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# Trends in global E-food supply chain and implications for transport: literature review and research directions

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ABSTRACT

With food supply chains distributed across global markets connected via internet using e-business solutions, transporting food from farm to fork is a critical element of any such supply chains. The transport can fall anywhere in the spectrum from long distances between farmers in one country to processors or distributors in another country, to short distances from retailers to end consumers both on the same street. We identify the key characteristics of the food supply chain and review the literature. Furthermore, we discuss a few trends that will lead the future of food transport and list a number of relevant and challenging research areas. In general, food supply chains are impacted by (1) socio-economic trends, (2) digitalization and innovation, and (3) transboundary animal and plant pests and diseases. Such developments have significant implications for food transport. In order to feed the billions of people that will live in big cities across the world in the coming decades, the academic community needs to unite with practitioners to efficiently manage the global transportation of food using the traditional and new modes of transportation that will be all connected thanks to digitalization.

## 1. Introduction

The global population has grown at a faster rate within the last 50 years. Within the next three decades it is projected that the global population is going to reach over 9 billion people setting a historical record (Ash, Jasny, Malakoff, & Sugden, 2010; Godfray et al., 2010) and has the potential to increase to over 11 billion at the turn of the century (FAO, 2017c). With the potential for having over 9 billion people globally in the 2050s the world will be faced with a new food challenge. Food production has grown to keep the increased number of people in the world fed. Green Revolution technology and increased use of natural resources such as land and water has helped agricultural production triple in 55 years starting in the 1960s (see Fig. 1). At the same time, hunger and malnutrition is still a persistent problem in a large portion of the world and it is widespread (FAO, 2017a). Despite the widespread hunger, those who have food are becoming relatively wealthier and are consuming more processed food, dairy, meat, and fish. With the increased demand for food, the resources that are needed for food production such as water, energy, and land are limited and competition is increasing for food producers. Climate change is becoming more evident and it is impacting food production along with the increased competition for food producing resources (Schmidhuber & Tubiello, 2007; Tilman et al., 2001). The need for increased food production, which has in turn caused economic growth has had a large negative effect on nature. In addition, the ways that food is produced will be affected by climate change in the future.

The food supply chain (FSC) will have to adapt the way food is produced, stored, processed, distributed, and accessed to meet the challenges that it is facing. In the past, all these processes occurred locally in a small area. Such a FSC is not sustainable and cannot address the demand of the entire world population. Therefore, the FSC is transforming into a global FSC in which all or some parts of the production, storage, process, or distribution processes will be done in multiple areas throughout the world (see Fig. 2). Therefore, on average, the length of farm to plate distance has grown as the FSC have expanded along with the increased consumption of prepared, packaged, and processed food everywhere but in the most remote rural areas. Furthermore, FSC is transforming to E-FSC by effective utilization of Information and Communication Technologies (ICT) and E-Business solutions that help in delivering goods, services and information from farm to fork and vice versa (see, for example, eFoodChain, 2017).

The ability to transport agricultural products (Chopra & Meindl, 2016) allows for the global food trade to exist. The E-FSC's global growth, with more of the vital operations being outsourced overseas, transportation has a greater impact on the performance of the E-FSC. An example of this can be seen in Fig. 3a, which shows the amount of

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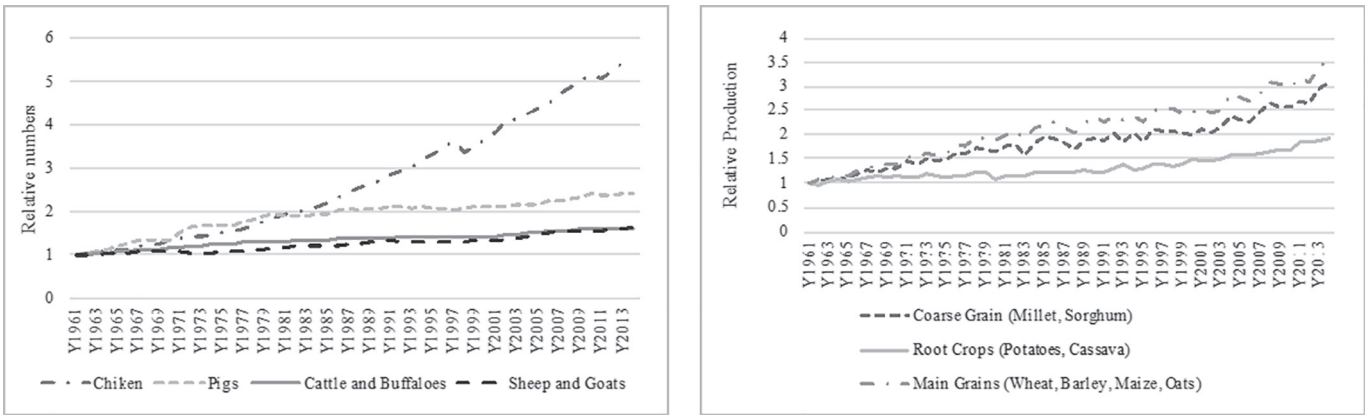



(a) major types of livestock (b) Major crop plants and grains

**Fig. 1.** Changes in the relative global production of crops and animals since 1961, when relative production scaled to 1 in 1961.
(Source: FAO, 2017b).

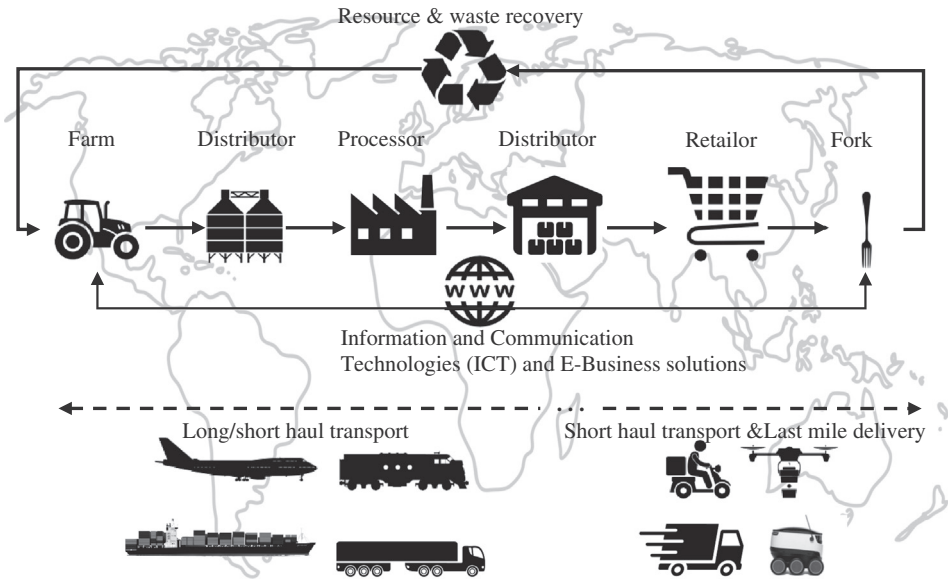
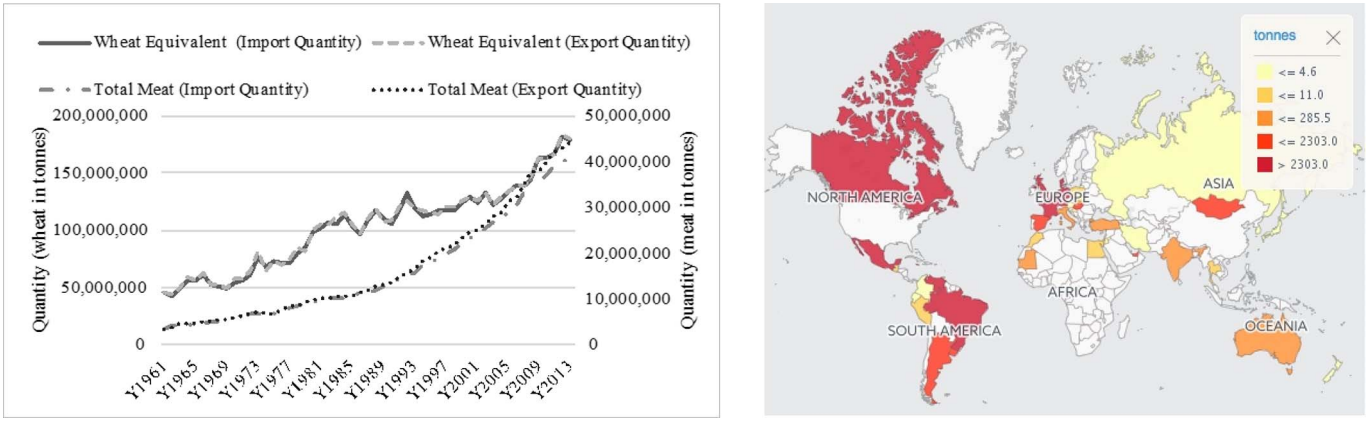



**Fig. 2.** Global E-food supply chain.




(a) Export and import of meat and wheat in the world (b) Import of wheat, the case of the United States

**Fig. 3.** Export and import of meat and wheat.
(Source: FAO, 2017b).

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