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Tackling Uncertainty through Business Plan Analysis—A Case Study on Citrus Waste Valorisation in the South of Italy

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Received: 16 September 2015 ; Accepted: 13 January 2016 ; Published: 19 January 2016
Academic Editor: Stephen R. Smith

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Abstract: The paper addresses issues related to the citrus waste valorisation process and its inherent uncertainties from the perspective of a new and innovative firm. Thus, we investigate the relevance/role of a business plan analysis in developing a new business (new biobased value chains) in the case of citrus waste valorisation. We look primarily at the inherent uncertainty associated with the start-up phase of a new business aimed at producing and wholesaling semi-finished products derived from the recovery of citrus waste in southern Italy. In order to do so, we use a qualitative case study approach focusing on a small citrus waste valorisation firm located in Calabria, using Agro Management Development (AMD) as a unit of analysis. The choice of this research setting is not random, given the fact that many companies from the Mediterranean are trying to engage in activities to valorise citrus waste deriving from production value chains. The main findings of our analysis can be summarized as follows: (i) focusing primarily on one area of uncertainty (*i.e.*, market uncertainty) might undermine chances of success, as it could indicate an incomplete business strategy to stakeholders, hence hindering their willingness to commit to a new entrepreneurial initiative; (ii) although a business plan could be an effective way to narrow down uncertainty for a new innovative firm, it should be properly customised in order to address all relevant dimensions of uncertainty. Indeed, an insufficiently developed plan might be counterproductive, revealing (for instance, to possible investors) an inadequate strategy for facing and solving emerging problems, therefore putting the whole business project at risk.

Keywords: uncertainty; business plan; citrus waste valorisation

1. Introduction

The need to find a sustainable and economically viable way of managing waste, particularly food waste, is a driving force behind many recent waste valorisation practices around the world [1]. Additionally, it is now widely accepted that food waste constitutes a largely underexploited reservoir from which a variety of valuable resources— from chemicals to energy—can be derived [2]. The specific case of citrus waste valorisation is particularly interesting in this regard because of the massive industrialisation associated with this specific value chain, which generates a huge amount of waste.

Many agro-industrial stakeholders in the Mediterranean are indeed trying to engage in activities to valorise citrus waste derived from the production value chains (Mediterranean citrus producers account for about 20% of world citrus production and 60% of the world's fresh citrus trade [3]). Nevertheless, the uncertainty that is typically associated with the development of new

products and technologies might hinder this trend. A few examples of key sources of uncertainties in this area are: heterogeneity of drivers of change; technology challenges in scaling up; capital generation; low degree of market transparency; need to establish new and highly complex value chains; lack of information on bio-based production (BBP) among consumers and downstream producers; integration of new BBP into existing value chains; high price competition with traditional products; and, sustainability factors [4]. Uncertainty becomes even more significant when production input is classified as waste, a fact which might determine, for instance, unpredictable demand-side behaviours due to perceived health risks or problems linked to the legislative framework, which might forbid or limit the use of waste for certain applications.

Although firms may not be able to fully control or eliminate uncertainty, they can take calculated measures to minimise possible losses linked to negative decision outcomes [5]. One way of doing this would be for innovating companies to adapt their business development approaches to different environmental conditions and to varying degrees of uncertainty [6]. However, in order to achieve this, a better understanding of the various sources of uncertainty and of their effects on the emerging BBP market, as well as of the hazards (and opportunities) they create, is needed [4].

The present study aims to assess the effectiveness of a business plan analysis as a tool to manage uncertainty. Specifically, our paper addresses the relevance of a business plan analysis for a small citrus waste valorisation firm located in Calabria, an economically lagging region in the south of Italy. To the best of our knowledge, no previous study concerning the citrus waste valorisation process and its inherent uncertainties has been undertaken through a business plan analysis.

The paper is structured as follows: a theoretical discussion, reviewing the concept of uncertainty as it has evolved over the years, is provided in Section 2; in Section 3, the uncertainty taxonomy is analysed in association with business planning, in an attempt to identify if and how this tool can contribute to narrowing down uncertainty; Section 4 depicts the case study and the methodology. Section 5 presents results and, finally, concluding remarks are highlighted in Section 6.

2. Uncertainty in Food Waste Valorisation Activities: A Theoretical Appraisal

Uncertainty is a major challenge for new economic activities as well as for already established businesses aiming to explore new opportunities. In the presence of a high degree of uncertainty, entrepreneurs might be discouraged from investing financial resources while also finding it hard to obtain external sources of funding. Basically, high uncertainty creates a paralysis loop, which curbs investments and puts any innovative activity on hold. Hence, it is no surprise that economists have continually attempted to tackle the issue of uncertainty in the production process. However, before looking into how this has been done, we shall first provide a general definition of the concept of uncertainty in the economic literature.

2.1. Defining Uncertainty

The traditional definition of uncertainty was introduced in the early twentieth century by the American economist Frank Knight [7]. Knightian uncertainty has to be understood as risk that is immeasurable, *i.e.*, not possible to calculate. In this sense, uncertainty differs from risk as the latter refers to a situation where the probability of the alternative outcomes (or alternative states of the world) is either known *ex-ante*, or can be reliably estimated. Conversely, uncertainty entails the impossibility of specifying numerical probabilities for specific events.

Therefore, the distinction between risk and uncertainty relates to "knowledge about probabilities," this being unproblematic in the first case and problematic in the second case [8,9]. However, there is another type of knowledge that is not always available to the decision maker; namely "knowledge about the possibilities" (*i.e.*, knowledge about all possible states of the world). Whenever knowledge about possibilities is problematic, risk and uncertainty, as defined above, no longer apply. Under this condition we refer to ambiguity and ignorance.

Dosi and Egidi, from an evolutionary economics perspective, refer to these four types of uncertainty (*i.e.*, risk, uncertainty, ambiguity and ignorance) as substantive forms of uncertainty. As

put by the authors, "a quite diffused theoretical presumption in the economic analysis of information is that agents make the best possible use of the available information, which is generally taken to mean both that they utilize maximisation procedures and that these procedures are somewhat 'naturally' associated with their normal cognitive competences. That is, there is no competence gap in their information processing" [10]. However, the complexity of the decision characterizing most aspects of modern societies may easily determine a competence gap, in addition to the information gap. Following Dosi and Egidi [1], we shall refer to such circumstances—whereby the decision makers are constrained in their computational and cognitive capabilities—as characterized by procedural uncertainty.

As discussed in Morone and Tartiu [4], complex innovation systems are largely characterized by both types of uncertainty. In fact, introducing an innovation involves uncertainty at various levels. First, since an innovation is something that has not yet been attempted on the market, its results are characterized by substantive uncertainty at the time of decision. Moreover, since complex systems are characterized by a tight interrelation between parts and the collective behaviour of the system, this produces further (procedural) uncertainty due to "the density of structural linkages and interactions between the parts of an interdependent system" [11].

Within complex innovation systems, the notion of procedural uncertainty is compatible with, and complementary to, the notion of substantive uncertainty: a reality that is subject to a non-predetermined structural change may also be complex, and people who are capable of innovating may also have limited abilities [12]. Hence, we can agree that complex innovation systems are characterized by substantive uncertainty as well as procedural uncertainty. In what follows we shall try to give an account of such forms of uncertainty in the specific case of a food waste valorisation system. As we will show, the emerging complex system is characterized by many sources of uncertainty related to the non-predetermined structure of the system (such as unpredictable demand-side behaviours due to perceived health risks or regulation-side problems, which might at the time be too tight, too loose or temporally unstable) as well as to the complex interdependence of the system itself.

2.2. Mapping Uncertainty

As noted previously, uncertainty is a major obstacle to the development of bio-based production activities, generating multiple orders of problems. First and foremost, is the problem of funding instability, which stems from the substantive uncertainty associated with such activities. It was observed that new bio-based chemicals need 5 to 10 years longer than most investors can tolerate without revenues or profits. This relates to the scaling-up problem, with venture capitalists and risk-oriented equity investors often unwilling to put up the billions of dollars needed for commercial scale up [13].

Another source of substantive uncertainty is associated with technology performance, since uncertainty is not only "about the technology itself, which still needs to be shaped, but also about the socio-institutional setting in which the emerging technology will be embedded." Technology developers will perceive uncertainty about user requirements and market demand, whereas potential users will perceive uncertainty about what the new technology might have to offer" [14]. Furthermore, the uncertainty about the technology itself can be greatly influenced by stakeholders' perception of technology (based on their knowledge, previous experiences, expectations, risk aversion, *etc.*), thus this kind of uncertainty may hinder a proper assessment of the innovation and consequently postpone the innovation decision or even encourage its abandonment. Along with the uncertainty about the technology itself, two other types of uncertainty shall be carefully considered. The first is (i) uncertainty about the relation between the technology and the infrastructure within which the new technology will be integrated. Firms will hesitate to invest in a technology that requires a new infrastructure or in a new infrastructure when the technology that complements it is still lacking. The second is (ii) uncertainty about the availability of alternative technological solutions. Typically, technological change creates uncertainty with respect to the speed of development and improvement of new technologies relative to current state-of-the-art technologies, as well as

uncertainty about the possibility that future technologies can cause older technologies to become obsolete [15].

In addition, there is the uncertainty related to the potential market size, the need to set new and complex value chains, which require a long-term perspective, as well as the uncertainty associated with the overarching regulatory framework. This latter source of uncertainty exerts rather direct effects on determining whether investments have potential instability in the regulatory environment, which might hinder firms from investing in new technologies/products [14,16]. In contrast, a stable and reliable regulatory environment reduces the risk of hold-up and *ex-post* expropriation by state actors, creating conditions under which firms are more willing to make sunk investments. Another fundamental source of uncertainty stems from markets' unpredictability. Indeed, any new product, no matter how innovative, would quickly disappear if not placed in a sufficiently large market. Additionally, in the case of bio-based materials and bio-chemicals, both innovative players and market regulators are challenged to manage the trade-off between the benefits that new innovative technologies provide for consumers and the costs they impose on supply chain actors. Thus, market uncertainty can be subdivided into the following subcategories: (i) consumer uncertainty, which refers to both consumer preferences ("Potential customers cannot easily articulate their needs and preferences that the new technology should fulfil" [17]) and characteristics (In most cases, both the developers of the new technology and the investors want to be certain about consumer characteristics in order to proceed with the innovation) as well as to the demand pattern (especially the demand size and the time required to become stable); (ii) supplier uncertainty, encompassing mainly uncertainty about partners as, for instance, in a joint venture. This type of uncertainty increases significantly in the case of innovations that require establishing a new supply chain, and therefore new relations; (iii) competitive uncertainty, categorized as innocent competitive uncertainty if related to lack of awareness to the prospective actions of competitors, and strategic competitive uncertainty whenever stakeholders deliberately create uncertainty for their competitors in order to gain an advantage [15].

Last but not least there is the problem of procedural uncertainty, stemming from the involvement of a wide range of stakeholders who have different levels of expertise and knowledge that can lead to the accumulation of perceived uncertainties and loss of motivation, and invariably to different ways of understanding the decision-making process. "Negative interactions between different sources of perceived uncertainty and factors in the internal and external project environment (such as changes in the constitution of actors involved, institutional change or external technological developments) appeared to play a crucial role in this" [14].

These sources of uncertainty will be associated with the business plan, in an attempt to identify if and how this tool can contribute to narrowing down uncertainty.

3. Business Plan as a Tool for Reducing Uncertainty

This section establishes a link, on theoretical grounds, between uncertainty and business planning, identifying strengths and weaknesses of the latter as a tool for curbing uncertainty. We will then see in Section 4 how this tool has been put into practice by means of a case study analysis applied to citrus waste valorisation.

3.1. Business Plan and Firms' Performances: Two Different Approaches

A business plan can be defined as a document that describes in detail how an entrepreneurial activity is going to achieve its goals. It sets out the method for running a specific activity over a specific duration [18]. It lays out the overall business strategy; covering marketing, financial and operational areas of business. In addition, it provides a detailed description of the overall budget required for the business activity, current and projected sources of financing, a detailed market analysis and a description of the foreseen marketing strategy [19]. Finally, and most importantly, the plan helps to understand whether an investment is worth the risk (by assessing the opportunity cost of not investing elsewhere) and, if it is indeed the case, it usually demonstrates why there is good reason to ignore short-term financial loss in favour of lon- term gain [18].

Entrepreneurship researchers are engaged in an intense debate about the value of business planning for established and new firms. In particular, two prominent schools of thought provide a distinct theoretical foundation that explain the outcomes of business planning on firm performance. These are the planning school and the learning school [19,20].

The planning school has investigated at length the empirical relation linking business planning and firms' performances, showing that planning generally improves the effectiveness of management actions, thus facilitating the achievement of a firm's goals. This stream of literature has identified various positive effects of planning, such as quicker decision making, optimization of resources, and the opportunity to avoid wrong strategies [21]. From this perspective, business planning implies first the need to specify goals and subsequently to identify the steps required to achieve them. When following these steps, firms should be facilitated to keep their goal achieving strategies and possible deviations from the business plan under control.

These findings are particularly relevant for small firms, where an even stronger positive relation between business planning and firms' performances is observed [21,22]. Additionally, several authors showed how business planning is a valuable tool for a firm operating in dynamic and unstable external environments, as it reduces uncertainty by developing new forms of action [21].

The learning school counters this approach, pointing out the paucity of empirical evidence in regard to reducing uncertainty. These scholars propose an adaptive and incremental approach instead of a strategic one, typically fostered by business planners [23,24]. In summary, this school of thought suggests that firms should invest resources in learning and in efforts to reduce information gaps while looking for flexible strategies to face high degrees of environmental uncertainty rather than constraining themselves to ex-ante defined strategies of action [25]. Further, as business planning can lead to cognitive and organizational rigidities and limited strategic flexibility, these researchers argue that dedicating top management time to business planning results in lower returns, as opposed to dedicating time to resources acquisition and organizational building activities [26].

Finally, the learning school also points out that most potential funders wish to see a business plan as a first step in deciding whether or not to invest. The consequence is that different types of funders might look at the same business plan from different perspectives. Bankers, for instance, stress the financial aspects (in particular cash flows, warranties and covenants) of the proposal and give little emphasis to market or organizational issues. Equity investors and venture capital fund managers, on the other hand, have a very different approach, emphasising both market and finance issues. Finally, business angels pay more attention to the entrepreneurs and to organizational considerations. The implication for entrepreneurs is that they must customise their business plan to address those they are seeking funding from (banks, venture capital funds or business angels, [27]).

3.2. Small and Innovative New Firms

Although there are contrasting views on the general relevance of a business plan, establishing a clear distinction between old and new firms seems to be a largely agreed-upon idea. Indeed, the effectiveness of business planning might depend on whether the firm is new or not. Contrary to established firms, new firms face the challenge of launching their production process in the marketplace while being exposed to higher degrees of uncertainty, as well as to wider information gaps [19].

This latter aspect relates to a fundamental difference between new and established firms, which is the degree of procedural uncertainty. As pointed out by Brinckmann *et al.* [19]: "Compared to managers of established small firms, entrepreneurs launching new firms are likely to face higher degrees of uncertainty, since they have less experience concerning the new firm's environment, the impact of environmental dynamics on the new firm, and adequate response options."

For innovative small firms, this type of uncertainty is often coupled with substantive uncertainty stemming from, as in the case of already established firms discussed above, both a lack of knowledge about probabilities and/or possibilities.

4. Case Study and Methodology

In Italy, the citrus-processing industry has increased its importance over the last ten years. As reported in Table 1, citrus production (and the associated waste management) is concentrated in two regions (Calabria and Sicily), which accounts for around 85% of the overall national production.

Table 1. Citrus production by regions (year 2013).

Region	Area (%)	Population (%)	Citrus Production (%)
Sicily	8.5%	8.4%	54%
Calabria	5.0%	3.3%	31%
Puglia	6.4%	6.7%	7%
Basilicata	3.3%	1.0%	3%
Campania	4.5%	9.7%	3%

Source: [28,29].

The main product of the Italian industrial process is the juice (35%–45% of the total weight of fresh product), while the main by-products are represented by *pastazzo* (a mixture of citrus pulp and skins −60% of fruit weight), and a significant amount of sludge obtained by industrial waste water treatment.

Bearing this in mind, waste valorisation seems to be a good answer to the economic and environmental problem connected to the large amount of by-products obtained (600,000 t of *pastazzo* year^{-1}). Yet, this process presents many uncertainties that, if not properly addressed, might jeopardise new entrepreneurial developments and initiatives targeting this aim. As discussed in Section 3, laying down a business plan might serve the very purpose of reducing uncertainty. Subsection 4.1 introduces the case study of the Agro Management Development (AMD) business plan, whereas Subsection 4.2 discusses the methodology used to conduct the empirical investigation.

4.1. The Case of Citrus Waste Valorisation in the South of Italy

As stated in the introduction, many companies in the Mediterranean area are trying to valorise their wastes as a strategy to overcome the hurdles associated with unfavourable economic conditions. Agro Management Development (AMD) is an establishing firm that aims to locate its business activity in the very area of waste valorisation. Specifically, AMD was set up by three entrepreneurs in an attempt to overcome the difficulties linked to the on-going economic crisis affecting the agricultural sector in Reggio Calabria. The city, located in southern Italy, and its surroundings are characterised by a wide variety of citrus fruits, among them the bergamot fruit, which is produced almost nowhere else in the world. This local feature has laid the grounds for the idea to reuse the waste generated by the citrus fruits value chain.

The interest of AMD in the reusability of the citrus chain waste is also linked to the economic opportunity offered by the low costs of these by-products and by the relatively low initial investment costs. The citrus value chain in Italy, and in particular the juice value chain, produces by-products constituting about 50%–60% of the original weight of the citrus fruits used in the process (with an annual production rate averaging 500,000 tonnes). Out of this share, 70% of the production chain is found in Calabria and Sicilia where, because of the low cost, the waste is unprocessed/untreated and used for animal feed.

Thus, AMD aims to produce and wholesale semi-finished products from the recovery of waste products of the food industry, starting with citrus fruits (bergamot, orange, lemon, tangerine), and in particular recovering the process's by-products (commonly referred to as the citrus fruit pulp). In parallel to the actual production, the company aims to launch a continuous R and D programme to look into new products derived from the citrus and agricultural by-products in question (for instance, typical medicinal plants). The interest in citrus by-products, involving mainly mixture peels (60%–75%), pulp (23%–33%) and seeds (0–9%), is linked to the fact that they contain recognized physiologically active components such as fibres and antioxidant polyphenols, and important pharmacological properties that allow numerous therapeutic applications. Furthermore,

the variety of compounds found in the produced granulate makes it a potential ingredient for the preparation of cosmetic products and foodstuffs.

The first and main outlet market of the products obtained with the granules formulated by AMD was nutraceuticals, characterised by a growing demand for: natural supplements and high quality natural products; certified, natural, and local products; and, consequently, raw materials available in large quantities and varieties (differentiation). AMD stated that it would approach companies at the national level, such as Bios Line and Naturando, that have been on the market for many years and that, in addition to R and D activities (conducted internally or outsourced), would directly promote lines of diet supplements and cosmetic products under its own brand. The differentiation of AMD, especially in the first years of operation, will entail centring its R and D activities on the development of new granules and extracts, thus protecting, within the terms prescribed by law, their achievements, and establishing themselves as a supplier to manufacturers of dietary supplements and cosmetic products. Having passed this first phase, the company will market products (supplements and cosmetics) under its own brand. This choice is linked to the fact that the nutraceutical market brings forward, especially in recent years, many products that involve large investments by commercial companies (costs that AMD currently prefers to allocate to the continuous improvement of the production lines and the laboratory). Currently, the closest competitor to AMD is H&AD, a company established in 2009 and also based in the Calabria region, which is active in the extraction of polyphenols from the white lemon pith and of bergamot juice.

4.2. Methodology

Our investigation focuses on the citrus waste valorisation process in the case of a small new firm facing a high degree of uncertainty, limited prior information, and no business structures and procedures. Hence, we build on three streams of research related to our work: uncertainty in food waste valorisation activities, innovation systems, and business models involving early-stage entrepreneurial firms. We use a qualitative case study approach. More specifically, we opted for an instrumental case study design in which "the case is of secondary interest; it plays a supportive role, facilitating our understanding of something else" [30]. By "something else" we refer to our key research question: *i.e.*, assessing the effectiveness of a business plan analysis as a tool for reducing uncertainty in the realm of waste valorising activities. The remainder of this section describes (a) how we gathered the data needed to answer this research question, and (b) the method used for the analysis.

4.2.1. Data Gathering

As mentioned above, our unit of analysis (research setting) is the Agro Management Development company, a small citrus waste valorisation firm located in Calabria, an economically lagging region of southern Italy. The investigation is based on a *desk research* phase with the aim to analyse the business plan role in creating new businesses and bio-based value chains in the case of citrus waste valorisation. This was complemented by a *field research* phase to gather primary data through face-to-face, in-depth interviews undertaken during November 2013–October 2014, with the CEO of AMD and his managerial team. More specifically, we conducted six semi-structured interviews, focusing on the various development stages of AMD's creation project, the subsequent preparation of its business plan, and the types of uncertainty considered (keeping in mind that there are multiple sources of uncertainty that can emerge and evolve as projects develop). In particular, the following items were included in the interview protocol: (i) development of the project idea and design of the project (which turned out to be an *ad hoc* company with various professional experts included as partners); (ii) analysis of the sources and methods of supply for the production processes with the simultaneous evaluation of critical aspects (*i.e.*, seasonality, feedstock supply); (iii) target market, main competitors and other significant particularities (e.g., average size of competitors, consolidated and pre-existing trade agreements in respect to the main competitors, *etc.*); (iv) communication strategies with banks and potential investors to gather financial resources; and (v) types of knowledge about possible industrial partners in the new value chain.

As a follow-up, two additional interviews were conducted in January and March 2015 with the CEO of AMD, with the intention of discussing the preliminary findings and exploring further possibilities for project expansion in the light of these findings.

4.2.2. Data Analysis

Even if there seems to be a positive relationship between planning and a firm's performance, as has emerged from the debate presented in Section 3, the existing literature does not provide conclusive answers on how this would change for various types and degrees of uncertainty or for alternative business planning models and processes (e.g., [31,32]). Further, when narrowing the focus of investigation down to a small and innovative new firm, as in the AMD case, the effectiveness of a business plan as a tool to reduce uncertainty and catalyse the interest of prospective investors, customers, and suppliers to the new business activity should be closely examined.

Preliminarily, we note that AMD focused its business plan on three areas: market uncertainty, regulatory/institutional uncertainty and technological uncertainty. As the citrus waste valorisation process involves the adoption and the development of innovations/innovative processes, other sources of uncertainty can be identified. Following Jalonen [12], along with technological uncertainty, market uncertainty and regulatory/institutional uncertainty, other relevant types of uncertainty are: political uncertainty, acceptance/legitimacy uncertainty, managerial uncertainty, resource uncertainty and timing uncertainty. These additional areas of uncertainty, however, were not considered in this case study, as we were not able to s gather sufficiently detailed information to satisfactorily address them). In Figure 1, we link the key actors to whom the business plan refers, pinpointing the type of uncertainty for each actor. This resulted in an uncertainty map emerging from the case study under investigation.

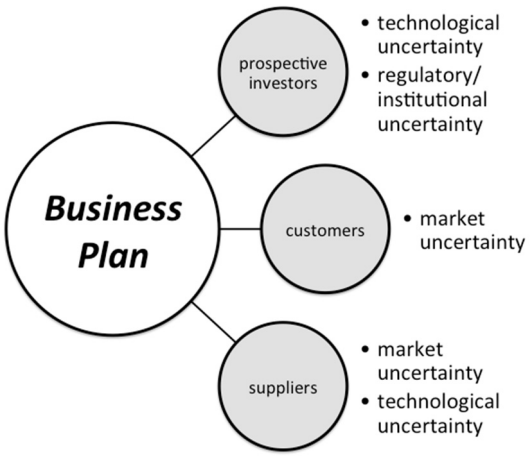

Figure 1. Addressing Uncertainty through the AMD Business Plan.

5. Results

In order to deliver a comprehensive view from the perspective of an early-stage entrepreneurial firm on how different types of uncertainty affect business development (*i.e.*, the materialization/commercialization of the innovative idea), three key areas will now be discussed in more detail, making use of data from the innovative project initiated by AMD.

Market uncertainty: In the case of AMD, the analysis of the business plan proved to be a useful step in identifying all these uncertainties, considering that entrepreneurs wish to identify their reference market as a way of reducing uncertainty. The main findings of the analysis are summarized in the following.

AMD stated that it would work upstream of the food and nutraceutical sectors, providing vegetal flours of citrus fruits for the production of food flour and semi-finished products for food supplements. As was emphasised in the business plan, these sectors are growing extensively,

pushed by the demand for high quality products that can be easily traced by consumers. Indeed, most of the flour-related products currently available on the market are of foreign origin, and this has a negative impact on the choice of products made by consumers. As mentioned in the plan, the strong demand for products from the nutraceutical, food and cosmetics sectors, along with the vast array of potential applications of the semi-finished products derived from the citrus value chain in other sectors (such as beverages and paper), stimulated the design of the initiative. An overview of the potential outlet markets, which have emerged as a result of the business plan, is presented in Table 2.

Table 2. Potential outlet markets of AMD products.

Sector	Application
Food	Aromatic flour for the production of food products
Nutraceutics	Dietary fibres for the production of food supplements
Galenic	Semi-finished products from which to obtain dry extracts for the production of galenic formulations
Alcoholic beverages	Semi-finished products to be used in alcohol bath for the production of alcoholic liquors
Cosmetics *	Oils of citrus seeds as a basis for the formulation of new products
Paper	The fibre obtained can be used as the basis for the production of paper

***** The possibility to extract oils of citrus seeds will be evaluated in the second year.

The growing spread of products of Protected Designation of Origin (DOP) and of Typical Geographical Indication (IGT) is one attempt to address the problem of protecting local products and, as such, it must ensure full product traceability, including chemical traceability. In this latter case, objective and easily identifiable parameters, which are often associated with compounds and/or chemical-physical attributes, should be used. The identification of molecular markers indicating authenticity of a food product through innovative analytical methods is therefore an indispensable tool for the valorisation of such products. In addition, the entrepreneurial idea was encouraged by the wide availability and the relatively high quality of citrus waste (and in particular of bergamot, which is typically produced in Reggio Calabria), currently representing a cost for the fruit-processing companies (for disposal), and by a production technology that is simple and energy efficient.

The choices made by AMD show a horizontal approach to the market, where the company is at the centre of the micro-market, facilitating interaction between potential customers and its own retail (shop—company—consumer). Hence, a key element of the AMD marketing strategy is meeting nutraceutical customer-manufacturer demands and subsequently that of products' end users.

Regulatory/institutional uncertainty*:* This source of uncertainty may act as an obstacle if unclear and/or contradictory signals mislead both the developers of the new technology and the investors, leading to the postponement or even the abandonment of the innovation. Conversely, a pro-active and supportive regulatory/institutional framework can facilitate or speed up the development of the new technology. In the case of AMD the analysis revealed that in southern Italy there is currently a pro-active and supportive regulatory framework in place, namely the Reuse Citrus Waste Act (2014). The main objective of this act is to promote industrial research and experimental development in the agro-industrial sector (with particular reference to the sustainable reuse of waste from industrial processing of citrus fruits) in southern Italy. This is achieved through an economic incentive awarded to the best projects developed by entrepreneurs engaged in the production of fruit juices and vegetables and the beverage industry. However relevant, AMD does not seem to be in a position to take full advantage of this supportive regulatory/institutional framework. In fact, most of the innovative activities it proposes are deliberately postponed to the second phase of the activities when R and D activities will gain a central role in determining business strategies, as well as the firm's overall competitiveness.

Finally, other regulatory issues affecting by-product valorisation are associated with the permits and authorisations. In order to assess the "permissibility" of a waste product used as an

input substance (*i.e.*, a substance used in the food processing), this input substance has to qualify, and the intended use of the output substance must be made known since this will determine which legislation applies [33]. In the specific case of new bio-based chemicals, more stringent regulations must also be taken into account, particularly since the chemical industry is under the ever-increasing scrutiny of national and international bodies due to concerns of related toxicity effects. The European Union provides an example as it has adopted a rigorous regulation (EC—No. 2006/1907) on the Registration, Evaluation, Authorisation and Restriction of Chemicals (the so-called REACH Regulation). Moreover, the regulation procedure for bio-based chemicals is rather complex and sometimes "more onerous than rules governing petrochemicals." For instance, "a single bio-based chemical can be subject to regulations at more than one agency, making compliance with the law complicated, uncertain, and expensive—especially for start-ups" [13].

The business plan analysis indicated entrepreneurial awareness of these potential pitfalls, acknowledging the lack of appropriate standards for some of the innovative bioactive compounds considered in the company portfolio. As previously recognised, this lack of standards may act as a blocking mechanism, negatively affecting the resource mobilization and knowledge development and diffusion.

Technological uncertainty: The declared aim of AMD is to set up a soft technology, favouring processes that do not alter the content of the biologically active substances during the production cycle, thus guaranteeing the best performance and the highest biological effectiveness of the product (two conditions that are essential to ensure the added value of local products). In fact, as mentioned above, AMD has implemented a two-step technological development plan: In the first phase, no major technological improvements are foreseen. This should allow the firm to gain a competitive position in the market as an established, well-recognised actor. Once this target is achieved and extra profits are obtained, AMD would step into its second phase where a more technological aggressive strategy is foreseen. The key advantage of this two-step strategy would be to distinguish market uncertainty from technological uncertainty, hence reducing overall uncertainty (and risks) especially during the business start-up phase.

Based on the analysis developed so far, we can conclude that, whenever entering a new market, a company is concomitantly confronted with several types of uncertainty. This makes it often impossible to accurately measure inputs entering the innovation process, assess costs and benefits and make accurate performance forecasts. One way to overcome this difficulty is to consider that the innovator often knows more about the business initiative than stakeholders. This knowledge advantage should be properly used in business planning and well communicated externally. This strategy would ultimately attract the attention of stakeholders, a necessary (yet somewhat insufficient) condition for success.

Perhaps AMD did not fully succeed in achieving this target, as the uncertainty analysis was restricted to three specific realms that were not fully developed. Improvements could be achieved, however, following a trial-and-error learning mechanism [34], which is highly appropriate in the presence of uncertainty and changing conditions [35]. In this regard, AMD should invest in reducing the time between subsequent business model iterations, while market, managerial, and entrepreneurial knowledge should be adequately developed to reduce the number of iterations necessary to reach a solution [36].

6. Conclusions

In this paper we addressed the issue of citrus waste management from the perspective of a new and innovative firm. We did so by looking primarily at the inherent uncertainty associated with the start-up phase of a new business activity. Specifically, we concentrated on a business initiative aimed at producing and wholesaling semi-finished products deriving from the recovery of waste products of several citrus fruits (bergamot, orange, lemon, tangerine) cultivated in southern Italy. With reference to the case study in question, we assessed the effectiveness of a business plan as a tool to manage several sources of uncertainty in parallel.

Our investigation showed how several dimensions of uncertainty were not considered in the AMD business plan (*i.e.*, political, resource and managerial uncertainties, as well as timing and acceptance and legitimacy uncertainties), a fact which narrowed the spectrum of our investigation. Moreover, while developing the plan, AMD entrepreneurs focused their attention mainly upon market uncertainty, while technological uncertainty and regulatory/institutional uncertainty were tackled predominantly indirectly, postponing key innovative activities to a second phase, after the start-up firm gained momentum and reached a stable and competitive position in the market. This cautionary and conservative approach might well be an appropriate way to narrow down uncertainty. Yet, it might also signal an incomplete business strategy to stakeholders, hence hindering their willingness to commit to the new entrepreneurial initiative. In fact, although a two-step strategy could indeed be pursued, it should not simply appear as a strategy to postpone a sound risk assessment.

This case study shows that although a business plan could be an effective way to narrow down uncertainty for a new innovative firm, it should be properly customised in order to address all relevant dimensions of uncertainty. Indeed, an insufficiently developed plan might prove counterproductive, revealing (e.g., to possible investors) an inadequate strategy for facing and solving emerging problems, consequently putting the whole business project at risk.

Acknowledgments: We whish to thank AMD for providing all needed information to conduct the case study. The usual disclaimers apply.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Ki Lin, C.S.; Pfaltzgraff, L.A.; Herrero-Davila, L.; Mubofu, E.B.; Abderrahim, S.; Clark, J.H.; Koutinas, A.A.; Kopsahelis, N.; Stamatelatou, K.; Dickson, F.; *et al.* Food waste as a valuable resource for the production of chemicals, materials and fuels. Current situation and global perspective. *Energy Environ. Sci.* **2013**, *6*, 426–464.
2. Clark, J.H.; Luque, R. Valorisation of food residues: Waste to wealth using green chemical technologies. *Sustain. Chem. Process* **2013**, doi:10.1186/2043-7129-1-10.
3. FAO Statistical Division. 2010. Available online: http://faostat.fao.org (accessed on 10 June 2015).
4. Morone, P.; Tartiu, V.E. Addressing Uncertainty in Complex Systems—The case of bio-based products derived from urban bio-waste valorisation. In *Uncertainty Management in Simulation-Optimization of Complex Systems: Algorithms and Applications*; Meloni, C., Dellino, G., Eds.; Operations Research/Computer Science Interfaces Series; Springer: Berlin, Germany, 2015.
5. Yusuf, A.; Nyomori, R.O. Uncertainty, planning sophistication and performance in small New Zealand firm. *J. Entrep.* **2002**, *11*, 1–17.
6. Bstieler, L.; Gross, C.W. Measuring the effect of environmental uncertainty on process activities, project team characteristics, and new product success. *J. Bus. Ind. Mark.* **2003**, *18*, 146–161.
7. Knight, F.H. *Risk, Uncertainty, and Profit*; Houghton Mifflin: Boston, MA, USA, 1921.
8. Stirling, A. Keep it complex. *Nature* **2010**, *468*, 1029–1031.
9. Stirling, A. Science, precaution, and the politics of technological risk. Converging implications in evolutionary and social scientific perspectives. *Ann. NY Acad. Sci.* **2008**, *1128*, 95–110.
10. Dosi, G.; Egidi, M. Substantive and procedural uncertainty. *J. Evol. Econ.* **1991**, *1*, 145–198.
11. Hodgson, G.F. The ubiquity of habits and rules. *Camb. J. Econ.* **1997**, *21*, 663–684.
12. Dequech, D. Uncertainty: A Typology and Refinements of Existing Concepts. *J. Econ. Issues* **2011**, *45*, 621–640.
13. Andrews, E.; MacLean; C.; Kurtzman, J. *Unleashing the Power of the Bio-Economy*; Financial Innovations Lab® Report; Milken Institute: Santa Monica, CA, USA, 2013. Available online: http://www.milkeninstitute.org/pdf/BioEconFIL.pdf (accessed on 26 August 2013).
14. Meijer, I.S.M.; Hekkert, M.P.; Faber, J.; Smits, R.E. Perceived Uncertainties Regarding Socio-Technological Transformations: Towards a Typology. Working Paper for the Druid Winter 2005 PhD Conference. 2005. Available online: http://www2.druid.dk/conferences/viewpaper.php?id=2534&cf=17 (accessed on 27 June 2013).

15. Meijer, I.S.M.; Koppenjan, J.F.M.; Pruyt, E.; Negro, S.O.; Hekkert, M.P. The influence of perceived uncertainty on entrepreneurial action in the transition to a low-emission energy infrastructure: The case of biomass combustion in The Netherlands. *Technol. Forecast. Soc. Chang.* **2010**, *77*, 1222–1236.
16. Jalonen, H. The Uncertainty of Innovation: A Systematic Review of the Literature. *J. Manag. Res.* **2012**, *4*, doi:10.5296/jmr.v4i1.1039.
17. Mullins, J.; Sutherland, D. New product development in rapidly changing markets: An exploratory study. *J. Prod. Innov. Manag.* **1998**, *15*, 224–236.
18. Stutely, R. *The Definitive Business Plan: The Fast-Track to Intelligent Business Planning for Executives and Entrepreneurs*; Financial Times Prentice Hall: London, UK; New York, NY, USA, 2002.
19. Brinckmann, J.; Grichnik, D.; Kapsa, D. Should entrepreneurs plan or just storm the castle? A meta-analysis on contextual factors impacting the business planning–performance relationship in small firms. *J. Bus. Ventur.* **2010**, *25*, 24–40.
20. Wiltbank, R.; Dew, N.; Read, S.; Sarasvathy, S.D. What to do next? The case for non-predictive strategy. *Strateg. Manag. J.* **2006**, *27*, 981–998.
21. Delmar, F.; Shane, S. Does business planning facilitate the development of new ventures? *Strateg. Manag. J.* **2003**, *24*, 1165–1185.
22. Upton, N.; Teal, E.J.; Felan, J.T. Strategic and business planning practices of fast growth family businesses. *J. Small Bus. Manag.* **2001**, *39*, 60–72.
23. Brews, P.J.; Hunt, M.R. Learning to plan and planning to learn: Resolving the planning school/learning school debate. *Strateg. Manag. J.* **1999**, *20*, 889–913.
24. Honig, B.; Karlsson, T. Institutional forces and the written business plan. *J. Manag.* **2004**, *30*, 29–48.
25. Hough, J.R.; White, M.A. Environmental dynamism and strategic decision-making rationality: An examination at the decision level. *Strateg. Manag. J.* **2003**, *24*, 481–489.
26. Bhide, A. *The Origin and Evolution of New Businesses*; Oxford University Press: Oxford, UK, 2000.
27. Mason, C.; Stark, M. What do investors look for in a business plan? A comparison of the investment criteria of bankers, venture capitalists and venture capitalists. *Int. Small Bus. J.* **2004**, *22*, 227–248.
28. Energia dagli scarti degli agrumi. http://blog.zonageografia.scuola.com/2015/energia-dagli-scarti-degli-agrumi/ (accessed on 3 August 2015).
29. Comuni-italiani. Available online: http://www.comuni-italiani.it/regioni.html (accessed on 15 December 2015).
30. Baxter, P.; Jack, S. Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *Qual. Rep.* **2008**, *13*, 544–559.
31. Dibrell, C.; Craig, J.B.; Neubaum, D.O. Linking the formal strategic planning process, planning flexibility, and innovativeness to firm performance. *J. Bus. Res.* **2014**, *67*, 2000–2007.
32. Chwolka, A.; Raith, M.G. The value of business planning before start-up—A decision-theoretical perspective. *J. Bus. Ventur.* **2012**, *27*, 385–399.
33. Baiano,A. Recovery of biomolecules from food wastes—A review. *Molecules* **2014**, *19*, 14821–14842.
34. Loch, C.H.; Solt, M.E.; Bailey, E.M. Diagnosing Unforeseeable Uncertainty in a New Venture. *J. Prod. Innov. Manag.* **2008**, *25*, 28–46.
35. Sosna, M.; Trevinyo-Rodriguez, R.; Velamuri, S. Business model innovation through trial-and-error learning: The Naturhouse case. *Long Range Plan.* **2010**, *43*, 383–407.
36. Pereira Da Costa, A.S.; Levie, J. Business model change in early-stage entrepreneurial firms facing high uncertainty. In Proceedings of the 32nd Strategic Management Society Conference, Prague, Czech Republic, 6–9 October 2012. Available online: https://www.strath.ac.uk/media/departments/huntercentre/research/workingpapers/Business_Models_Changein_Early-stage_Entrepreneurial_Firms_Facing_High_Uncertainty.pdf (accessed on 16 July 2015).