Sustainability of surplus food redistribution systems[1]

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Introduction

A large and growing number of people in many developed European countries in 2018 are food insecure (Michelini et al., 2017; Oxfam, 2015). In these countries food insecurity is mainly related not to shortage of food supply or inaccessibility of food distribution sources, but rather to poverty and low income (Michelini et al., 2017). In parallel with food insecurity there also exists a great deal of produced food which is never consumed, but finishes its "life" in a landfill. In 2012, Europe produced approximately 87.6 million tonnes of food waste (Stenmarck et al., 2016). While food is a perishable product and some part of its produce will always get spoilt before reaching consumers, other part of that wasted food can be considered as a surplus. Surplus food is defined as "edible food that is produced, manufactured, retailed, or ready to be served, but which for various reasons is not sold to, or consumed by, its intended customers" (Baglioni et al. 2017). Today, multiple non-profit charitable organizations provide food assistance by collecting, sorting and redistributing surplus unmarketable food to people in need (Mousa et al., 2017). These food charities form and subsequently operate in complex food redistribution systems with extensive supply chains and multiple actors like food donors, beneficiaries and volunteers (Bramanti et al., 2017). Food banks represent the most prominent and widespread type of surplus food redistributing initiatives in Western countries (Middleton et al., 2018). Food banks are "non-profit organizations that collect, store and distribute donated and surplus food to hungry people, either directly or by going through front line social welfare agencies" (Middleton et al., 2018, p.699). Recently food banks have been attracting a lot of attention among scholars as they are establishing a more and more important role in fighting food insecurity. Lambie-Mumford (2013) and Riches (2011) argue that these organizations have even become the main response to food insecurity in a range of high-income countries. Just in the UK, the number of food banks increased from 54 in 2010 to 201 in 2012 (Middleton et al., 2018). However, it is still highly questionable whether food redistributing organizations in general, and, food banks in specific are appropriate and sustainable solution to tackle food insecurity. Some critics of food banks consider them merely as a "band-aid" short-term solution which does not address the underlying causes of food insecurity (Middleton et al., 2018; Tarasuk, 2001). Others believe that food banks can even worsen the situation with food insecurity by becoming the main response to the problem and distracting policy makers from creating sound policies aimed at improving the underlying unemployment and income problems (Middleton et al., 2018). Additionally, in most cases the demand for charitable food is higher than the amount of food which food redistributing organizations can provide (Lorenz, 2012). However, yet there has been no holistic study which would address the existing criticism and examine effectiveness and sustainability of surplus food redistribution systems as solution to the food insecurity problem. Thus, given the growing dependence on food redistribution, there appears to be a need for such study. Moreover, because food banks have established the role of primary players in the food redistribution sector (Middleton et al., 2018), it appears logical that the focus should be on this type of initiative. Hence, the goal of the present study is to close the above described existing knowledge gap by examining sustainability of surplus food redistribution systems. From the effectiveness point of view, it is important to understand the extent to which food banks can fulfill the food security goals they announce. Sustainability-wise, the question at stake is the following: even if food banks can meet the food demand of their beneficiaries at a certain point in time, will they be able to maintain such performance in the long-term?

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Case study: The Re-Food food bank in Lumiar

In order to fulfil the above mentioned goal, the present research was made in collaboration with a currently operating food bank in the Lumiar municipality of Lisbon, Portugal. The food bank is part of the Re-Food initiative – the biggest food banks network in Portugal, which currently includes over 25 centres around the country (Re-Food, 2016). The Lumiar's food center has over 100 volunteers working in different shifts, around 200 beneficiaries and approximately 40 food donors (for example, restaurants, bakeries, supermarkets), Basically, the food bank's volunteers collect surplus food from food donors located within the municipality, sort it and eventually give it away to beneficiaries who come directly to the food bank's premises.

Methods and research design

System Dynamics (SD) was chosen as the primary method to holistically analyse sustainability of food redistribution systems on an example of the Re-Food's food bank in Lisbon, Portugal. Both qualitative CLD model and quantitative SFD simulation models of the Lumiar's food bank system were created based on the semi-structured interviews with several volunteers from the center (please see Appendix A and B). Additionally, the researchers adopted participant observation method to understand better how the food bank operates and to create more robust SD models.

Conclusions and Discussion

The main outcomes of this research were derived from the qualitative CLD model analysis as well as from the simulation of four different scenarios of the computer model. Please refer to Appendix C for the behavior over time graphs and descriptions of the scenarios.

One of the main conclusions from the present study is that the question about sustainability of food redistribution systems can primarily be analysed through the lens of their food supply and demand. The simulation model outcomes as well as the qualitative CLD explicitly show that food redistributing organizations have an inevitably limited food supply. The limit is derived from the overall number of potential food donors located in a specific area as well as the amount of surplus food they produce. This constraint will be present even for the large-scale food redistributing initiatives and food banks. Moreover, it was discovered that food banks not only have no essential control of their food supply, but they even unintentionally decrease it over time. By working with the Re-Food's food bank, the amount of generated surplus food becomes evident to food producers and they gradually start finding ways on how to optimize their operations. Consequently, food banks constantly need to recruit new food donors to compensate for the decrease in the supply caused by donor's production optimization. On the one hand, this side-effect could be considered as positive, as one of the goals of surplus food redistribution is to eliminate food waste. However, if the question at stake is sustainability of food redistribution systems as a solution to food insecurity, this finding constitutes another critical concern about the ability of surplus food redistributing systems to tackle the problem of hunger.

Previous studies in the field demonstrate that the demand for charitable food assistance has been ever-growing lately (Middleton et al., 2018). Yet, there has been no substantial evidence found whether charitable food redistribution systems by any means contribute to the reduction of the demand for food assistance. It appears that food demand is intrinsically exogenous for the food redistribution systems. Therefore, the conclusion can be made that by no means food banks or other kind of similar charitable food services can be considered as a primary solution for the food insecurity problem or a substitute for real policies and governmental interventions aimed at food insecurity and income-related problems.

Generally, based on the outcomes of this study, it can be stated that surplus food redistributing systems, and, food banks in specific, cannot be considered as a sustainable solution to food insecurity by themselves, although they can significantly affect the food waste problem by promoting a learning effect among food donors. Food redistribution systems do not solve the underlying problems of food insecurity and have a lot of challenges with meeting a growing food demand with their supply. However, if paired with sound public policies which would help to at least stabilize the growing demand for charitable food, these systems could potentially provide an important bridge to help people in difficult life circumstances until the food insecurity problem could be eliminated completely.

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Supplementary Materials

The full version of the research paper including SFD and CLD Stella software models' files are available from the authors as well as the conference committee on request.

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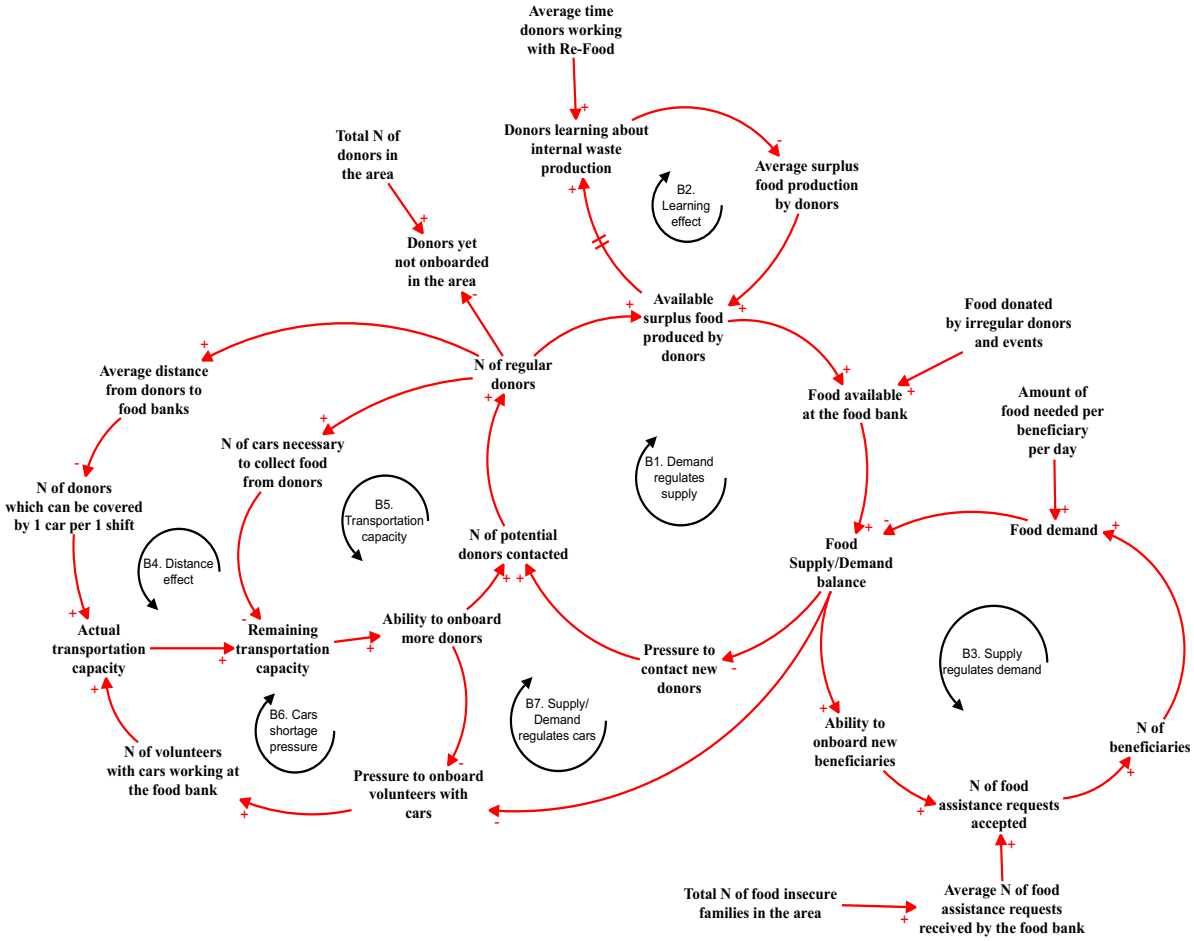
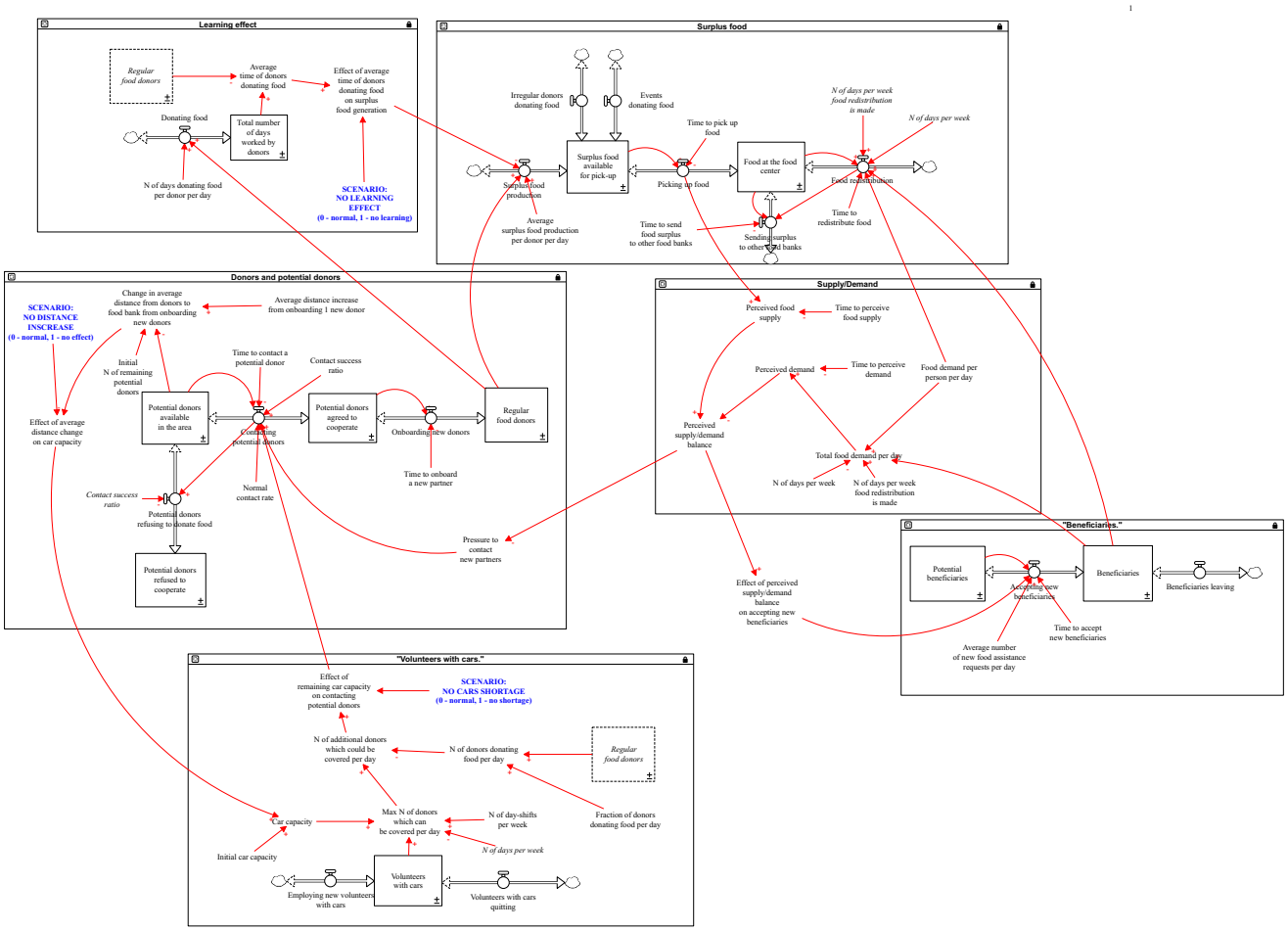
Appendix A: Causal loop diagram of the Re-Food food bank's system



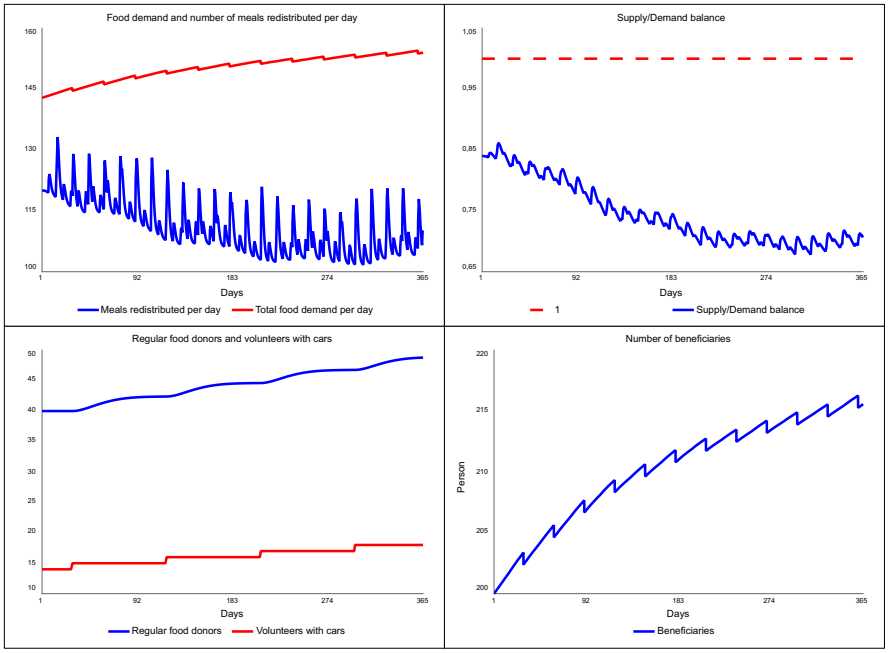
Appendix B: *Stock and flow diagram of the* Re-Food food bank's system



Appendix C: Simulation outcomes

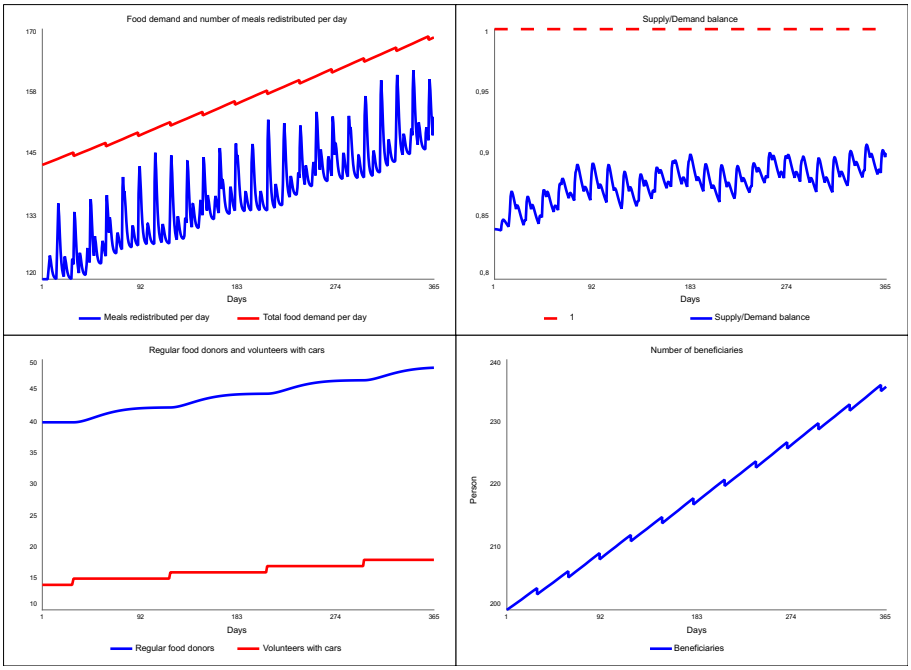
Scenario 1: Base run

The base run parametrization includes the actual "conditions" of the food bank present on the moment of the study. It also includes its main food supply constraints identified during the interviews. The model simulation is made with the duration of one year. It is also assumed that donors would start learning about their surplus food production only from the start of the simulation.



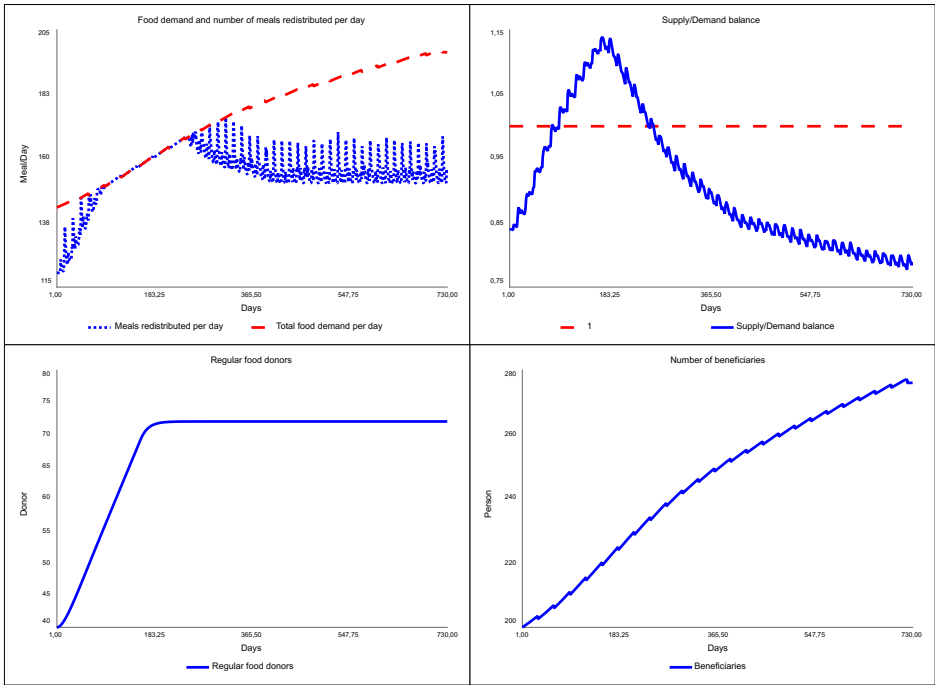
Scenario 2: "Food donors do not optimize and have a constant food waste production rate"

This simulation scenario uses the same parametrization as the base run with only one difference – the "learning effect" is switched of. In this scenario, food donors do not optimize their production and generate surplus food on a constant level.



Scenario 3: "The food bank has no transportation shortage"

In "Scenario 3", the food bank would have unlimited transportation capacity, and, hence would be able to recruit as many donors as the food demand would require. The duration of the simulation run is two years.



Scenario 4: "The food bank has no transportation shortage and constant food demand"

However, it also appears reasonable to test an even more idealistic scenario in which the food bank would not only have unlimited transportation capacity, but also constant food demand. The simulation duration is two years.