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Ex-Ante Business Model Evaluation Methods: A Proposal of Improvement and Applicability

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Abstract

Purpose: The purpose of this paper is to choose the best method for ex ante business model evaluation, improve it and provide a framework to put it into practice.

Design/Methodology/Approach: After an in-depth review, we chose the best method for ex ante business model evaluation, improved this method, and applied it to a real case study in which business models had been proposed for a Sustainable Smart District project.

Findings: We analysed existing ex ante business model evaluation methods, justifying our choice of the best one. We improved this key question-based method by combining classic management tools and a new, promising procedure. We finally found a strong tool to improve business models before their implementation or, in other words, to improve business model design.

Practical implications: The resulting methodology can be applied in a broad range of situations in which a set of business models needs to be evaluated and ordered before making decisions about their implementation. Accordingly, we think it represents a significant contribution to the field of business model evaluation.

Social implications: We applied this methodology to a set of business models to be used in a new Sustainable Smart District. This term has gained momentum over the last few years because it is understood to be a good way to combat climate change.

Originality/value: We refined and improved an existing methodology for ex ante business model evaluation making it more accurate and credible, and we applied it in the context of a relevant social field, such as the fight against climate change.

Keywords: Business model innovation; Business model assessment; Business model evaluation; Smart city; Smart Sustainable District

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Introduction

The purpose of this paper is to make a contribution to the evaluation of the business models field. To achieve this, we review existing literature in the area about methods that can evaluate business models before being implemented (ex-ante methods), and we propose a scientific advance to improve these methods, in order to compare and select the most promising business models among those available.

Several methods have been proposed over the last few years for business model evaluation. However, most of them are not useful for our goals or have numerous limitations, partly because they have not been specifically developed for this purpose. They often use forecasts for different economic and financial parameters which, in a context of extreme uncertainty, may not be reliable. In this paper, after an in-depth review, we choose a method that has been specifically developed for business model evaluation, such as the one proposed by Mateu and March-Chorda (2016). This method consists of a scale of eight indicators that evaluate eight key factors in a business model.

The implementation of this method in a real case study gave us the opportunity to refine and improve the method. The real case study consisted of the evaluation of a set of 22 services, with their corresponding business models, which had been proposed for development in a new Smart Sustainable District (SSD).

The improved methodology presented in this paper can be applied to a large number of analogous situations. The business model is the cornerstone of the current entrepreneurship paradigm. Accordingly, entrepreneurs must choose the most promising business model for their venture carefully. Similarly, companies that face problematic situations, or firms that are considering diversification or intrapreneurship processes also need to choose the most promising business model. Along these lines, we are convinced that our findings can be useful in a wide range of situations.

The rest of this paper is organised as follows. We start with a systematic literature review of the field of business model evaluation, which focuses mainly on choosing the most suitable method to achieved our goals. Then, once the most suitable method has been identified, we propose several improvements to the method. Using a real case study, we also test the applicability of the improved method in order to refine our proposal. The paper ends with a discussion of the results, analyses the findings, and provides some concluding remarks and comments about the limitations of the work and possible future developments.

Business Model Evaluation Methods

General approach to business model evaluation methods

Pateli and Giaglis (2004) identified business model evaluation as a sub-domain of business model research, but they considered that the area was still too immature. Research on this topic has increased considerably since then, but there are still important gaps that have not yet been addressed.

D'Souza, Wortmann, Huitema and Velthuijsen (2015) identified three different goals for evaluating business models: comparison with competitors, evaluating alternative business models for implementation by a firm, and evaluating business models according to their viability. Our focus centres on the second goal, given our ex-ante applicability requirement.

Our review of business models evaluation literature targeted four systematic reviews on the subject by Alexa (2014), Tesch and Brillinger (2017), Schoormann, Kaufhold, Behrens and Knackstedt (2018) and Steinhöfel, Hussinki and Bornemann (2018).

Alexa (2014) identified eleven business model evaluation methods, and briefly described most of them, focusing on the evaluation criteria they used. Hamel (2000) used four criteria (efficiency, uniqueness, fit and profit boosters); Zott and Amit (2007) evaluated four sources of value (novelty, lock-in, complementarities and efficiency); Afuah and Tucci (2003) used profitability measures and benchmark questions to compare the business model with competitors' models; Morris, Schindehutte and Allen (2005) suggested a method with seven performance indicators, although "it is not clear how it can be operationalized" (Alexa 2014, p. 254); Ballon, Kern, Poel and Tee (2005) proposed a five-step framework to evaluate objectives and scope,

market developments, innovation topics and bottlenecks; Horsti's tool is based on critical success factors (Horsti, 2007); Osterwalder and Pigneur (2010) proposed an evaluation of the big picture as well as SWOTs of each building block in their business model ontology.

Tesch and Brillinger (2017) catalogued 39 business model evaluation methodologies according to two criteria, namely causal vs. effectual and qualitative vs. quantitative evaluation. Both are interrelated, and it is important to clarify these dichotomies.

Traditional entrepreneurship theory (Casson, 2003; Shane, 2003) emerged within a causal perspective. According to this theory, the entrepreneur draws up a business plan to turn the idea or the opportunity into a successful company. The recommendations to draw up this plan include specifying quantitative details, thus quantifying future sales and profits and including them in financial spreadsheets. At the start of this century, some authors pointed out that uncertainty was so high in the business creation environment that it was more than a leap of faith to believe in this comfortable path (Ries, 2011) with planning being seriously questioned in the business creation arena (Gruber, 2007; Brinckmann, Grichnik and Kapsa, 2010; Chwolka and Raith, 2011). The first task of a start-up shifts as a consequence moving to the adoption of a new task: the validation of a business model (Blank, 2006) by means of a learning process (Ries, 2011), of experimentation (McGrath, 2010), and trial and error (Morris, Schindehutte and Allen, 2005; Sosna, Trevinyo-Rodriguez and Velamuri, 2010). To foresee credible future numbers in this context becomes difficult, and often impossible.

Sarasvathy raised the bar seeing that successful serial entrepreneurs, far from planning their ventures, used a more diffuse logic, the so-called effectual logic (Sarasvathy, 2001, 2008). Effectual logic becomes useful when decisions must be taken in a context of significant uncertainty.

Tesch and Brillinger (2017) brought together several qualitative business model evaluation methods under the effectual logic umbrella. These methods are not methods to classify and compare alternative business models. They are actually methods to check and improve a specific business model, through analysing ontology components and their coherence (Osterwalder and Pigneur, 2010), through a list of key questions (Teece, 2010), suggesting business model choices (Casadesus-Masanell and Enric Ricart, 2010), proposing business model patterns which can be compared with the real or designed ones (Gassmann, Frankenberger and Csik, 2014), through roadmapping (Reuver, Bouwman and Haaker, 2013), and through experimentation and an iterative process of trial and error (McGrath, 2010; Sosna, Trevinyo-Rodriguez and Velamuri, 2010).

Conversely, causal logic enables both qualitative and quantitative methods. On the qualitative side, Tesch and Brillinger (2017) included some papers that adapted traditional management tools, like a SWOT analysis (Martikainen, Niemi and Pekkanen, 2014) and a PESTEL analysis (Yüksel, 2012). Other qualitative methods presented by these authors focused on generating alternative business models rather than on evaluating them, i.e. methods based on morphological boxes (Kley, Lerch and Dallinger, 2011) and methods based on levers to provide new business models (Bosbach, Tesch and Kirschner, 2017).

On the quantitative side, Tesch and Brillinger (2017) included the paper by Gordijn and Akkermans (2001), which measures the value for all of the actors involved, expressing that value in monetary units, although the authors found that estimating precise profit was unrealistic. Other quantitative methods identified by Tesch and Brillinger are based on balanced scorecards and metrics (i.e. Heikkilä, Bouwman, Heikkilä, Solaimani and Janssen, 2016), scenario planning (i.e. Bouwman, Zhengjia, van der Duin and Limonard, 2008), market simulations, predictions and forecasting (Kauffman and Wang, 2008), etc.

Schoormann *et al.* (2018) revised 45 approaches to business model evaluation, and catalogued them into 10 categories (I to X) and 44 subcategories. These categories are: I Benchmark-, Comparison- and Trade Off-oriented Evaluation, II -Economic-/Financial-oriented Evaluation and Metrics, III Mathematical-oriented Evaluation Methods, IV Survey- and Questionnaire-oriented evaluation, V Simulation-based Evaluation Modelling Techniques/Tools, VI Strategy-oriented Evaluation Tools, VII Business Model Ontology-oriented Evaluation, VIII Decision Structuring-oriented Evaluation, IX

Pattern- and Key Question-based Evaluation and X Value Proposition-oriented Evaluation Tools.

Finally, Steinhöfel, Hussinki and Bornemann (2018) found 21 relevant papers focused on tools, methodologies and approaches to evaluate business models.

In the specific field of smart cities, Diaz-Diaz, Munoz and Perez-Gonzalez (2017) developed a comprehensive method to evaluate business models, but it cannot be considered as an ex-ante method, because although the new business model is evaluated before its implementation, it is evaluated by comparing it to the previously existing model. Therefore, it is not useful to evaluate and compare totally new business models before their implementation.

Finally, we made a new search, in order to update these reviews. As both of the latest reviews are based on articles published up to January 2018, we searched for articles published in 2018 and 2019 in the Scopus and Web of Science databases (the search was carried out in July 2019). We used the same search criteria used by Steinhöfel, Hussinki and Bornemann (2018), namely articles containing 'business model*' in the title as well as one of these textual streams: 'analy*', 'assess*', 'compar*', 'control*', 'estimat*', 'evaluat*', 'examin*', 'measur*', 'monitor*', 'test*' or 'valuat*'. This search produced 118 articles in Scopus and 112 articles in the Web of Science which, after removing 39 duplicate papers, yielded a total of 191 articles.

Adding the lists by Alexa (2014), Tesch and Brillinger (2017), Schoormann *et al.* (2018) and Steinhöfel et al. (2018), and subtracting duplicated papers, we obtained a total of 98 articles directly related to business model evaluation methodologies. Adding our less refined list of articles from 2018 and 2019, we ended up with a final list of 299 articles.

Required characteristics of an ex-ante business model evaluation method

We now turn our attention to the characteristics that a good business model evaluation method must have in order to meet our goal. As we stated before, this paper aims to develop and propose an improved ex-ante method that can compare alternative potential business models. Consequently, we will not consider methods that compare new business models with current ones, or methods that only suggest improvements to a specific business model without any way of comparing them. We intend to develop a proposal that may help decision-makers to choose a business model as early as possible during the entrepreneurial process, in order to avoid wasting time and effort, yet ensuring the choice is as rigorous as possible. In this sense, we discarded the methods based on unrealistic numerical forecasts, and the methods that only provided qualitative information, which is difficult to check from one business model to another.

We aimed to develop a method that used numerical indicators derived from the business model definition, not from the hypothetical behaviour of the business model once launched. As these indicators try to measure a hypothetical construct (the goodness of the model to a certain extent) we demanded validity and reliability (Bannigan and Watson, 2009), completeness (indicators had to be able to cover all the possible values the variable can take), exclusivity (no overlapping) and precision (Cea D'Ancona, 1999).

Finally, the proposed method had to be useful to evaluate business models used in different industries and sectors.

Consequently, from our list of 299 methods we removed those that focused on evaluating real companies' business models (e.g. Brea-Solís, Casadesus-Masanell and Grifell-Tatjé, 2015), methods focused on improving current business models (e.g. Diaz-Diaz, Munoz and Perez-Gonzalez, 2017), those that proposed evaluation methods to be applied ex-post (e.g. Horsti, 2007), methods defined for a specific industry (e.g. Shin and Park, 2009), those based on financial forecasts or similar 'unrealistic at this stage' numerical indicators (e.g. Gordijn and Akkermans, 2001), methods that only evaluated specific business model characteristics which were not sufficient to forecast the success of the business models (Hamel, 2000) and methods that did not have a manageable level of operationalisation, like simple lists of questions (e.g. Osterwalder, 2007, or Teece, 2010), or variables that were difficult to operationalise (e.g. Morris, Schindehutte and Allen, 2005). Many papers were excluded for more than one of these reasons. The result was a short list of two methods

from which to choose: Ishida, Sakuma, Abe and Fazekas (2006) and Mateu and March-Chorda, (2016).

The method drawn up by Ishida *et al.* (2006) offers an exhaustive list of indicators catalogued in five categories, namely Business concept, Environment analysis, Technology Competitiveness Analysis, Modelling, and Profitability analysis. Each category includes between 6 to 12 indicators that are scored from 1 to 5, making a total of 38 indicators.

Mateu and March-Chorda's methodology (2016) proposes a scale for ex-ante business model assessment consisting of eight indicators that evaluate eight key factors in the model. The evaluation is carried out by answering specific questions about the model that is being analysed. Possible answers are 1, 2, 3, 4 and 5. Table 1 shows the questions in their generic formulation.

1. How would the value proposition bring utility to the customer? To what extent?
2. Are all the necessary complements already available? If not, can we obtain those complements or develop them conveniently and at a reasonable price?
3. How large is the market in terms of both customer volume and purchasing power?
4. How difficult will it be to explain the benefits of the value proposition to the potential customers?
5. Would the potential customers be ready to pay the price and make the effort the new business model requires?
6. Will it be costly for us to offer the value proposition?, or, on the contrary, will it give us an attractive margin?
7. Are there many alternative value propositions competing for the same customers? How valuable are those alternative options? How strong are those competitors?
8. Does the new Business Model provide a mechanism to hold the imitators at bay?

Table 1: Questions for ex-ante business model evaluation method (Mateu and March-Chorda, 2016).

Mateu and March-Chorda's methodology (2016), in addition to fulfilling all our conditions, has several advantages. First, it is a good answer to Alexa's statement, i.e., "there is a need for simple and versatile instruments" (Alexa, 2014, p. 259). Second, it is clearly focused on the business model, thus enabling the isolation of this key element from other concomitant factors like entrepreneurs' capabilities or the environment. Third, it considers a wide range of relevant business model factors (Steinhöfel, Hussinki and Bornemann, 2018).

The general template used to evaluate business models using this methodology includes the questions and some elements to facilitate the evaluation, such as examples of well-known models that could obtain a particular score, as well as a description of extreme cases (1 and 5) for each indicator (see Mateu and March-Chorda, 2016).

Refining and Improving Mateu and March-Chorda's Methodology

A relevant issue in this methodology is related to who carries out the evaluation. In the original formulation of Mateu and March-Chorda's method, evaluation was entrusted to management experts or people that were familiar with the sector. The varying nature of the eight indicators suggests that each could be best rated using different techniques and entrusting them to different authors.

Indicator 1, for example, is related to the value that the business model gives to the potential customer. Therefore, it would be useful to find out the opinion of these potential customers in order to evaluate this indicator. This also holds true for indicator 3 to a certain extent, because this indicator tries to measure not only the size of the market but also the part of the market that is interested in the value proposition.

According to Teece, "a good business model yields value propositions that are compelling to customers" (Teece, 2010, p. 174). How can we measure to what extent a business model is compelling to customers? Traditional marketing has been postulating for decades the advantages of using market research to answer this question (Kotler and Keller, 2016). Bearing in mind that a number of core marketing activities are part of a business model (Ehret, Kashyap and Wirtz, 2013), including value proposition delivery, recent scholar's works have recovered the link between business model research and marketing (Coombes and Nicholson, 2013; Klimanov and Tetriak, 2019). In fact, some authors

have already used surveys with potential customers in order to evaluate the value proposition of the business models, and especially to compare different business models (Ghezzi, Georgiades, Reichl, Le-Sauze, Di Cairano-Gilfedder, and Managiaracina, 2013; Piscicelli, Ludden and Cooper, 2018).

The rest of the indicators require more expert knowledge. Only an expert in management can, for instance, evaluate aspects such as the effort required to implement a business model before this model is comprehensively defined (indicator 2).

Consequently, we refined the method introducing a mixed evaluation in which each indicator was evaluated using the most suitable process.

To evaluate the indicators for each of the business models, we used the following processes and rules. Indicators 1 and 3 were rated with a survey answered by the future residents of the district. Indicators 2, 4, 5, 6 and 8 were rated by experts, that is to say, the authors of this study, who individually rated each model for each indicator. When scores diverged they were discussed to reach a consensus.

Finally, indicator 7 was also rated by experts, though on this occasion, we used Porter's Five Forces Analysis (Porter, 1980). Indicator 7 is focused on measuring the number and strength of competitors. Porter's Five Forces Analysis centres specifically on measuring competitive rivalry. It is particularly useful when it is not only the competitors' force that is relevant. For instance, in many of the services, customers could choose a self-service option or just go without the service. Consequently, we think that it is important to open the scope of the analysis taking other agents into consideration. This led us to use a traditional, broad-scope method, Porter's Five Forces Analysis (Porter, 1980). In fact, the five competitive forces are used as five of the 12 indicators to analyse the environment by Ishida et al.'s (2006) business model evaluation method.

The Five Forces Analysis takes into consideration the rivalry of existing competitors, but also four additional forces: (1) the threat of substitutes or alternatives to satisfy the need, (2) the bargaining power of suppliers, (3) the bargaining power of customers, and (4) the threat of new entrants.

Five Forces Framework has been criticised from the perspective of the Dynamic Capabilities Framework (Teece, 2007), because of its limited ability to describe competition in dynamic environments. However, most of Teece's criticisms are not relevant in this context. Teece criticises Porter's tool because it does not take into account factors which in Mateu and March-Chorda's evaluation method are assessed by other indicators, not by indicator seven, such as factors that impact imitation and appropriation issues (evaluated in Indicator 8), the role of complementary assets (evaluated in Indicator 2), network externalities (evaluated in Indicator 6) and factors inside the company that constrain choices (this is not relevant to us because we are evaluating the business model in isolation). In conclusion, although other minor criticisms made by Teece remain unanswered, the Five Forces Method fits the need and the context correctly.

Testing the Improved Method: Application to a Real Case Study

After introducing the refined method, we applied it to our case, in order to test whether it was applicable and useful for decision-makers.

We applied our improved formulation of Mateu and March-Chorda's methodology to a project for a *smart city* which is being developed in the Valencia region of Spain. We defined a *smart city* as a 'forward-looking city performing well in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens' (Diaz-Diaz, Munoz and Perez-Gonzalez, 2017; following Giffinger and Gudrun, 2010).

The term *smart city* has gained momentum over the last few years (Mora, Bolici and Deakin, 2017), not only among academics, but also among a wide range of practitioners, such as local authorities and private real-estate developers. As an example, the Spanish network of smart cities (*Red Española de Ciudades Inteligentes*) is made up of 65 Spanish towns and cities.

The European Union promotes and supports communities of universities, companies and other organisations centring on a specific global challenge, under the name of Knowledge and Innovation Community (KIC). Climate-KIC is a European Union Knowledge and Innovation Community working towards a prosperous, inclusive, climate-resilient society founded on a circular, zero-carbon economy. Climate-KIC has four areas of focus: (1) urban transitions, (2) sustainable production systems, (3) decision metrics & finance and (4) sustainable land use. The first of these areas pursues the challenge of creating the climate-resilient and zero-carbon towns and cities of tomorrow. Climate-KIC's urban transitions include initiatives on different scales, such as buildings, districts and even whole cities. The Smart Sustainable Districts initiative (SSD) is focused at district level, with twelve district projects from European cities being supported through the SSD programme so far, such as the Queen Elizabeth Olympic Park, in London, and Moabit West, in Berlin.
La Pinada has been one of the SSDs in Climate-KIC since 2017, and it is similar to the rest of the SSDs in its intention to build an innovative and sustainable district in all its dimensions: intelligent use of energy and water, sustainable mobility, circular and shared economy, integration with nature, social cohesion, community vitality, and local shops and services, all backed by socially and environmentally responsible suppliers.

La Pinada is to be built as a district of the metropolitan area of Valencia, in Spain, and it is set to house around a thousand families in a 25 Ha area. It is a peculiar project insofar as it is going to be developed almost entirely with private investment and because it is going to be built via a co-creation process, in which its future residents will be taking part. In fact, these future inhabitants are already giving their opinion about all the relevant decisions that will affect the appearance of the district, the characteristics of the buildings and the kind of services they want the district to provide.

A long list of possible services has been identified. Some of them have been suggested by the future inhabitants during a series of co-creation sessions. The rest have been suggested by other teams involved in the Climate-KIC's SSD Programme. As the original list of models was too long, we extracted a shorter list for this article, which is included in Table 2. The specific questionnaire we gave to the La Pinada team, in order to gather information about the different models, is included in Appendix 1, as well as the answers for Model C, which are provided as an example.

These services have been chosen under the premise that they contribute to the objectives established for a SSD. Accordingly, they must be environmentally friendly and they must improve the inhabitants' quality of life, but beyond this, they must be sustainable from an economic perspective. This means that these services must also be managed from a business perspective.

The economic viability assessment, as defined by La Pinada team, pursued a twofold objective:

1. To assess the economic viability of the business models proposed to start up each of the services.
2. To prioritise their implementation, in order to start with the models that have the greatest potential.

Business model evaluation methods are required to achieve these goals. We applied our refined methodology. We found this methodology to be specially suited to this case. Similarly, we found this case to be particularly useful, because most of the situations that required business model evaluation only included a small number of business models that had to be evaluated. A significant number of business models enables us to test the methodology in depth, as well as to obtain more interesting findings.

Details about this application are summarised below.

1. Value creation condition

As has been said, we appealed to the stakeholders, that is to say, the potential customers (future residents of the district), to rate indicator 1. We asked them about the value they saw in each of the business models. The survey asked them to rate this value on a scale from 1 (totally useless) to 5 (extraordinarily useful). Appendix 2 shows the details of this survey. It offered only a brief description of the business models, because giving all the details would have discouraged respondents from completing the survey.

Code	Service/Business model	Short value proposition description
A	Collective transport to the city centre	A means of transport (bus), with a scheduled timetable, to transport the neighbours between the neighbourhood and different points in the city centre.
B	Launderette service	Available washers and dryers in a specific area of each building.
C	Car-sharing	Electric cars available for hours or days.
D	Advisory service	An expert that can help to better control subscriptions and personal accounts.
E	Second-hand shop	To sell objects in good condition that are no longer needed, and to buy them.
F	Appliance rental store	Physical store that offers limited-use and high-priced appliances (Thermomix, steam wagons) for a short period of time.
G	Bike repair	To have the premises, the tools and the spare parts to repair or self-repair bikes and similar devices.
H	General repairs	To solve the small setbacks that may arise in the day to day running of a house (internet connections, moving furniture, home repairs)
I	Elderly care	Personal care for elderly people.
J	Fitness centre	Facilities and qualified personnel to stay fit
K	Orchard rental	To rent an urban orchard
L	Reception of goods and delivery of packages	Reception point for receiving and sending packages, including home delivery.
M	Local removal firm	Transport of personal objects from one place to another
N	Ambulance service	Ambulance that allows immediate transport to the hospital
O	Property management	Building administration service
P	Bike sharing	System of shared bicycles within the neighbourhood
Q	Service exchange platform	A platform through which people do jobs in exchange for virtual currencies or in exchange of other services carried out by others
R	Take-away meals	Shop of traditionally cooked meals to take away
S	Toy library	Allows children and adults to have a greater variety of toys
T	Household cleaning service	House cleaning service, by people at risk of exclusion
U	Central purchasing body	Buying together provides better offers and lower negotiated prices.
V	Rental of spaces for activities	To rent common areas on the ground floor of the buildings to organise events

Table 2: List of services to be evaluated

The survey was sent to all available emails in the La Pinada database (1,093 emails, belonging to people that had showed interest in the project at some stage). The emails were sent at the beginning of September 2018, and respondents had until 16th September to respond. 352 people opened the survey, but only 30 completed questionnaires were received.

As the focus of the article centres on the definition of the methodology, not on the analysed business models, the lack of representativeness of the sample is not deemed to be relevant.

Additionally, although the sample is not representative of the whole group of potential customers, it is representative of the most motivated and committed members. The current entrepreneurship paradigm gives an outstanding role to these most highly motivated members of the market, making them lead-users (Hippel, 1986). In fact, the value proposition must be focused on these lead-users, turning them into the beachhead that can clear market access (Moore, 1991).

We used the average of the 30 answers as the scores for indicator 1, for each of the models. These scores are shown in the column of indicator 1 in Table 4 (included in the Results Section of this article).

2. Complete value proposition condition

We adapted this indicator to answer the question: how much effort will be required to implement the business model? We assigned a score to each model for this indicator based on the experience and management knowledge of the authors of this study.

To do this, we had to add some premises. These included applying minimal investment as a criterion. Accordingly, any required asset would be rented if possible, instead of buying them, at least initially (until the viability of the model was demonstrated). This would be the case of a bus for model A, for example.

On the other hand, the majority of the models are not radically new or hard to implement. Therefore, the majority of the models obtained a high score in this indicator (from 3 to 5). The specific rubric was as follows:

- Rated with a score of 5: easy to implement models that require very low economic investment, and do not need any sophisticated technological resources or particularly qualified staff.
- Rated with a score of 4: models that require a small economic investment (such as the refurbishment of a space facilitated by the La Pinada organisation, or the purchase of some equipment) and/or to hire qualified staff with specialisations which abound in the labour market (tax advisors, for example).
- Rated with a score of 3: models that require a more significant economic investment or sophisticated technological resources. Although an asset such as a bus or minibus can be rented, with or without a driver, the supplier will demand a certain minimum commitment, which will raise the required investment, although not as much as if the vehicle has to be purchased. Conversely, we understand sophisticated technological resources as being the software and other elements required to start up a more innovative service.
- Rated with a score of 2: models that require a larger-scale investment, for example, to buy goods that cannot be rented, are expensive or are hardly accessible.
- Rated with a score of 1: models that require major investment and/or cutting-edge technological adaptations.

3. Sufficient size of the market condition

The approach of the proposed models is to provide services to the neighbourhood, and this significantly limits the target audience. Consequently, we have limited the maximum score for this indicator to 3. By doing so, we maintain the comparability of our evaluation with that of other models in other works.

The specific score was assigned based on the willingness to use the services of the 30 future neighbours who responded to the survey. The survey question that addressed this goal was: would you use this service if it were available at a reasonable price? The answer could vary between 1 (I would not use it) and 5 (I would always use it, or almost always).

As already mentioned above, and in order to maintain comparability with the general scale, the means of the 30 responses for each service were adjusted to a scale between 1 and 3, that is, they were divided by 5 and multiplied by 3. The results are shown in Table 4, included in section 5.

4. Access to the potential customer condition

The geographical concentration of the main potential market of all the proposed services greatly facilitates their communication and promotion. On the other hand, the genesis of the neighbourhood requires the participation of the neighbours and their engagement in local activities. This explains the high score assigned in this indicator to the majority of the models. In summary, the target audience of communication is close at hand and it is willing to listen, and this makes it easy to promote the services.

Based on this we established the following rubric:

- Rated with a score of 5: models which are obviously useful (they do not need any explanation),

regardless of whether the service is of interest to a particular resident.
- Rated with a score of 4: models which, given their professional foundation, require a certain degree of explanation in order to show their value or usefulness.
- Rated with a score of 3: models which, given their novelty value or innovative nature, represent a change in the way potential customers now solve the specific need that is served.
- Scores 1 and 2 have no meaning in this context.

5. Willingness to make an effort condition

Different and sometimes opposing factors should be taken into consideration to evaluate this indicator. These factors had to be balanced out to reach just one score. One of these factors is, for example, the extra cost incurred by the potential customer in the way the new model aims to solve the need which has been fulfilled in a different and cheaper way up until now. Another example is the extra effort the potential customer must make for the same reason.

Based on this, and using an expert evaluation, we propose the following rubric. For descriptive purposes, we used the reverse order from the one we used in previous indicators (from 1 to 5 in this case).

- Rated with a score of 1: services usually offered for free.
- Rated with a score of 2: models that offer services that the customer can self-provide or can hire at a low cost and with little effort.
- Rated with a score of 3: models that offer services for which the customer has comparable alternatives, though with different attributes. A score of 3 was also given to models that are more neutral in character compared to the existing alternatives.
- Rated with a score of 4: models that provide significant added value to potential users. This would be the case of a service that provides something occasionally or that gives an advantage when needed (such as buying second-hand goods or renting them).
- Rated with a score of 5: models for which we understand that the effort required of users will be made willingly.

6. Affordable costs condition

We rated this indicator for each model based on our experience and management knowledge. Rates were low for the majority of the models, because they involve a high degree of personal effort and, consequently, there are no economies of scale.

Based on this, we use the following rubric (ordered from 1 to 5).

- Rated with a score of 1: models based almost exclusively on personal effort, with no economies of scale.
- Rated with a score of 2: models that have a certain degree of economies of scale in secondary activities of the value chain, or can delegate certain activities to the customer via technology. The first case would be the case of models that require a physical space for their provision, in so far as they can benefit from economies of scale in terms of the rental cost.
- Rated with a score of 3: models that involve better economies of scale.
- Rated with a score of 4: models that only require sporadic or occasional staff participation, that is, the user does not require assistance from staff during the service.
- Rated with a score of 5: models with excellent economies of scale, network economies or others.

7. Superiority over competitor condition

As stated above, we applied the Five Forces Analysis to rate this Indicator. Accordingly:

- We rated each of the five forces for each of the models as LOW, MEDIUM or HIGH.
- Suppliers have low bargaining power for the majority of the models, because they compete in mature markets.
- The score attributed to rivalry depends on the advantage offered by proximity. If many of the

services are out of the district it is difficult to operate them. In this case, rivalry must be rated as LOW. When proximity is not an advantage, the model must compete against competitors both online and from the city. In this case, rivalry is rated as HIGH.

- Once the service is established, the threat of new entrants will be LOW, because the small size of the direct market will discourage potential new entrants.
- The definitive score is calculated by subtracting to 5 all the forces that have been rated as HIGH. For each force qualified as MEDIUM, only a half point is subtracted.

Our knowledge and experience using the aforementioned criteria gave the scores shown in Table 3.

8. Entry barrier existence condition

Applying the general rubric (Table 1), we observed that the assessment would be low in general for this indicator, as there are no elements of significant differentiation or innovation that can be protected legally (patents) or network effects or other analogous mechanisms. Scores of 5 in this indicator are therefore meaningless.

For some of the models, the most significant protection comes from the size of the investment required, which, when targeting a reduced market, discourages potential competition. However, to take advantage of this fact, the first-mover advantage would have to be activated (reducing time to market, for example).

Mod	Substitutes	Suppliers	Competitors	Customers	New entrants	Score
A	LOW	LOW	LOW	HIGH	LOW	4
B	LOW	LOW	LOW (far)	HIGH	LOW	4
C	MEDIUM	LOW	LOW	HIGH	LOW	3.5
D	MEDIUM	LOW	HIGH	HIGH	HIGH	1.5
E	HIGH	LOW	HIGH	LOW	LOW	3
F	LOW	LOW	LOW	HIGH	LOW	4
G	LOW	LOW	LOW	HIGH	LOW	4
H	MEDIUM	LOW	HIGH	MEDIUM	MEDIUM	2.5
I	LOW	LOW	HIGH	MEDIUM	MEDIUM	2
J	HIGH	LOW	MEDIUM	HIGH	MEDIUM	2
K	HIGH	LOW	LOW	LOW	LOW	4
L	MEDIUM	MEDIUM	MEDIUM	HIGH	LOW	2.5
M	LOW	LOW	HIGH	HIGH	MEDIUM	2.5
N	MEDIUM	LOW	HIGH	MEDIUM	LOW	3
O	LOW	LOW	HIGH	MEDIUM	HIGH	2.5
P	HIGH	LOW	MEDIUM	HIGH	LOW	2.5
Q	HIGH	LOW	LOW	LOW	LOW	4
R	HIGH	LOW	MEDIUM	HIGH	LOW	2.5
S	HIGH	LOW	LOW	HIGH	LOW	3
T	MEDIUM	LOW	HIGH	HIGH	MEDIUM	2
U	MEDIUM	MEDIUM	LOW	LOW	LOW	4
V	MEDIUM	MEDIUM	MEDIUM	LOW	LOW	3.5

Table 3: Scores for indicator 7 using the Five Forces Analysis (Porter 1980).

Therefore, we applied the following rubric:

- Rated with a score of 4: models that have network effects, or other similar effects, that would help a first mover to gain a competitive advantage.
- Rated with a score of 3: models that are easy to imitate but which have a considerable entry barrier given the volume of investment they require and the small market they serve.
- Rated with a score of 2: models that are easy to imitate but could have first-mover advantages at local level.
- Rated with a score of 1: easy to imitate models where it is difficult to establish any barrier to deter copies.

Evaluation Results

Table 4 sets out the score obtained by each of the models in each of the eight indicators on the scale, in line with the rules presented above.

The set of eight indicators evaluates each model briefly, but at the same time provides a wealth of information, given that it evaluates relevant criteria of a very different nature.

In any case, when evaluating a significant number of models in each of the indicators, an important volume of data is obtained (176 pieces of data). This volume may be hard to manage in some cases, such as when the goal is to prioritise the models and establish an order for their implementation. Therefore, it would be

		1	2	3	4	5	6	7	8	Avg.	Int.
A	Collective transport to the city centre	4.03	3	2.15	5	4	3	4	3	3.52	3.66
B	Launderette service	3.76	3	2.15	5	2	2	4	3	3.11	3.35
C	Car-sharing	4.45	3	2.13	3	4	2	3.5	3	3.13	3.52
D	Advisory service	3.45	4	1.59	4	2	1	1.5	2	2.44	2.73
E	Second-hand shop	4.17	4	2.21	5	3	2	3	2	3.17	3.52
F	Appliance rental store	3.66	2	1.93	5	3	2	4	2	2.95	3.25
G	Bike repair	4.10	4	2.12	5	4	1	4	2	3.28	3.64
H	General repairs	3.93	3	1.95	5	3	1	2.5	2	2.80	3.25
I	Elderly care	4.34	4	1.78	5	3	1	2	2	2.89	3.35
J	Fitness centre	4.00	2	2.23	5	3	4	2	3	3.15	3.36
K	Orchard rental	4.17	3	2.23	4	4	3	4	3	3.43	3.62
L	Reception of goods and delivery of packages	3.82	4	1.93	5	1	3	2.5	3	3.03	3.14
M	Local removal firm	3.25	5	1.52	5	5	1	2.5	2	3.16	3.19
N	Ambulance service	3.54	2	1.71	5	1	1	3	3	2.53	2.89
O	Property management	3.32	4	1.76	5	4	1	2.5	2	2.95	3.13
P	Bike sharing	4.46	2	2.40	4	3	2	2.5	3	2.92	3.47
Q	Service exchange platform	4.00	3	2.16	3	4	4	4	4	3.52	3.50
R	Take-away meals	3.82	2	1.97	5	5	3	2.5	3	3.29	3.45
S	Toy library	4.14	5	2.22	5	5	3	3	2	3.67	3.78
T	Household cleaning service	3.96	5	2.01	5	4	1	2	2	3.12	3.43
U	Central purchasing body	4.29	3	2.31	3	5	4	4	4	3.70	3.74
V	Rental of spaces for activities	4.07	4	2.16	5	5	4	3.5	3	3.84	3.80
		3.94	3.36	2.03	4.59	3.50	2.23	3.02	2.64	3.16	3.40

Table 4: Scores obtained by each model in each of the indicators on the scale, average scores and scores obtained through the emulation of intuitive assessment

necessary to obtain a sole (or brief) assessment for each model.

Next, we present two ways to obtain a sole evaluation of each model, using the set of scores obtained by the model in the eight indicators.

Average score

In this case, we obtained the sole model evaluation by averaging the assessment obtained by the model in the eight indicators. In practice, this meant giving the same weight to each of the eight indicators. Table 4 shows this evaluation in its penultimate column.

Intuitive assessment

Intuitive model assessment is deemed to be an evaluation that would be given without carrying out a detailed analysis like the one conducted here. Mateu and March-Chorda (2016) showed the correlation between their eight indicators evaluation and a purely intuitive assessment. This allowed us to estimate the intuitive assessment of a model as a linear combination of the scores obtained by this model in each of the eight indicators on the scale.

$$E_i = \sum_j p_j E_{ij}$$

Where:

E_i is the intuitive assessment of the model i

P_j is the weight assigned to indicator j in the linear combination (j takes values between 1 and 8).

E_{ij} is the rating of the model i in indicator j (in our case they are the numbers showed in Table 4 for each of the models)

Table 5 shows the weights that Mateu and March-Chorda (2016) found when emulating the intuitive assessment through this linear combination of the eight indicators on their scale. As we can see, indicators 1 and 3 were the ones that received greater consideration or greater weight.

Table 4 shows the intuitive assessment of the models in its last column, by means of the linear combination and the weights included in Table 5.

Indicator	Weight
1. Value creation	0.33
2. Complete value proposition	0.04
3. Sufficient size of the market	0.25
4. Access to the potential customer	0.10
5. Willingness to make an effort	0.05
6. Affordable costs	0.05
7. Superiority over competitors	0.12
8. Entry barriers existence	0.10

Table 5: Weights for each indicator in a sole evaluation that emulates intuitive assessment, through a linear combination of the eight indicators put forward by Mateu and March-Chorda.

Discussion

Figure 1 shows the original models according to both aggregation profiles (*average score* and *intuitive assessment*). It shows the most highly rated models in the upper right quadrant. They are models A, G, K, Q, S, U and V.

By contrast, the evaluated models with the poorest results appear in the lower left quadrant. They are models D and N.

In any case, Table 4 and Figure 1 respond to the specific objectives established, that is, to evaluate the potential viability of the different models and facilitate their prioritisation, thus becoming the most useful tool for the managers of the project.

This can also be a starting point for additional research on the improvement of the business models. The score obtained by many of the models in indicators 3, 6 and 8 points to the need to improve the business models in certain directions:

1. **Are there new customer segments we could serve?** The most obvious response is to expand the target audience of the services, offering these services to potential customers outside the district. This will have advantages and disadvantages that need to be taken into account in order to reformulate (to improve) the models.
2. Another question that can give us clues for improvement is: **are there activities we would be better outsourcing to partners?** To a certain

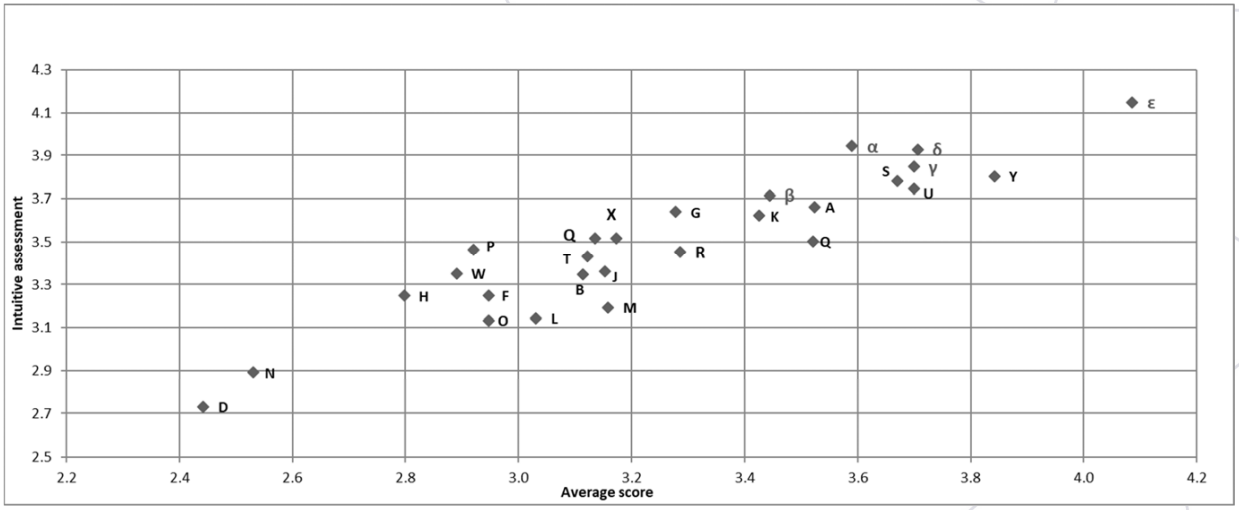

Figure 1: Presentation of the models according to their average score and their intuitive assessment

extent, this dovetails with the following: are there key resources that could be provided more efficiently and/or cheaper by suppliers or partners?

3. **Are there ways we could reduce our cost structure?** This is an important question which, given the impossibility of applying economies of scale when the target audience is so small, we could change as follows: can we activate alternative economies in order to reduce costs?

The last of these suggestions (the search for economies of scope) points to the need to reformulate the models with a broader perspective instead of simply improving the elements of the model independently. In other words, in order to find more effective ways to improve the models, with fewer disadvantages, we must take into consideration the systemic effects derived from the interaction of the different elements in the business model.

There are several logics or mechanisms which explain the low score obtained by many of the models in indicators 3, 6 and 8. They include the following:

1. The threat of not reaching the critical mass, and consequently the viability threshold, due to the lack of clients.
2. Incurring high unit costs due to the lack of customers and, as a consequence, implying that the necessary resources work below their optimum activity level.
3. The difficulty to incorporate certain key resources due to the impossibility of assuming their cost. This would be the case of certain members of staff; perhaps not in operational tasks but certainly in organisational tasks (executive staff).

In view of these mechanisms, solutions emerge not related to increasing the size of the target audience, but to sharing certain resources or by synchronising certain activities across different models, in line with the search for the aforementioned economies of scope.

For instance, the unqualified staff required by the Household cleaning service (model T) could manage the Launderette service (model B) when they did not have to perform the previous task. Something similar could be applied to the staff in charge of the Appliance rental store (F), the Second-hand shop (E) or the Bike repair service (G). Sharing and optimising human resources can in this case also be extended to material resources, such as physical space, maintenance tools or other kind of equipment.

This sharing of resources could, if not neutralise, at least palliate the threats discussed above:

1. The critical mass should not be reached for a given service, but for a specific resource, by sharing it among several services.
2. More efficient use of resources would reduce downtime, increasing the percentage of time actually

spent on customers. Lower prices could thus cover the cost of resources, by not having to finance idle time in those resources.

3. The margin for administration and organisation, extended to the group of jointly managed services, would allow financing more efficient human resources for these tasks. This would mean increasing management knowledge, and enabling virtuous systemic circles to be activated that would ensure the viability of the services.

Based on this analysis, we grouped most of the services initially proposed into five higher level services (those shown in Table 6). The names proposed are merely illustrative. We have assigned codes consisting of Greek letters to differentiate them from those used in the initial services. Some of the original models are not grouped.

An interesting fact can be highlighted here. During our research for a robust method to evaluate business models before their implementation we found a strong tool to improve business models before their implementation or, in other words, to improve business model design. All of this thanks to the details provided by Mateu and March's methodology and our improvements.

Conclusions and Future Developments

In this paper we have tackled the issue of choosing the most promising business models before implementing them. To do this, we chose Mateu and March-Chorda's business model evaluation methodology. Their eight independent indicators enabled us to break down their scale and use the most suitable ways to rate each of the eight indicators on the scale. In fact, the varying nature of each indicator suggested the most suitable way to rate each one. Table 7, summarises the ways we defined to award a score to each of the indicators, thus improving this useful evaluation method.

Code	Service/Model and description	Models	1	2	3	4	5	6	7	8	Avg.	Int.
α	**La Pinada, Mobility** This could group the services oriented to facilitate the sustainable mobility of the residents	A, C, N and P	4.62	3	2.60	5	4	3	3.50	3	3.59	3.94
β	**La Pinada, Professional services** This could group the services that require qualified staff	D, G, H and O	4.20	4	2.35	5	4	2	3.00	3	3.44	3.72
γ	**La Pinada, Personal services** This could group the services that require low qualified staff	B, I, J, M and T	4.36	5	2.44	5	4	3	2.80	3	3.70	3.85
δ	**La Pinada, Circular economy** This could group the services oriented to facilitate savings and the efficient and sustainable use of long-lasting products	E and F	4.41	4	2.57	5	4	3	3.67	3	3.71	3.93
ε	**La Pinada, Community resources** Focused on managing community resources	K, L, S and V	4.55	5	2.64	5	5	4	3.50	3	4.09	4.15
			4.43	4.20	2.52	5.00	4.20	3.00	3.29	3.00	3.71	3.92

Table 6: Proposal of grouped or higher-level models

Indicator	Description	Scoring
1	Value creation condition	Research into potential market/ lead users (survey or others)
2	Complete value proposition condition	By experts
3	Sufficient size of the market condition	Research into potential market/ lead users (survey or others)
4	Access to the potential customer condition	By experts
5	Willingness to make an effort condition	By experts
6	Affordable costs condition	Five Forces Analysis by experts
7	Superiority over competitor condition	By experts
8	Entry barrier existence condition	By experts

Table 7: Improved business model evaluation method summary.

The set of eight indicators provided a wealth of information. It allowed us to explore and propose an interesting way to improve the case study's original business models, thus grouping them into higher level business models.

We provided two ways to offer a sole assessment for each model, departing from the information provided in the eight indicators: average score and intuitive score (using a linear combination also provided by Mateu and March-Chorda). This suggests a possible field for future research, based on new specific profiles for evaluation. What weightings would experts give to different indicators (expert profile)? Which evaluation profile could highlight the models with the greatest potential for extraordinary profit (or extraordinary losses)? Conversely, which evaluation profile could highlight the most conservative models (those that will probably generate little profits or small losses)? Identifying new and useful evaluation profiles suggests an interesting and fruitful avenue for improving decision-making paradigms.

A more ambitious line of research would be to compare the ex-ante evaluation obtained by each potential business model with the results of the model after implementation, although this possibility would only be possible for business models that had been effectively implemented.

In summary, we refined and improved Mateu and March-Chorda's ex-ante business model evaluation methodology, making the measurements calculated for each indicator more accurate and credible. This refined and improved methodology is useful when a set of business models has to be evaluated and ordered. We applied this methodology to a set of business models to be used in a new Sustainable Smart District, thus drawing interesting conclusions, though this method can also be applied in a broad spectrum of other situations.

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Appendix 1: Example of business model description (Model C.- Car sharing)

1. What need does the model address? What problem does it solve? What wants does it satisfy?	It offers a personal mean of transport available by hours.
What value attributes complement the value proposition?	It avoids the need to have a personal car, or use it systematically. It uses low pollutant and low consumption electric cars.
To what extent does it meet the need or solve the problem	It can avoid the purchase of a car, which is a major expense.
2. Is it a need or want shared by most of the residents or only by some of them?	It is probably a broadly shared want or need.
Could the model serve residents outside the neighbourhood?	Initially not, maybe depending on which areas it could be used in.
3. How is the service provided? (describe the system and resources required to provide the service)	It depends on whether we work together with a company in the sector or we decide to start from scratch. Investment is greater in the second scenario, as we would have to buy cars and create the platform. In the first scenario, the cost is smaller.
3.1. How difficult would it be to start up and run the service? What particularly complex elements does the model require?	It would be complex because cars would have to be bought, the platform created, areas of use defined and rates established, etc.
3.2. What initial investments does the model require for start up? (include an estimate if known)	Depending on the model, the investment could be very high.
3.3. What are the main recurring costs associated with the provision of the service? (include an estimate if known)	Maintenance of the platform, vehicles, and customer service system.
3.4. Will the model compete with the service provided by companies outside the neighbourhood that offer an analogous service?	Direct competition: people who prefer to have their own car, and public transport.
4. Would the potential customer be ready to pay the price and put in the effort required by the new business model?	Probably.
Which of these income formulas are contemplated in the model (either exclusively or simultaneously)?	**Free for all**: ; **Periodic fee (flat rate)**: ; **Pay per use**: X (*); **Other (to specify)**:
	(*) A one-off payment plus a payment based on kilometres travelled

Appendix 2: Survey

We would like to find out your opinion about some services that we are thinking of setting up in the neighbourhood. All of them will feature the environmental and social concerns that characterise the project. It is also important to know how useful you would find these services, and if you would use them.

We would like you to rate these services with a score ranging from 1 to 5, depending on how useful they would be to you. Give a score of 1 to those services you find totally useless, a score of 5 to those that you would find totally useful, or scores 2, 3 or 4 for intermediate ratings.

Let us show you an example. Choose the answer that best fits haw useful you would find a service that consists of...

	Of no use at all	Of limited usefulness	Of average utility	Quite useful	Extraordinarily useful
... a means of public transport (bus), with a set timetable, which connects the neighbourhood with several key places in Valencia	1	2	3	4	5

For this service, please answer this question as well: would you use this service if it was available at a reasonable price? (select the option that best describes your willingness to use it).

	I would not use it	I would use it occasionally	I would use it sometimes	I would use it very often	Always or almost always
... a means of public transport (bus), with a set timetable, which connects the neighbourhood with several key places in Valencia	1	2	3	4	5

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