing behaviour in price negotiations, in order to preserve their relations with common third parties and keep a reputation of trustworthy firms.
- Reputation of being a trustworthy firm is transferable to other social groups and alliances through gossiping.
- Patterns of communication within a group influence the degree of consensus that can be achieved within the group, and the decisions being taken by the group leader.
- The adopter (retailer or manufacturer) of a solution that prevents or reduces food waste can be identified as a donor if the innovation is (downstream or upstream) imitated by peers: this adopter is a donor, and the deriving economic benefit his reward (indirect reciprocity).
- Reputation requires communication of an “image” of innovator agents (donors and recipients), and calls for an active role of networks/alliances and public and private mediators.
- Incentives and altruistic punishments of defectors, as factors to enhance the mechanisms for the evolution of cooperation and benefit the community, imply an active role for public policies.
- The common understanding of the rules that guide business behaviour represents an important factor to cooperate and develop alliances.
- Individuals reduce the risk associated with cooperation through partner selection based on expected payoffs; in large populations, defectors can jump from a group to another, avoiding the ostracism used by small population to protect themselves against free-riders.
- Firms choose whether reinforcing their existing interlocks and alliances or creating new ties depending on the type of uncertainty they face (market-based, or firm-based). As for the tendency to reinforce existing ties, the relation with uncertainty is similar for interlocks and alliances; the choice to create new ties is not influenced by firm-specific uncertainty if interlocks are concerned, while alliances are broadened only when firm-specific uncertainty is high, and market-based uncertainty low (otherwise, market-based uncertainty prevents the creation of new ties).
- In presence of value transferability, links are preferred with weakly connected partners rather than with more connected ones.
- Imitation is an important heuristic for innovation diffusion within or across networks and can shorten the lag between exposure to innovations and their adoption.
- “Tight” networks favour incremental innovations (process rather than product-based) thanks to the spill-overs of suppliers); “loose” and “bridging” networks are more likely to discover radical eco-innovations (product rather than process-based).
- Social relations create spatio-temporal correlation in the early stages of diffusion of a pro-environmental innovation, but not in later ones: early adopters are “independent thinkers” driven by values, imitators are motivated by legitimacy concerns, late adopters implement a cost-benefit analysis, since the innovation has already affirmed itself as “normal”.

5 Business behaviour and food waste: lessons learnt

5.1 Business behaviour in processing and retail

The food supply chain includes five broad sectors: primary production (agriculture, aquaculture and fisheries), processing and manufacturing (food industry), commercialization (wholesale, retail and markets), food services (restaurants, canteens, etc.), and households (i.e. the consumption side). These sectors present different conditions in terms of food waste generation. This report focuses on the processing and retail stages with the aim to understand the impact of behavioural typologies and interrelationships on the propensity of businesses to introduce innovations aimed at preventing (or reducing) food waste.

According to the FUSIONS Project definition, «food manufacturers process raw materials to make food products [...]. During manufacturing, foodstuffs undergo one or more of a whole range of procedures [...], from incoming raw materials to finished products. Different processing industries [...] perform different types of activities when transforming raw materials into various food products. Processes can be relatively simple (e.g. cleaning or bagging of fruits) or more elaborated (e.g. manufactured of prepared meals)» (Tostivint *et al.* 2016, 63). Some processing activities are performed by primary producers, depending on the country and the product. Hence, the resulting waste may be ascribed either to them, or to the “processing and manufacturing” sector, depending on the specific situation, with a view to avoid double counting.

Food retail is a branch of the sector called “wholesale, retail and markets” by the FUSIONS Project. Wholesalers are «business-to-business operations that buy and sell large quantities of goods» (*Ibid*, 74). Grocery wholesalers include four categories, based on the main type of customers they serve and the platform they use: specialist wholesale markets, cash and carry wholesalers, delivered grocery wholesalers, and delivered food service wholesalers. Retailers are operators that «sell goods to consumers, as opposed to wholesalers, who normally sell goods to another business» (*Ibid*, 74). They include both modern grocery retail (hypermarkets, supermarkets, discount shops), and other forms of retail (independent and traditional shops, and “new modern retail”⁶). Finally, markets include «street markets, and covered markets, as well as “farmer markets” – i.e. physical retail markets featuring foods sold directly by farmers to consumers» (*Ibid*, 77). For the purpose of this report, retail refers to retail proper (either modern, or more traditional).

⁶ «E-commerce, drive-through markets, frozen food shops, organic food shops, fresh product shops, and very small supermarkets (<400m²) such as convenience stores» (Tostivint *et al.* 2016, 75).

Retailers may be broadly grouped into large-scale (hypermarkets, supermarkets, and food retail chains in general) and small-scale ones (mostly family shops). Due to mergers and acquisitions, the EU food retail sector has experienced huge economies of scale in the last decades. Small independent groceries have been mostly replaced by large scale retailers. Already in 2004, the top 30 subjects controlled a market share of 63.5 percent; this figure was much higher in Western Europe (e.g., four retailers controlled 76 percent of the UK-wide food market in 2012). These modern large-scale retailers do not have economic incentives for reducing food waste, because they may earn a profit from the waste produced.

Although scholars agree that, in developed countries, households are the main producers of food waste, retailers have a strong influence on their waste attitudes. Hence, in order to reduce the amount of food wasted, the retail sector and, in particular, the issue of its big market power, needs to be addressed. E.g., Adam (2015) suggests to policymakers to focus on labelling (by abolishing quality-related labelling – best-before dates – and empowering an independent commission to set the expiring dates based on product characteristics), and on quality standards (by forbidding the sorting out of food exclusively for aesthetical reasons, in order to make use of the entire crop).

5.2 Business behaviour and innovation adoption

The adoption of innovations may help improve the competitiveness of food businesses, as well as of other firms, and (eventually) reduce the amount of food that is wasted. Among businesses in general, Rogers (1983) identifies four different innovation profiles, based on the timing of adoption: innovators, early adopters, early majority, and late majority. Moreover, he identifies critical masses of adoption (i.e. points after which further diffusion becomes self-sustaining).

Focusing on four qualitative cases from the food industry (a slaughterhouse, a dairy, a bakery, and a nutraceutical), Makkonen *et al.* (2016) define the adoption behaviour of food businesses. They find that it is shaped by the objectives set, by technical infrastructures, by inter-business relationships, and by key individuals. Overall, they identify four typologies of behaviour: the “*builder*” is very active, keeps relationships with both technology suppliers and fellow firms, and continuously scans for potential needs and solutions. The “*bureaucrat*” is active in relation to other firms but less active in relation with suppliers, and less able to match needs with solutions, because of a slow and bureaucratic adoption process. Due to limited know-how and resources, the “*downhiller*” tends to assess technology fit by using it, thus implementing also inefficient innovations, which cause even more problems. Finally, the “*sniper*” focuses on market needs and on their implications for his business, and adopts scant easily reachable solutions, adapting them to his necessities. Based on these observations, Makkonen *et al.* (2016) suggest to food business managers the following lines of action: constantly questioning current performances and routines, supporting the process of

identification of potential needs and solutions, matching the former with the latter, and choosing their best couplings in order to implement them. Therefore, managers should fight the structural inertia that promotes stability, build networks with both suppliers and fellow companies, stimulate the innovation activities of employees, and create procedures that convert initiatives into action.

When dealing with investment choices, business decision-making is influenced by a large spectrum of considerations that include economic and psychological evaluations. This dual framework results even more composite when the innovation is oriented towards addressing the issue of food waste, given the peculiarities of this subject. Apart from technological and organizational implications, food waste presents a number of social, ethic, and environmental aspects. First, since they produce positive externalities, food waste prevention and reduction may be understood as clear pro-social behaviours; also, being associated to the consumption of natural resources in a long-term perspective, they are likely to be affected by pro-environmental values and beliefs, and by social and institutional norms. Also, if considered as a vice, food waste is subject to time inconsistency: businesses tend to postpone the investments aimed at reducing or preventing food waste. Finally, on the one hand, food-saving behaviours have a positive impact on firm reputation; on the other hand, the visibility of such behaviours is limited, and revealing the amount of food wasted may negatively impact on business reputation.

5.3 Behavioural typologies and interrelationships

The literature review on business behavioural economics suggests two main characteristics as far as food waste is regarded: its complexity (multidimensionality), and its uncertainty (of the innovation process, and of its outputs). Complexity is due to idiosyncratic characteristics of businesses, and of their leading figures (either family heads, or managers), to their structural differentiation (large, small, family-led, etc.), their sector of activity (production, retail, etc.), and the external environment (perfect competition, oligopolies, developed or developing countries, etc.). Uncertainty refers to business food-waste-related investment decisions, that are affected by specific behavioural patterns (dynamic inconsistency, imperfect decision framing, etc.), information exchange schemes (formal, informal), and coordination schemes (tight alliances, loose networks, etc.).

Individual *idiosyncrasies* of businesses include the (eventual) acknowledgment of their responsibility for generating food waste, which may undermine their reputation, and their intrinsic motivations, like other-regarding preferences (altruism), values and beliefs, which may push them to implement initiatives to prevent or reduce waste.

The second source of complexity is represented by business *structural characteristics*, i.e. their *size* (small, or large, although the literature reviewed did not report any clear threshold), and their *management* (e.g., family).

Size is probably the most important structural determinant of their behaviour. On the one hand, *small firms* prefer to remain as independent as possible from market pressure, tend to seek lifestyle regards rather than financial gains, and are sometimes reluctant to seek opportunities. They acquire information mostly through informal channels, based on personal interrelationships, and highly evaluate trust. Regular communications, transparent negotiations, avoidance of top-down approaches, and solving conflicts through friendly and informal mechanisms are essential for them to build good interrelationships. They tend to adopt a satisficing behaviour (either by accepting lower profit levels, or by conforming later – or not at all – to complex regulations), and use imitation as the main strategy for achieving their goals in terms of innovation. Most small firms are also family-led. Like overall small firms, *family* ones tend to avoid dependency from external stakeholders and may have difficulties in cooperating with larger partners; however, a common “family” background may help achieve a fruitful cooperation. Although their environmental performance is dubious, if they are embedded in their social context they tend to assign more importance to the environment, due to reputational concerns. They are influenced, in their innovating and other behaviours, by salient local referents, and by successful family members.

On the other hand, *large firms* are more dynamic, and more concerned about their reputation in the market as a whole; hence, they tend to conform fully and faster to formal regulations (e.g., food safety ones). They prefer to acquire information about innovations from experts, or using their internal personnel resources, and rely on originality rather than on imitation when innovation is concerned, although chance plays also an important role. As for their coordination behaviour, they favour the formal governance of alliances (e.g., by signing detailed contracts), rather than informal (trust-based) ties. However, they would avoid using their market power towards smaller partners, especially if they are involved in a large number of networks, in order to preserve their reputation. A specific type of businesses is represented by *socially-oriented* ones. These tend to adopt satisficing behaviour more often than their counterparts, especially when they focus on value capture, while they maximize on value creation. Also, they implement direct or indirect reciprocity, punishing businesses that act selfishly, or that earn an “unfair” share of profits.

A third source of complexity is due to the *sector* in which businesses operate. Indeed, food processors and retailers show clear differences in the structure of economic incentives for the adoption of innovations aimed at avoiding or reducing food waste. On the one hand, for food processing industries, such innovations produce private benefits in terms of productivity, lowering their costs and increasing their revenues; hence, their adoption may represent a rational choice also in terms of financial payoffs. On the other hand, for retailers, reducing waste means reducing their revenues, because they set their prices based on their overall supply, that includes also the food that will be (eventually) wasted. For these reasons, they are in general not keen to invest in waste-reducing innovations, unless prices can be self-determined (like in case of collusion).

The fourth determinant of complexity is the *socio-economic context*. Indeed, food businesses (processors and retailers), operate in imperfect markets, where competition is mainly quantity-based: large firms act as price leaders, small ones are price takers. Due to market segmentation, multi-equilibrium prices are expected. Moreover, businesses are subject to mimetic pressure, which is stronger in case of dependence from a single (or a limited number of) source(s) of vital resources, centralized resource supplies, reliance on academic experts, participation of their managers in professional associations, frequent contacts with State agencies, and technological uncertainty.

Turning to the *uncertainty* which affects investment decisions, a first determinant may be identified in business behavioural patterns: these may be time-inconsistent (i.e. business preferences change over time, with vices being preferred to virtues as the moment of consumption approaches), frame-dependent (which causes under, or over-assessment), or affected by behavioural biases (loss aversion, salience, etc.). Overall, early adopters tend to make independent evaluations and are driven by values, imitators are moved by legitimacy concerns, and laggards implement a cost-benefit analysis.

The second source of uncertainty is due to the patterns of *information* circulation. Information availability shapes firms' foresight, that is usually limited. As specified above, different types of businesses acquire information in different ways: large firms from consultants, small ones through informal channels (from their peers), family firms from local stakeholders (opinion leaders). An innovation can spread also thanks to its visibility, which affects the reputation of its adopters: as for pro-environmental innovations, their visibility is fundamental, especially when their functionality is unclear. Information circulates also across food sectors, and across social groups. On the one hand, retailers, which lose when their level of food waste is reduced, may anyway act as "donors" of information in order to receive reputational gains; on the other hand, processors, that obtain a comparative economic advantage from their innovations, may be induced to share information through altruistic punishment. Information may spread within and across alliances and networks through gossiping (that makes altruistic punishment possible also in large populations). Finally, according to threshold models, clear information about the number of adopters is needed in order for businesses to choose whether to adopt an innovation.

Uncertainty in innovation adoption may be addressed through *coordination schemes*. High firm-based uncertainty (and low market-based one) causes firms to enlarge their alliances, while market-based uncertainty prevents the creation of new linkages. Coordination schemes may be of different types: "tight" and highly formalized (interlocks), "loose" (cooperative alliances), or "bridging" (when their members are located across alliance fractures). "Tight" ones favour incremental innovations, while "loose" and "bridging" ones are more likely to discover radical innovations.

Cooperation is strongly correlated to trust. Although these two phenomena are mutually reinforcing, a risk-taking attitude (cooperation without trust) is

needed in the first phases of cooperation in order to activate the mechanism. In large populations, selfish and defecting firms may avoid building a reputation of being a trustworthy firm by jumping from a group to another, while in small ones this is not possible. Finally, as mentioned above, the coordination scheme preferred by food businesses depends on their structural characteristics: family firms tend to avoid cooperation with large firms (since they are afraid of becoming dependent on them), and base their relationships on trust, large ones usually opt for formal alliances. In some circumstances, cooperation without trust may be even more effective, since it reduces uncertainty through the building of institutions.

5.4 Implications for ABM within REFRESH WP4

The uncertainty and complexity which characterize the phenomenon of food waste imply the opportunity to extend its analysis beyond the standard (payoff-centred) models, by including behavioural economic typologies and interrelationships. In order to achieve this goal, a systematic approach is needed. From the methodological point of view, it may be achieved by means of ABMs.

Overall, the literature review showed that behavioural typologies and interrelationships of food businesses, and their interactions, depend on their structural and managerial typology. Although there is a lack of literature on the food sector, and specifically on food waste, a number of behavioural typologies and interrelationships hold an important explanatory potential with respect to this issue, and to the role of innovation for addressing it. With respect to processors and retailers, and to the market conditions where they operate, the preliminary version of the business ABM will assume two main behavioural schemes, associated to businesses' structural typologies (sizes):

- large businesses (e.g., stock exchange processor companies, large-scale retailers) are characterized by indirect reciprocity, prefer formal coordination schemes, and tend to adopt innovations first;
- small firms (e.g., local processors, family firms, traditional shops) adopt a satisficing behaviour, and imitate the innovation patterns of their most successful peers.

The preliminary model design will be further developed through the introduction of additional behavioural typologies (e.g., limited foresight, risk aversion, pro-social behaviour, intrinsic motivations, etc.) and interrelationships (e.g., dynamics of trust and reputation building, adoption thresholds, information circulation schemes, coordination and alliances, etc.).

The literature review highlighted also the strategic role of information in reducing uncertainty. Thanks to the additional information received from peers, food-waste-concerned firms may overcome their fear of reputation loss, give visibility to their virtuous behaviours, improve (or worsen) their reputation, or build alliances. Moreover, access to information (either formal,

or informal) favours the adoption of innovation through the imitation of successful peers. By means of ABMs, it is possible to model the patterns of circulation of information among businesses, thanks to their networks and alliances at different scales.

Finally, the literature on the behaviour of food businesses is limited, especially with respect to the issue of food waste. Whereas the literature on consumer behaviour and household waste is developing rapidly, the behavioural factors that induce the firms to conceive or adopt innovations aimed at preventing or reducing food waste (or prevent them from doing so) have not been studied in depth so far. Future research needs to inquire the determinants of altruistic behaviours among businesses, and especially among large firms, while future developments in food waste modelling could be oriented to the extension of the analysis from a single sector, to the entire food supply chain. This would allow to identify the interrelationships among the single components of the food supply chain, and their impact on food waste generation.

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7 Appendix

7.1 Glossary of socio-economic terms

Adaptive expectations: Situation in which individual expectations about the future are slowly and incompletely adapted to new information, or new market conditions.

Agent (individual): Economic entity (business or consumer) who acts to achieve its purposes, using heuristic or simple decision-making rules, experiencing adaptation and interaction, and whose behaviour is modelled within agent-based models.

Agent-based model (ABM): Class of computational probabilistic models for simulating the actions and interactions of autonomous agents (both individual and collective entities, such as organizations or groups), with a view to identifying emerging issues at different scales, and assessing their effects on the system as a whole.

Alliance: Agreement, formal or informal, between two or more businesses, in order to perform activities together; it differs from a network since its participants are connected to each other by a contract, or by a set of more or less formalized rules.

Altruism: Attitude of individuals who perform «costly acts that confer economic benefits on other individuals» (Fehr and Fishbacher 2003, 785).

Anti-social behaviour: Negative or destructive behaviour, aimed at hurting an organization or its members through actions or words (Lapointe and Vandenberghe 2015).

Behavioural economics: Science that studies the effects of psychological, social, cognitive, and emotional factors on the economic decisions of individuals and organizations, and the consequences for market conditions and resource allocation.

Belief: Subjective probability that an object (action, relation, etc.) has a certain attribute; agents form their beliefs either based on their own experience, or by accepting the information provided by others (media, friends, family, etc.), or through an inferential process (self-generated beliefs).

Bounded rationality: Characteristic of economic agents with limited computational capacities, whose decision-making process is constrained by the way they process information.

Business (or *firm*, or *company*): Privately owned organization involved in the provision of goods, services, or both to consumers (final or intermediate), in exchange for other goods, services, or money. It refers to a particular organization, such as a single processing company or a large-scale retailer, and not to the entire market sector; within this report, it is intended to include food processors and retailers.

Cluster: «Concentrated group of companies in a particular field, [whose] activities are closely related and complementary to each other [...]. The companies involved include upstream and downstream buyers, as well as suppliers and producers» (Financial Times).

Collective efficacy: A group's conjoint ability to implement the course of action to achieve a goal.

Commitment: Set of «moral obligations of the units of a system of social interaction to maintain the integrity of a value-pattern and to strive toward its implementation in action through combination with non-value factors» (Parsons 1968, 135). Organizational commitment (of managers and employees towards an organization) has three components: affective, continuation, and normative (Meyer and Allen 1991).

Company: see Business.

Consumer: Individual (physical person) who pays for using services and/or commodities, and is the final user of goods (e.g., food), or services (e.g., restoration services) produced, distributed, and sold by businesses.

Corporate Social Responsibility (CSR): «Achieving commercial success in ways that honour ethical values and respect people, communities, and the natural environment» (Kong 2012, 323).

Direct reciprocity: «Direct reciprocity arises if there are repeated encounters between the same two individuals. Because they interact repeatedly, these individuals can use conditional strategies whereby behavior depends on previous out-comes. Direct reciprocity allows the evolution of cooperation if the probability of another interaction is sufficiently high» (Rand and Nowak 2013, 414).

Distrust: Having negative expectations about the behaviour and the abilities of others.

Duopoly of Bertrand: Model of economic competition used to describe a market where only two producers compete by setting their individual prices, and consumers choose the quantities they want to buy at the prices set.

Duopoly of Cournot: Model of economic competition used to describe a market where only two suppliers compete on the quantity they produce (and sell), by setting their individual amounts independently from each other and at the same time.

Duopoly: Specific type of oligopoly where only two suppliers exist in a market; in general, it indicates a market dominated by two large firms with market power.

Endowment effect: Systematic cognitive bias that emerges when people demand much more to renounce to an object, than what they would pay to acquire it, and results in a reduction in the propensity to both selling and buying the object. It is instantaneous, and emerges right after an agent has obtained the object.

Expectations: Set of predictions of an economic agent on the future states of the world; within a model, if expectations are rational, they are always confirmed *ex post*.

Expected utility theorem: Theorem according to which the subjective value associated by an individual to a given uncertain option (or choice) corresponds to his statistical expectation on the values of the outcomes of that choice.

Experimental markets: Reproduction, within a laboratory setting, of market interaction mechanisms (games, etc.).

Fairness: Caring about the good balance of one's own payoff relative to those of others (Fehr and Schmidt 1999); it may refer either to the internal organization of a firm, or to its relationships with other firms. Fairness within an alliance is called procedural justice, and concerns «the decision-making process, and the procedures that influence each party's gains and interests» (Luo 2005, 696).

Firm: see Business.

Framing (of a decision): Cognitive bias that causes economic agents to react to a particular choice in different ways depending on how this choice is presented (e.g., as a loss, or as a gain). Since judgements are comparative, changes in the framing can affect individual decisions (DellaVigna 2009).

Heuristic (rule of thumb): «Simple procedure that helps find adequate, though often imperfect, answers to difficult questions» (Kahneman 2011, 98). It is frequently used when the decision-making process is affected by cognitive biases. It may lead either to good outcomes, or to erroneous judgments. Two examples are assessing the likelihood of an event according to the easiness of recalling a similar one (salience, Tversky and Kahneman 1973), or retaining a previous decision in the face of new information. Another simple form of heuristic is imitation (Di Maggio and Powell 1983).

Indirect reciprocity: «Indirect reciprocity operates if there are repeated encounters within a population, and third parties observe some of these encounters, or find out about them. Information about such encounters can spread through communication, affecting the reputations of the participants. Individuals can thus adopt conditional strategies that base their decision on the reputation of the recipient» (Rand and Nowak 2013, 414-415).

Interaction: Relationships among several behavioural typologies that characterize a single agent, and that generate a different outcome in terms of business decisions from the case when these typologies are observed separately.

Interrelationship: Exchange of opinions, imitation, coordination schemes, etc., that take place in the framework of networks, alliances and clusters.

Investment: Capital formation, i.e. «the acquisition or creation of resources to be used in production» (The New Palgrave Dictionary of Economics).

Market power: Ability of a company of somewhat raising prices above the perfect competition levels, without losing all its clients immediately.

Nash equilibrium: Set of choices of all economic agents in a strategic situation such that each agent maximizes his own payoff given the other agents' behaviour, and that no agent can earn a profit from changing his behaviour.

Network: Two or more economic agents (not necessarily operating in the same sectors) that are connected or work together, making use of meetings among each other in order to share information (especially on innovation), assist each other, etc. Differently from alliances, networks do not imply direct connections or collaborations among all partners.

Norms: Accepted standards and conventional wisdom which, together with formal regulations, represent institutional constraints (Andrews and Johnson 2016).

Oligopoly: Market dominated by relatively few large businesses holding significant market power.

Organizational value: Set of values, either written or tacitly acknowledged by the members of an organization, that define the culture and beliefs of that organization, guiding its perspective as well as its actions; they reinforce organizational commitment of managers and employees.

Overconfidence: «Positive difference between confidence and accuracy» (Schaefer *et al.* 2004, 473).

Pigouvian tax: Tax levied on any market activity that generates negative externalities (e.g., pollution), and that is set equal to the social cost of these externalities.

Pro-social behaviour: Acting kindly and helpfully towards strangers also if caregiving is not part of one's professional role (Vlaholias *et al.* 2005). It includes philanthropic and altruistic behaviours.

Prospect theory: Behavioural economic theory that models the process of decision-making under risk (where the probabilities of each outcome are known), by supposing that economic agents make their decisions based on potential losses and gains (rather than on the value of the final outcome) and evaluate their losses and gains using heuristic rules.

Real Business Cycle: Type of macro-economic model aimed at studying and understanding the reasons of short-term fluctuations in economic activities.

Risk aversion: Economic agents (individual, or business) are said to be risk averse if they prefer a deterministic outcome equal to the expectation of a risky outcome, over that risky outcome.

Risk: A situation is said to involve risk if the outcomes of the actions of economic agents are subject to some degree of uncertainty, and the probabilities of the different outcomes are known.

Satisficing behaviour: «Accepting a choice or judgment as one that is good enough, one that satisfies» (Reber 1995, 701). As for firms, it consists in the acceptance of a profit level that is satisfactory (or “aspiration level”) instead of maximal (Dixon 2001).

Social capital: Linkages, shared values and understandings within a society that enable its individual members and groups to trust each other and, therefore, work together.

Strategic complementarity: Two or more economic agents are strategic complements if they mutually reinforce one another; under strategic complementarity, an increase in the output of one producer raises the marginal revenues of the others, since it gives them an incentive to produce more.

Strategic decision(s): Decisions that «normally fall within the purview of top management [and] are important to the organization either through the scope of their import and/or their long-term implication. The pattern of strategic decisions made by top management constitutes the strategy of the organization. [It] is aimed at effectively matching or aligning organizational capabilities with environmental opportunities and threats» (Harrison and Pelletier 1997, 358).

Strategic substitutability: Two or more economic agents are strategic substitutes if they mutually offset one another; under strategic substitutability, an increase in the output of one producer decreases the marginal revenues of the others, since it gives them an incentive to produce less.

Sunk cost(s): «Costs that have already been incurred and cannot be recovered. Sunk costs do not change regardless of which action is presently chosen. Therefore, an individual should ignore sunk costs to make a rational choice» (Mcafee *et al.* 2010, 323). If individuals do not ignore them, they commit sunk cost fallacy.

Time inconsistency: Type of non-rational behaviour observed when individual preferences are inconsistent (their ordering changes) over time; unlike rational agents, time-inconsistent individuals change their behaviour depending on when they are asked to take a decision.

Trust: «Having sufficient levels of positive expectations regarding [a] partner’s behaviour to feel able to commit valuable resources (e.g., financial, know-how, etc.) to the cooperation with that partner, despite the risk that [he] might take (unfair) advantage of this relationship, and abuse this trust» (Roessl 2005, cited by Hatak and Hyslop 2015, 6).

Typology: Specific psychological factor, identified by behavioural economics, that may potentially affect (either as a driver, or as a barrier) the adoption of technological innovations.

Uncertainty: A situation is said to involve uncertainty if the randomness faced by economic agents presents itself in the form of alternative possible events but there are no statistics available and, therefore, no calculable probabilities of the outcomes of alternative decisions.

Values: «Desirable goals, varying in importance, that serve as guiding principles in people’s lives» (Schwartz 1992, 21); «enduring beliefs that a specific mode, or conduct, or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct, or end-state of existence» (Rokeach 1973, 5). They may represent idiosyncratic characteristics of individuals, but also of businesses, or of the whole society.