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## Street food and innovation: the food truck phenomenon

### Introduction

Over the last decade, the food sector has faced a constant increase in competition in a context of continuous and fast changes involving also people's life styles and eating habits. The increased interest in and - success of- street foods demonstrates this. According to FAO, "*Street foods are ready-to-eat foods and beverages prepared and/or sold by vendors or hawkers, especially in the streets and other similar places*" (FAO, 1997). About 2.5 billion people around the world consume street food every day, thanks to its low cost and convenience (Fellows and Hilmi, 2012).

Moreover, this kind of food has an elevated socioeconomic value for a large worldwide public (FAO, 2009; Tinker, 1999; Simopoulos and Bhat, 2000). It has also become a way to preserve cultural and social heritage and to stimulate tourism (Long-Solís, 2007; Steyn et al., 2014; Alves da Silva et al., 2014). Indeed, street food attracts tourists in search of cuisine culture and different tastes and contributions to the enhancement of a country's tourism (Steyn and Labadarios, 2011; Privitera, 2015). Furthermore, as street food provides income to sellers with limited resources to start an economic activity (FAO, 2009), it also generates employment.

Last but not least, it has been recognised that street foods make a significant nutritional contribution, in terms of energy and protein, to the population's diet, especially in developing countries, as long as the food is both healthy and traditional (FAO, 1997; Blair, 1999; Steyn et al., 2013; Khairuzzaman et al., 2014; Sezgin and Sanlier, 2016). This phenomenon is in continuous evolution (Basinski, 2014) and links the habits and traditions of countries far from one another, both geographically and culturally, like with the pizza, as in *Jemaa El Fnaa place*, in Marrakesh (Minca, 2007; Skounti, 2012) or where the Vendy Award has been given in the United States of America. All that considered, street food has caught the attention of numerous researchers that have focussed their studies on it.

There are many and varied contamination and risk factors involved in this sector, in urban and sub-urban areas. These include, limited hygiene (also personal), inadequate access to potable water supplies, garbage disposal and unsanitary environmental conditions (FAO, 2009). In this context, the World Health Organisation (WHO) has adopted the *Five Keys to Safer Food*, i.e. keep clean, separate raw and cooked foodstuff, cook thoroughly, keep

food at safe temperatures and use safe water and raw materials (WHO, 2006) and integrate them into the street food sector (WHO, 2010). *These 5 Keys* are useful, as, to date, the methods and place of preparation do not always respect even the most elementary rules/regulations as to foodstuff. In fact, WHO provides a codification of street foods to identify the preparation criteria and state that street food is prepared in: a. "*in small-scale food factories or traditional workshops*", b. "*in the home*", c. "*in markets*", d. "*on the street*" (WHO, 2010).

The abovementioned studies have evidenced a low respect for these requirements during the food preparation due to inadequate raw materials, sites and/or tools, personal hygiene of the vendors and to the scarcity of inspections and controls (**Azanza et al., 2000**; Omemu and Aderoju, 2008; Thakur et al., 2013; **Adjrahet al., 2013**; Liu et al., 2014; Mchiza et al., 2014; De Souza et al., 2015; **Sabbithi et al., 2017**). Various alternatives have been proposed to meet these market requests, as indicated e.g. in the papers by Yahiro et al., 2013; Martin, 2014; Mukhola, 2014; Newman and Burnett, 2013; De Cassia Vieira Cardoso et al., 2014; **Cortese et al., 2016**.

A particular way of preparing and selling street food is by "food trucks", that have recently become a very popular and important part of the hospitality industry. A food truck is a large vehicle equipped for the preparation and selling food. It may use the same location each day and recently it offers gourmet cuisine and a variety of specialties and ethnic menus. The relatively low cost of entry, along with free and low-cost marketing via platforms, like social media, are just two of the reasons why the food truck business is drawing-in budding entrepreneurs.

Street food has been more investigated than has the food truck industry. This gap prompted the birth of this research paper, aimed at contributing at a national and international level, investigating and enhancing this growing sector. **Furthermore, it aimed at evidencing any peculiarities and emphasizing the innovation, which is an important key to competitive advantage in this sector, applying an efficiency performance analysis.** Starting from the aforementioned information, this paper analyses the food truck phenomenon in a specific urban area in North West Italy (Piedmont), i.e. the *Greater Torino* (in Italian called *Torino Città Metropolitana*).

**The paper proceeds with the analysis of a literature review and the identification of a theoretical framework. The methodology used to define the sample and analyze the data, the presentation of the results and the**

**conclusions. The last paragraph presents the implications and limitations of this study and identifies the topic of future research.**

## **Literature review and theoretical framework**

### *The food truck service*

As aforementioned, the last decade witnessed an increase in the *food truck industry worldwide*. Indeed, the U.S.A. food truck industry has become stronger over the past five years and is now one of the best performing segments in the broader food-service sector (Anenberg and Kung, 2015). This increase began in 2008, as the recession hit, as hundreds of new vendors recognised changing consumer preferences favouring unique, gourmet cuisine, driven by “gourmet food trucks” able to meet the consumers’ requests in the urban areas (Martin, 2014). The public had less cash to eat out, leaving numerous young chefs unemployed (Weber, 2012; Esparza et al., 2014). However, this *opened another door* for those unemployed chefs, as many of them pooled their talents with the food services guaranteed by trucks. Although this provided high quality and inexpensive creative food, both in the food truck movement and in street food, there were some problems in meeting the requirements for hygiene (Faw and Tuttle, 2013).

In 2015, the U.S. food truck industry was valued at 856.7 million dollars, with a foreseen value of 996.2 million dollars in 2020 (Statista database); the annual food truck revenue was \$1,200,000,000, with an average revenue generated per food truck of \$290,556 and an average spending per order at a food truck of \$12.40 (**Ibis World, 2016**).

Therefore, food trucks attracted the attention of researchers, leading to several studies being done in the field. The reviewed studies, done in countries like the U.S.A (Faw and Tuttle, 2013) or Malaysia (Ismail et al 2016), showed a general need for more general awareness among the street vendors and on the application of the WHO’s five *keys to safety*. Furthermore, the studies emphasised a low respect of hygiene requirements during food preparation due to inadequacy of: raw materials, sites and tools; personal hygiene of the vendors and hygienic practices and inspections and controls (**Azanza et al., 2000; Omemu and Aderoju, 2008; Thakur et al., 2013; Adjrahet al., 2013; Liu et al., 2014; Mchiza et al., 2014; De Souza et al., 2015; Sabbithi et al., 2017**). Various alternatives were proposed to solve these problems i.e. rules and guidelines dedicated to food truck operations (Linnekin et al., 2012; Martin, 2014), implementing new areas and re-adaption to standards for the old sites to prepare street food (Hernández-López, 2011;

Newman and Burnett, 2013), the creation of Street Vendors Associations (Esparza et al., 2014).

Moreover, a literature review showed that other key aspects were poorly addressed, like the different services offered; how the vendors combine and respect innovations and tradition (above all the gourmet food trucks); any innovations used in the field and customer satisfaction. This observed gap prompted this paper, aimed at enhancing this new way of doing business that allows for, the promotion of food, traditions and the linked territory. **This aspect represents the added value of the present research.**

### *Innovation and tradition in Italian food truck service*

The food sector is important for the Global economy (USDA, **2016**; Report Linker, **2017**), in particular European economy (FoodDrinkEurope, 2016). In this sector, *innovation* is considered a strategic problem solving tool to meet targets and is divided into incremental and radical, where incremental is more popular because the customer tends to maintain set food habits (Rama, 1996; Traill and Meulenberg, 2002; Capitano et al., 2009; Jakki et al., 2010; Dadura and Lee, 2011; Arcese et al., 2015; **Contò et al., 2015**; Boccia and Covino, 2016). At the same time, *tradition* is a strategic key so the food sector can change its future (DeSoucey, 2010; Tosato, 2013; Klaus and Aachmann, 2015; Bonadonna et al., 2017) aimed at increasing value e.g. foodstuffs (Jordana, 2000; Dogan and Gokovali, 2012; Gragnani, 2013; Rodrigo et al., 2015), specific foods (Schamel, 2007; Marcoz et al., 2016; Bonadonna et al., 2016), food services (Mkono, 2012; Gordin et al., 2016; Maltese et al., 2016). Sometimes, *tradition* is combined to *innovation* (Guerrero et al., 2009) e.g. in the case of strategies on family businesses (Vrontis et al., 2016). Street food and food truck services insert themselves into this context.

The Gourmet Food Trucks and street food have become more popular all over Europe. In Italy, in particular, *fast, cheap, gourmet, design* and *on the road*, seem to be the passwords for a successful business. The Italian food truck industry has gained strength and success, especially over the last seven years, also thanks to the influence of the American boom of food trucks, small mobile vehicles, occupying urban spaces at a much lower cost than a restaurant would require. According to statistics, collected by Coldiretti (2016), there was a 13% increase in itinerant food services in Italy, with 2,271 operative food trucks, 187/2,271 in Piedmont. These food trucks can be considered a new way of facing the economic crisis affecting the food service sector of late. This has stimulated the

rise of a new entrepreneurial class able to transform a passion into *a real job*, combining tradition i.e. the enhancement and use of local and excellent raw materials in food preparation, with innovation i.e. revised traditional recipes, innovative packaging, the use of social media (Rosati, 2015; Coldiretti, 2015).

Indeed, Italian Food Trucks offer a long-standing tradition of food services i.e. the "Traditional Food Trucks" (identified as TFT in this paper). This service is usually provided during concerts and/or sports events and as part of the *Italian night life*. The gastronomic offer involved in this sector is characterized by very cheap, fast, street food like hot dogs, sausages (salami) and precooked vegetables. Besides TFT, the last 5 years have witnessed the birth of *a new kind* of food trucker, operating with a new philosophy, oriented to satisfying various requests for *quality over hunger*, through the use of selected raw materials, aesthetic presentations and revisited traditional recipes. This new kind of service has been called "Gourmet Food Truck" (identified as GFT in this paper) which is specialized in serving higher quality food at higher prices than *more traditional mobile vendors* (Anenberg and Kung, 2015).

### ***Efficiency performance and food trucks***

**Efficiency performance is an important issue to achieve and maintain the competitive advantage and ensure ongoing business. Data Envelopment Analysis (DEA) is a method used to evaluate the efficiency among a number of organizations and differs from other analysis tools in as much as the efficiencies estimated involve the best performing companies and not, as is most commonly done, to the theoretical optimum.**

**Researchers studying service-industry efficiency have applied DEA to a variety of sectors, including foodservice (Giménez-García et al, 2007; Reynolds and Thompson, 2007) food industry (Dimara et al., 2008, Dadura and Lee, 2011) and the hospitality industry (Morey and Dittman, 1995; Anderson et al., 2000). To the best of our knowledge, this is the first study on efficiency performance of the food truck. The choice of inputs and outputs and the development of the model will be carried out on the basis of the studies dedicated to the restaurant analysis. DEA was used to identify efficient units (best practices), to compare TFT and GFT and to understand which units are inefficient by setting targets to improve outputs and/or reduce inputs.**

## Methodology

This paper aims at investigating the phenomenon of food trucks in Italy, in particular in the Turin agglomeration area, with 2,282,000 inhabitants. **Turin is the city where the *Salone del Gusto* and *Terra Madre* of Slow Food were born (Parkins and Craig, 2009; Myers, 2013) and the Eataly food hall (Massa and Testa, 2012; Sebastiani et al., 2013; Bertoldi et al., 2015), the only Italian distribution chain of high quality foodstuffs.**

It draws attention to the food truck service and its evolution in this area and traits, as to efficiency and the performance of the two different food truck types.

Firstly, it identified and pooled the different characteristics of the two kinds of food truck services, i.e. TFT and GFT and evaluated consumers' satisfaction of the food truck services (Suchánek et al., 2014). Secondly, the two kinds of food trucks were compared, evaluating their efficiency performance.

**A questionnaire was prepared *ad hoc* and administered to several food truck owners to assess the different food services offered i.e. their ability to meet the hygienic requirements, their raw materials selected, any possible innovations used. Another questionnaire was given to several food truck service consumers to assess the customer satisfaction level reached. The data were analysed and elaborated to evaluate the corporate efficiency performance of the food trucks investigated.**

The authors chose semi-structured interviews (Alvesson, 2003), which were carried out between November 2014 and February 2015, to collect information in two different ways. Both the questions and their order could be changed according to the individual interviewed, in line with other authors (Pitrone, 1984; Fideli and Marradi, 1996). The GFT interviews were carried out during the Pala Vela Event 2015, in Turin, dedicated to food truck movement and all the participants were potential interviewees. There was a prospective sample of 23 vendors and all of them accepted. The TFT interviews were made on different sites in the Turin Metropolitan area, on the basis of the "commercial style" of the traditional food truckers. Although the prospective sample included 26 food trucks, only 18/26 food truckers accepted. The interviewees' attitude towards the study differed, as all the GF Truckers were interested and contributed with a proactive behaviour.



Whilst the TF Truckers were less enthusiastic and some of them were not interested.

A specific questionnaire was prepared *ad hoc* and administered to all the 41 food truck owners to investigate into the different food services offered. The following information was requested and collected:

- personal details of the operators interviewed, i.e. age, gender, qualification and type of authorization for food and drink services, working experience;
- information on the geographical area where they carried out their food and drink activities;
- details about the vehicle used to practice the activities;
- details on the food and drink offered;
- information on how they met the hygienic requirements i.e. specific education on food and drink services and/or professional qualifications obtained; if the vehicle was correctly fitted-out with: running water systems, vacuum systems, food and raw material conservation systems; details of personal hygiene education/training; details on the cleanliness and hygiene of the cooking area and the vehicle as a whole and the application of the HACCP system. **Moreover, a control question was integrated into the questionnaire to verify how much was known about regulations on food safety.**

The interview team had two members, taken at random from the 3 authors, according to availability. One of them asked the questions, while the other completed the check list. Each interview lasted around 40 minutes and the results were analysed by a single author, to avoid any influence amongst them in the evaluation phase (Atkinson and Shaffir, 1998). Lastly, the results obtained were pooled, compared and the fundamental issues pertinent to the aim of the paper, were extrapolated.

The second questionnaire was prepared and given to 820 food truck service consumers to assess customer satisfaction. The following information was requested and collected:

- evaluation of the service obtained e.g. serving time, queue, the presence of a table and/or chair;
- satisfaction level as to the flavour of the food;
- perception of the quality of the raw materials e.g. declared guaranteed origin , traditional products;
- level of quality/price ratio;
- aesthetic presentation e.g. packaging, kind of knives and forks provided.

All data were collected with Likert-type scale questions (Likert, 1932) to assess the consumers' satisfaction of single food truck services. These scales had five points, ranging from 1 to 5 i.e. 1 = strongly unsatisfied, 5 = strongly satisfied, in line with other authors (Lülfes-Baden et al., 2008; Namin, 2017). All interviews were done from November 2014 to February 2015, at the same time as the interviews, 20 questionnaires were filled-in for each food truck. Each interview lasted around 5 minutes. The data were elaborated, calculating the average level of the consumers' satisfaction of each food truck i.e. the quality index.

The authors chose the DEA method to evaluate efficiency. This measurement involves the choice of the concept of efficiency, of the estimation method and, the definition of the inputs and outputs. DEA is a linear programming – based benchmarking technique, introduced by Charnes et al. (1978), which uses multiple inputs and outputs to measure how well a company performs compared to the best ones, by converting multiple inputs and outputs of each decision-making unit (DMU), or food truck, into measurable units.

The efficiency measure is related to the use of a minimum number of inputs, so as to produce a certain number of outputs or the maximum production of outputs, using a certain number of inputs (Fethi and Pasiouras, 2010). Productivity and efficiency are often considered to be synonyms and that, according to Cooper, Seiford and Zhu (2004), Coelli et al. (2005), and Sherman and Zhu (2006), is not correct because productivity is expressed by the output-to-input ratio (Lovell 1993).

The efficiency ratios, defined by Daraio and Simar (2007, **p. 14**) "*as a distance between the quantity of input and output and the quantity of input and output that defines a frontier, the best possible frontier for a firm in its cluster (industry)*" is able to encompass the issue. This frontier has particular managerial relevance, in as much as it allows for a comparison of disparate operating units.

As developed by Charnes et al. (1978) (CCR Model), DEA extends the basic output-to-input calculation of productivity, by integrating the weighted sum of outputs to the weighted sum of inputs.

For example, if Food Truck 1 is evaluated using two output variables,  $Y_1$  and  $Y_2$ , and two input variables,  $X_1$  and  $X_2$ , its efficiency ( $P_1$ ) is calculated by:

$$P_1 = \frac{U_1 Y_1 + U_2 Y_2}{V_1 X_1 + V_2 X_2}$$

In applying DEA, the weights ( $U_s$  and  $V_s$ ) are estimated separately for each food truck, so as to arrive at the maximum attainable efficiency. Moreover, the weights estimated for Food Truck 1 are such that, when they are applied to corresponding outputs and inputs from other units in the analysis, the ratio of weighted output to weighted inputs is less than, or equal to, 1. On a more general basis, assuming the number of outputs and inputs is conceptually infinite, the maximum efficiency of food truck  $o$  as compare to  $n$  other food trucks is calculated as follows:

$$\text{Maximize } P_o = \sum_{r=1}^s U_r Y_{ro}$$

subject to:

$$\sum_{r=1}^s U_r Y_{rj} - \sum_{i=1}^m V_i X_{ij} \leq 0$$

$$\sum_{i=1}^m V_i X_{io} = 1$$

$$U_r, V_i \geq 0$$

where  $Y_{rj}$  is the  $r$ th output for the  $j$ th food truck,  $X_{ij}$  is the  $i$ th input for the  $j$ th food truck,  $s$  is the number of outputs,  $m$  is the number of inputs and  $U_r$  and  $V_i$  are the variable weights estimated and used to determinate the relative efficiency of  $o$ .

Since DEA seeks optimization contingent on each performance of the individual food trucks, compared to the performance of all units, those with the greatest efficiency have a score ( $P$ ) of 1, suggesting 100% efficiency when compared to those in the competitive set. The goal of this analysis was to identify the best practices in the food trucks in the Turin area, in terms of efficiency performance. An output-oriented maximization in Constant Returns to Scale (CCR) and a Variable Returns to Scale (BCC) DEA model were used.

The assumption that Variable Returns to Scale (VRS) means taking into account the technological efficiency (based on radial minimization/maximization of all inputs/outputs), because the VRS score represents the pure technical efficiency (also known as managerial efficiency), while under Constant Returns to Scale is technologically efficient (Alfiero et al., 2016).

The following variables were selected as they were the most representative of the productive process for food trucks and this DEA model has two outputs and two inputs (Figure 1). Output factors included, the average selling price (expressed in Euros) and the quality index for each food truck unit. The quality index ranges from 0 to 100 and is based on quality questionnaires filled in by customers wishing to do so, at each food truck. Input variables were the average purchase price (expressed in Euros) and the equipment index. The equipment index ranges from 0 to 100 and the score summarizes the data collected by the semi-structured interviews i.e. education and professional qualification; work experience; water, vacuum and conservation systems; the presence/absence of an oven; adequate clothing; registration year of the truck (Table 1).

Figure 1. Schematic diagram of inputs and outputs

Table 1. Descriptive statistics for inputs and outputs

Variable	Input/Output	Average	Std. Dev.	Max.	Min
Average selling price	Output	2.99	1.49	8	1
Quality index	Output	64.51	18.94	94	22
Average purchase price	Input	1.44	0.54	3.6	0.6
Equipment index	Input	53.54	22.41	95	14.67

## Findings

**The data analysis showed that there were some important differences amongst the food truckers. The GFTs distinguished themselves for having a greater knowledge on hygienic requirements and a variety of gastronomic offerings. The average customer satisfaction index and the average equipment index of GFTs were higher than those of TFTs, i.e. 9% and 6% respectively.**

**After the efficiency performance analysis,** the final data showed that 9/41 (22%) food trucks were efficient, with an efficiency score of 1.0. The average efficiency score across all the 41 food trucks was 0.80 and over 51% of the sample reached an higher efficiency than the average i.e. the average efficiency score for TFT is 0.75 while for GFT it is 0.85 (Table 2). What to emphasize how to offer an innovative service is a rewarding factor also in terms of corporate performance.

Figure 2 shows the efficiency scores of the food trucks, which are rank-ordered based on

declining efficiency scores. The lowest scoring food truck had an efficiency score of 0.35.

Figure 2. DEA efficiency score of the 41 food trucks, rank-ordered in terms of declining score.

In blue the GFT, in red the TFT

Table 2. DEA Efficiency Score

	All	TFT	GFT
Mean	0.80	0.75	0.85
Std. Dev.	0.17	0.19	0.15
Min	0.35	0.35	0.44
Max	1	1	1

## Discussion

**Some limitations on the results of the analysis and discussion emerged, such as the sample size and the number of selected variables, even though the DEA method is an efficient system in food service management. A greater number of Food Truckers allowed for a more in-depth analysis of the phenomenon, as well as the introduction of variables that took into account the different conditions of service delivery e.g. festivals and feasts *ad hoc* versus football matches and music concerts (Reynolds and Thompson, 2007). However, the approach used to analyse the efficiency of the food truck phenomenon is a valid tool and the results obtained provided useful indications as to the performance and management implications. The authors also calculated the potential for improvement for each inefficient unit in order to provide useful managerial tools.**

This is presented as the percentage of change in each input or output variables necessary for the unit to become 100% efficient. It can have a positive or negative value, indicating whether the inputs or outputs are too large or too small to reach the optimal level. The potential improvement is calculated on the actual and the target score (the value of input or output that should be achievable by the sample and which would ensure a 100% efficiency) determined for each sample.

DEA suggested the following potential improvements for TFT: an average increase of the purchase price of 2.17%, on the equipment index of 4.53%, on the quality index of 12%

and a decrease in selling price of 4.33%. There was an average decrease of the purchase price of 1.25% for GFT, on the equipment index of 0.53% and an increase in the selling price of 1.97%.

There are generally two ways inefficient traditional food trucks can improve their efficiency scores. The first alternative is to improve the current input levels, increasing the quality of raw materials and thus their purchasing costs of and introducing innovative factors in terms of equipment, improving the process of cooking, food storage, as well as increasing attention to hygiene and the use of biodegradable packaging. The second option is to lower the selling price.

## Conclusions

The aim of this paper was to analyse how a business based on the combination of tradition and innovation can offer a competitive advantage and strengthen a strong connection to its territory, improving corporate performance, in terms of efficiency. Indeed, the analysis showed that the introduction of GFT may add something to the efficiency enhancement of the food truck phenomena. However, the results obtained clearly show that, not only are the quality of raw and innovative processes of cooking and food storage of relevance when referring to a way to improve efficiency, but it is also essential to take into account other several contextual factors, if the customers satisfaction level is to be increased.

## *Implications, limitations and future research*

**The literature on food truck service has not yet been fully developed and in some gaps still have to be filled in. Indeed, to date there has been no assessment of the competitiveness of the food service between different types of food truck. This study showed that the innovative food truck service, implemented by the gourmet tradition, was useful to be more competitive in the food sector. The results showed that the integrated innovation of the GFTs enabled 8 of them to obtain the maximum efficiency score, whilst only 2 TFTs had maximum points. Therefore, the study is able to provide some information to help truckers improve their food truck service.**

**However, the data collected had some limitations determined by the methodology applied, such as**

- **the number of food truck identified i.e. only the food truckers that**

operate in the Turin area were involved and a part of TF truckers declined to take part in the survey i.e. only 18/26 accepted the interview and some of these were reluctant to cooperate for the survey;

- the number of variables analysed is limited to only certain aspects of production and selling processes i.e. inputs, "the average selling price" and "the equipment index", calculated by details on the vehicle used, the food and drink offered and other information on strategy to meet the hygienic requirements; such as outputs, "the average purchase price" and "the quality index", on the basis of customer satisfaction.

However, the findings of the study are based on the initial results of a lengthy research and research on the analysis of the business model applied to the food truck sector is ongoing. Moreover, the future development will focus on the analysis of the rules and guidelines dedicated to food truck operations in urban and suburban areas, in line with other authors (Azanza et al., 2000; Valverde, 2008; Koch, 2015), this analysis will cover a larger international section of the food truck service.

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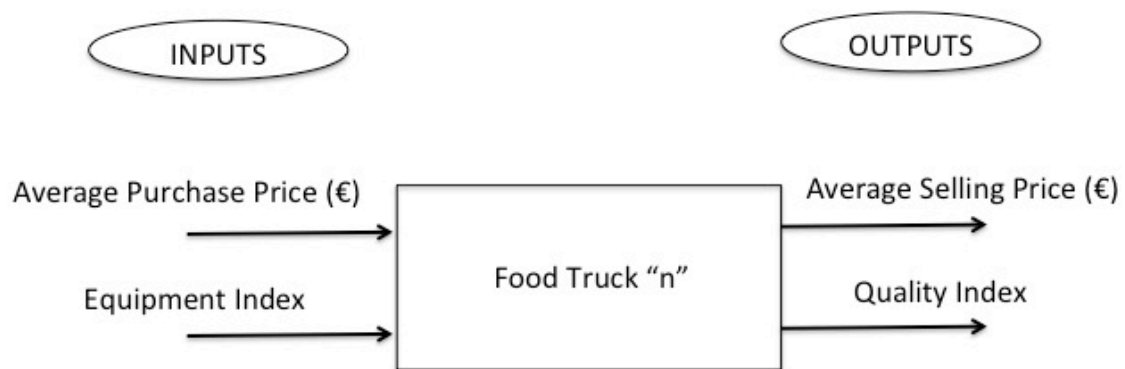
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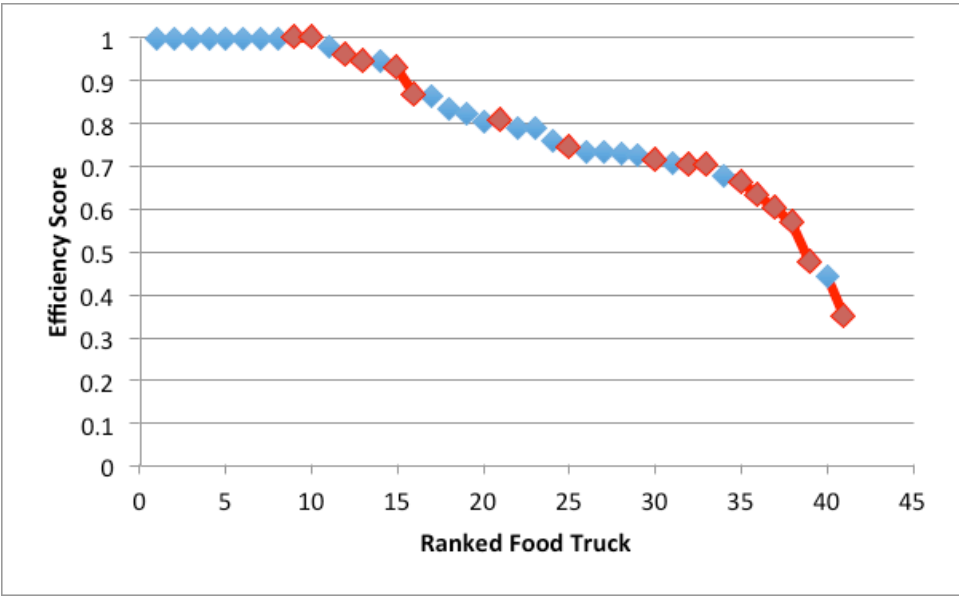


Figure 1. Schematic diagram of inputs and outputs



Source: Authors' elaboration.

Figure 2. DEA efficiency score of the 41 food trucks, rank-ordered in terms of declining score.  
In blue the GFT, in red the TFT



Source: Authors' elaboration.