Organ Transplantation: A Dual Supply Chain Perspective

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Organ transplantation is often studied in its medical, legal or ethical dimensions. Very few works have considered the supply chain dimension, even though the organisation of organ transportation is critical to the success of transplants given the extremely tight time constraint to guarantee the correct state of the organ. The authors examine the logistical systems associated with organ transplantation, distinguishing between two service processes: the push flow model, implemented in the context of legal transplants, and the pull flow model, implemented in the context of coercive transplants. While this dual supply chain perspective has never been analysed until now, the research note highlights a theorical gap which could be answered in future research.

Keywords: coercive transplant process, health management, legal transplant process, organ transplantation, pull flow model, push flow model, supply chain management

INTRODUCTION

In December 1967, Christiaan Barnard performed the first heart transplant in Cape Town (South Africa), and organ transplantation has continued to capture the attention of medical circles ever since, with the number of transplants increasing steadily since the 1990s. This is one of the best-known examples of individualised care and precision medicine, which is becoming increasingly important in modern healthcare management (Waelli *et al.*, 2021). Naturally, the supply chain performance occupies a central place because it conditions the success of operations, given the extremely short time surgeons have between the availability of an organ and the transplant. Most often, the place where an organ is available, for example, after an accidental death, and the place of transplantation can be several hundred or even thousands of kilometres apart. However, a human organ remains viable outside the body for only a limited time, despite the development of various preservation methods for a couple of years (van der Vliet & Warlé, 2013). This creates a severe *technical* time constraint, compared to short lifespan products like fruits & vegetables, to which are added the consideration of *ethical* criteria in the procurement and distribution of organs for transplantation.

In the context of a shortage of organs to be transplanted, where the supply is far less than the demand (Shafran *et al.*, 2014), the logistical question becomes essential: Can we accept that organ transportation

regularly fails, while many patients are suffering the effects of the organ shortage? Logistics management, which has become supply chain management over time, originally during 19th century emerged from the military world, designating the organisation of activities associated with the supply, accommodation and transportation of troops in combat (Prebilič, 2006). Beginning in the 1950s, the approach was extended to the business world by presenting logistics as all the transportation, handling and storage operations that allow a product to reach consumers from the material's source through its production in industrial units. Logistics management has been applied to a multitude of contexts outside of companies, particularly to humanitarian logistics linked to relief operations for populations who find themselves temporarily or permanently in an emergency situation (e.g., after a civil war, an earthquake, a pandemic, etc.). The case of humanitarian logistics is particularly interesting because it underlines that logistics tools can be used to serve society and not just to improve business performance (Merminod *et al.*, 2014). The logistics associated with organ transplants are part of this type of approach.

Organ transplantation constitutes an economic activity, and cost/benefit calculations are conducted to compare the costs linked to a transplantation with the resulting gains. For example, the cost of a kidney transplant is equivalent to the cost of a year of dialysis; however, the transplant saves several thousand euros in subsequent years. In the cost of a transplant, a logistical part must be integrated, and even if it remains modest in comparison with the medical part (e.g., equipment, specialised personnel, etc.), it cannot be considered non-existent. Organ transplantation is therefore a matter of market logic, even if, as Cole (2021) underlined, the organs themselves are exchanged without financial compensation, at least in cases of legal transplants where the recipient does not buy an organ. However, in any trade, the presence of logistical infrastructure is essential to link supply and demand that are geographically disjointed. More broadly, the central question refers to the optimal management of organ flows between donors and recipients. Conventionally, two flow management models are mentioned in logistics management (Russell & Taylor, 2023): pull and push models. They are distinguished according to the way they process the customer's order. In the case of the pull model, the customer's order "pulls" the production of the goods and then activates the supply chain. In the case of the push flow model, the production of goods begins in anticipation before an order exists.

Using the pull model has the advantage of not –or hardly– generating stock, which reduces storage space requirements and avoids any waste of resources, since what is produced is already sold. A well-known application is that in fast-food restaurants, where nothing is produced until a customer places an order, by shifting the "supply chain" approach to a "demand chain" approach (Christopher & Ryals, 2014). The major drawback of the pull model is that no human error or poor coordination between supply chain members is acceptable at the risk of paralysing the whole supply chain. Conversely, in the push model, goods are produced even before they are sold; the company commits its financial resources before customer needs arise. If the goods do not find buyers, they will be lost or will have to be sold off, which means a risk of financial loss for the company. However, the push flow model offers a remarkable ability to react to customer demand; with the goods in stock, the delivery time is reduced, which increases customer satisfaction. The following question arises from the presence of these two piloting models: *Which model applies to organ transplantation, and on what basis is it established?*

To the best of our knowledge, this question has not been addressed, even though there has been an increasing number of operational research studies on the supply chain associated with organ transplants. This gap is certainly explained by the highly technical vision of logistics, which often boils down to the optimisation of transportation operations and supply networks As Katinienė *et al.* (2021) underline, logistical performance does indeed require increasingly strong transportation competencies in many sectors: analytical competencies to organise an optimal route, select cargo criteria and identify the needs of the clients, and personal competencies to communicate and build trust with clients. However, it is important to understand and analyse how organ flows are controlled, from organ donor to recipient, because human lives are at stake. The objective of this research note is to shed light on the logistical process of organ transplants, taking into account a well-known but sometimes disturbing reality. Alongside legal transplants, which are organised within a strictly defined legal framework that is found in most Western countries, there are coercive transplants involving human trafficking, and they are found in poor countries and/or countries

that do not care about human rights. *Does the same management model apply, or, on the contrary, does each type of transplantation fall under a particular management model?*

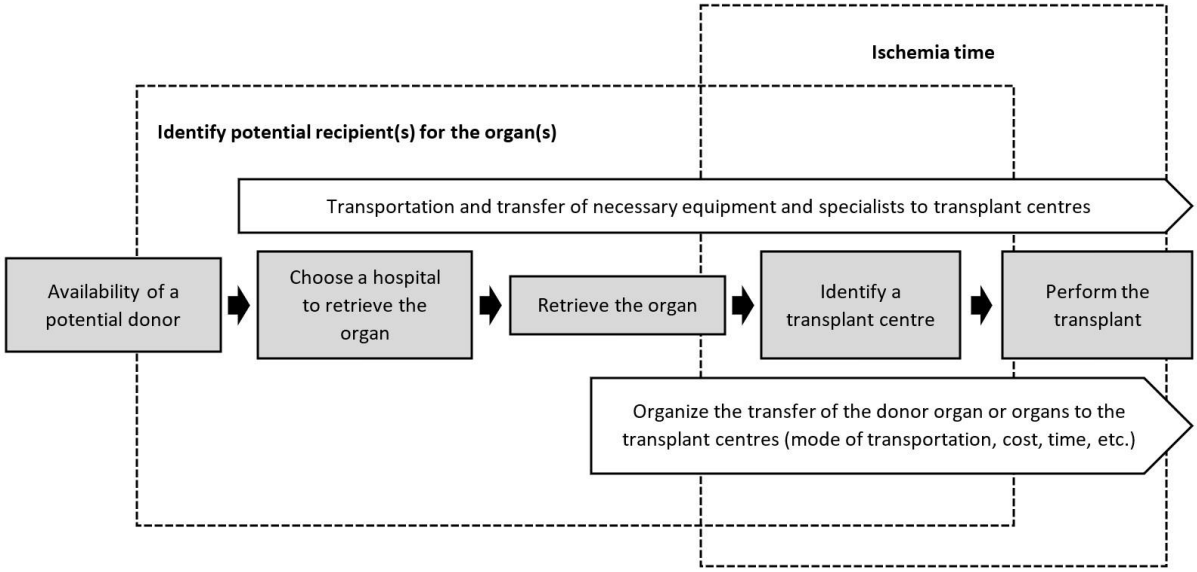
THE LEGAL SYSTEM: PUSH FLOW MODEL

For decades, the widening gap between organ supply and need (demand) has created a major global organ shortage, complicating transplant operations worldwide (Mamzer-Bruneel & Hervé, 2016). As supply often does not meet demand, the gap between demand and supply widens and keeps organ seekers on long waiting lists, leading to the deaths of many every year (Rouhani *et al.*, 2021). In addition, when the organ is available, organ removal and transplant surgery must be carried out under severe time constraint (Genc, 2008), the constraint being understood as "a factor that limits the performance of a system" (McCleskey, 2020). Every second counts due to the ischemia time, which is how long an organ can survive without a blood supply. Depending on the type of organ, the ischemia time can vary from less than four hours (for a heart or a lung) to around 20 hours (for a kidney). As with all conventional supply chains, the time constraint requires that different organisations work closely together to convert inputs into outputs for an efficient delivery to customers (Allam, 2022).

In addition, the organisation of transplant surgery is extremely complicated, with several criteria to consider. According to Zahiri *et al.* (2014), three decisions must be made simultaneously: (1) choosing an appropriate hospital from a potential set of hospitals; (2) choosing a transplant centre from a given set of candidate establishments (transplant centres are facilities where registration and transplant recipient surgeries are performed); and (3) determining which hospital or transplant centre is capable of handling organ retrieval and transplantation. Furthermore, the following three decisions are made dynamically in each period: (1) assigning different transportation agents to transfer donor organs and necessary materials between hospitals and transplant centres; (2) selecting transportation modes with different costs and times while the transplant operation is performed within a perishable time specified for each organ (the ischemia time); and (3) allocating individual patients to transplant centres in a vertical (or centralised) and hierarchical model (Savaser *et al.*, 2018). Figure 1 synthetises the legal transplant process according to the six criteria.

In the centralised method, to find a potential recipient, a search is carried out in a waiting list grouped at the national level according to the type of organ required. This sometimes results in inequalities in access to organ transplant based on social or ethnic characteristics, as is the case in the United States (Park *et al.*, 2022). From an operational point of view, the hierarchical method considers several waiting lists within a country, each of which is associated with a structural or geographical entity, such as a hospital, a city or a region (Savaser *et al.*, 2018). Regardless of the method of organ allocation to a recipient, the primary goal of legal transplant system is "*synchronisation*", which aims to find the best recipients for donated organs (Sheu *et al.*, 2020). As noted by Parent *et al.* (2020), the traditional method for heart transplants is direct organ removal, with a donor and a recipient located in close proximity to reduce the length of the logistical cycle. When proximity does not exist, the only option is direct organ harvesting after death, followed by normothermic reperfusion using an *ad hoc* infusion device. The initial ischemic impact is thus attenuated for the organ donor, while leaving more time for the medical team to perform any evaluations before transplantation. The speed at which the organ is delivered then becomes essential to leave enough leeway for the medical team.

FIGURE 1
LEGAL ORGAN TRANSPLANT PROCESS



Source: The authors.

Zahiri *et al.* (2014) presented the (legal) transplant supply chain, which included actors such as the organ donor, the hospital, the transplant centre, the transportation companies and the recipient. Given the small number of organ donors compared to the number of people on waiting lists, the legal transplant process starts as soon as a potential organ donor appears. At this precise moment, the objective of all the supply chain members is to push this organ –considered a product– towards a potential customer (the recipient) before the ischemia time ends. Consequently, the flow of products (organs) is from upstream to downstream in the supply chain; from this point of view, the logistical approach of legal transplant follow a push-type model. However, finding a potential recipient for an organ that has just appeared on the market within a very short time –the ischemia time– and under a push-type model requires a very sophisticated organisation and coordination of the supply chain members, as well as a transparent information exchange between these different members (Aghhavani-Shajari & Brion, 2020). Thus, quite naturally, academic research has focused on improving the transplant supply chain (Zahiri *et al.*, 2014), seeking to optimise all the time-consuming points.

Savaser *et al.* (2018) propose a model maximising potential compatible organ donor-recipient pairings within the time limits of ischemia, while other works are focused on issues related to hospital location and allocation and transplant centres (Beliën *et al.*, 2012; Syam & Côté, 2012; Rouhani *et al.*, 2021). Zahiri *et al.* (2014) formalise a multiperiod location-allocation model of hospitals and transplant centres while minimising the cost and time of the transplant process. Sheu *et al.* (2020) suggest a model optimising the direct and indirect costs of organ transportation as well as transportation time, and Paganelli *et al.* (2019) study the optimisation of the organ transportation mode (rail and air) as well as the medical team transportation between hospitals and transplant centres. Furthermore, while some of the individuals on the organ waiting list die while waiting for the organ they need, Kempf *et al.* (2005) show that the supply chain coordination between transplant centres and hospitals can allow an increase in the number of pancreatic islet transplant recipients thanks to the increase in organ donor pools, the optimised allocation of islet grafts and maintaining a high rate of pancreas tenders. Other researchers propose decision support models associated with organ allocation (Akan *et al.*, 2012), organ transportation planning, recipients' planning (Kargar *et al.*, 2020) and staff planning (Ahmadvand & Pishvaee, 2018).

In brief, the transplant supply chain requires a complex organisation involving a large number of actors. Poor coordination between the different actors can have dramatic consequences, such as the death of the

recipient (particularly for a vital organ like the heart), or the waste of the organ if the ischemia time is exceeded (Sheu *et al.*, 2020). One of the possible solutions is to rely on advanced technologies that make it possible to extend the storage period of the organ to be transplanted by reducing the time pressure exerted on the medical team. Brüggenwirth *et al.* (2022) examined the case of static cold storage after liver transplantation by conducting a survey of 12 European transplant centres between 2014 and 2021. The authors note that there was too little availability in terms of operating rooms, which led to dangerously postponing the programming of transplants. Thanks to an original technical solution, it was possible to increase the shelf life of organs (donor livers) with a high survival rate for the graft and the patient.

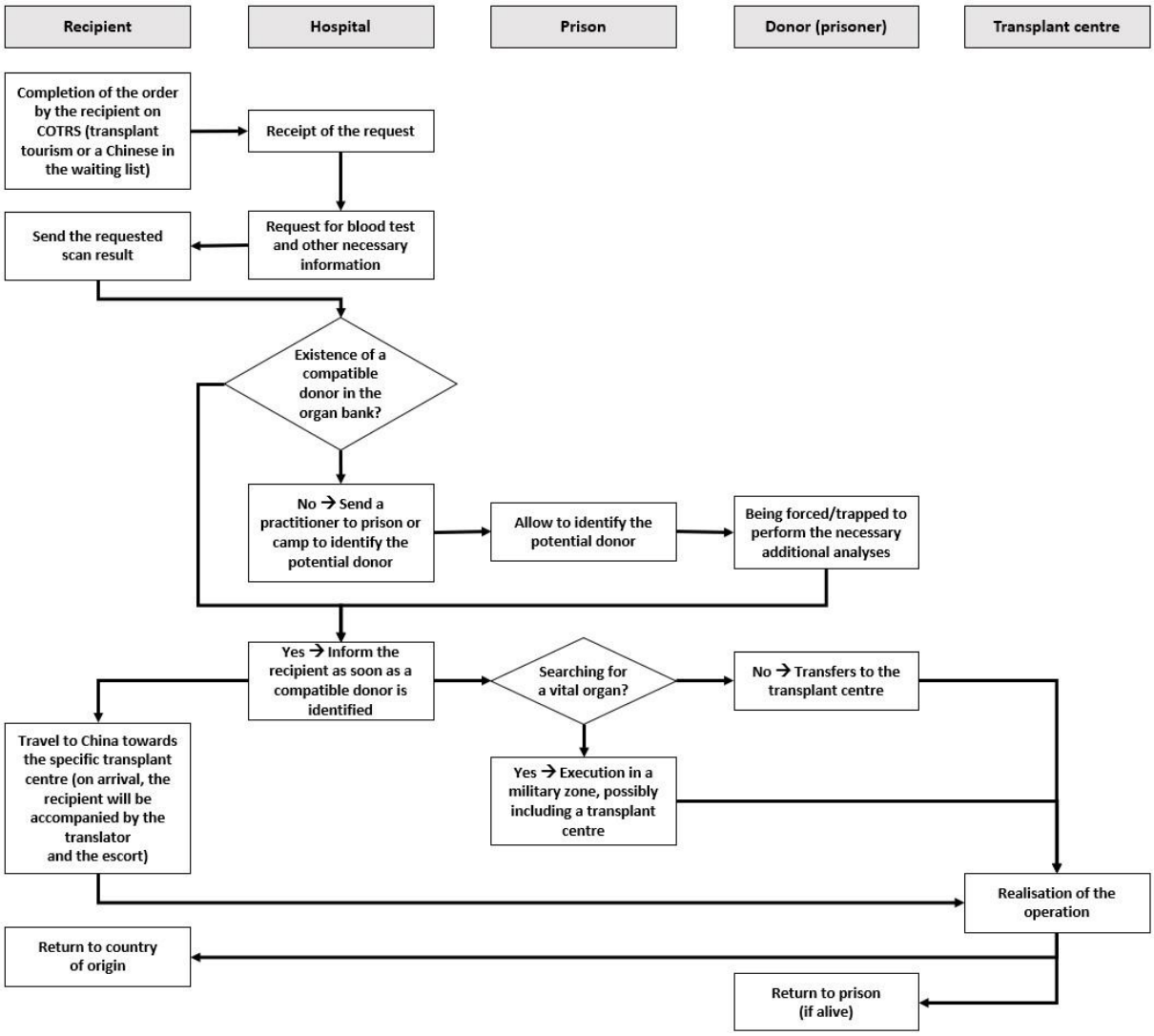
THE COERCIVE SYSTEM: PULL FLOW MODEL

Alongside the legal system, it is possible to identify transplant tourism, the excesses of which have given rise to regulations in different countries (Cohen, 2013). This is because, each year, the need and demand for organs increases, while the number of donors (deceased or living) decreases. Meng and Clark (2020) conclude that organ procurement sometimes relies on unethical channels. Indeed, the gap between supply and demand keeps people, often in the terminal stage of their illness, on long waiting lists. In such a situation, patients and their families seek to find an alternative solution, including seeking the organs they need outside the borders of their own country. Certain insurance companies in the United States, Israel, Yemen or Saudi Arabia encourage patients to seek a transplant abroad without really considering the source of the organ (Bramstedt & Xu, 2007). According to Shin-Hong *et al.* (2019), the transplant tourism represents approximately 10% of global transplant activity. It has led to extensive research into the decision-making process of patients (as "consumers"), including understanding the factors that explain the choice of one destination over another (Webb & Mcdonald, 2019).

The 2018 edition of the Declaration of Istanbul defines transplant travel as "the movement of organs, donors, recipients, or transplant professionals across jurisdictional borders for transplantation purposes. Travel for transplantation becomes transplant tourism if it involves organ trafficking and/or transplant commercialism or if the resources (organs, professionals, and transplant centres) devoted to providing transplants to patients from outside a country undermine the country's ability to provide transplant services for its own population" (https://www.declarationofistanbul.org/images/Policy_Documents/2018_Ed_Do/2018_Edition_of_the_Declaration_of_Istanbul_Final.pdf, Accessed September 10, 2022). Transplant tourists are mainly from Australia, Canada, Japan, South Korea and the United States, as well as countries in the Near East and Western Europe. The destination countries are mainly China, Bangladesh, Bolivia, Brazil, Colombia, Costa Rica, Egypt, India, Iraq, Lebanon, Moldova, Pakistan, Peru, Philippines, Sri Lanka, Turkey and Vietnam. This commentary is particularly interested in the logistics of organ trafficking in China. Certainly, there are legal and official organ transplant programs; however, at the same time, the largest coercive transplant organisation in the world is run by some corrupt officials which is tolerated directly or indirectly by the Chinese State.

China performs between 60,000 and 100,000 organ transplants each year, mostly from political prisoners (Gutmann, 2014; Trey & Matas, 2017). From the 1980s until today, followers of the Falun Gong practice, Muslim Uyghurs and Tibetans have been executed in secret prisons for the purpose of harvesting their organs, which are then transplanted in military hospitals. In 2007, the Chinese Vice-Minister of Health acknowledged that more than 90% of organs transplanted in China come from executed prisoners (Huang *et al.*, 2014). In the 2014 edition of the Declaration of Istanbul, China formally pledged to abandon practices that violate human rights. However, China continues to massively use the organs of prisoners, particularly from the Uyghur minority, according to the United Nations report submitted by Michelle Bachelet at the end of August 2022. It is important to specify that this organ trafficking is not only intended to meet the needs of the Chinese population, since organs also supply the international market (Trebinjac, 2020). The essential point to note is that unlike a legal transplant, where the potential organ donor, living or brain dead, is considered an input in the supply chain, in coercive transplant system, the customer's request activates the logistical flows. Figure 2 presents the process of prisoner organ transplant in China in a simplified way.

FIGURE 2
PRISONER ORGAN TRANSPLANT PROCESS IN CHINA



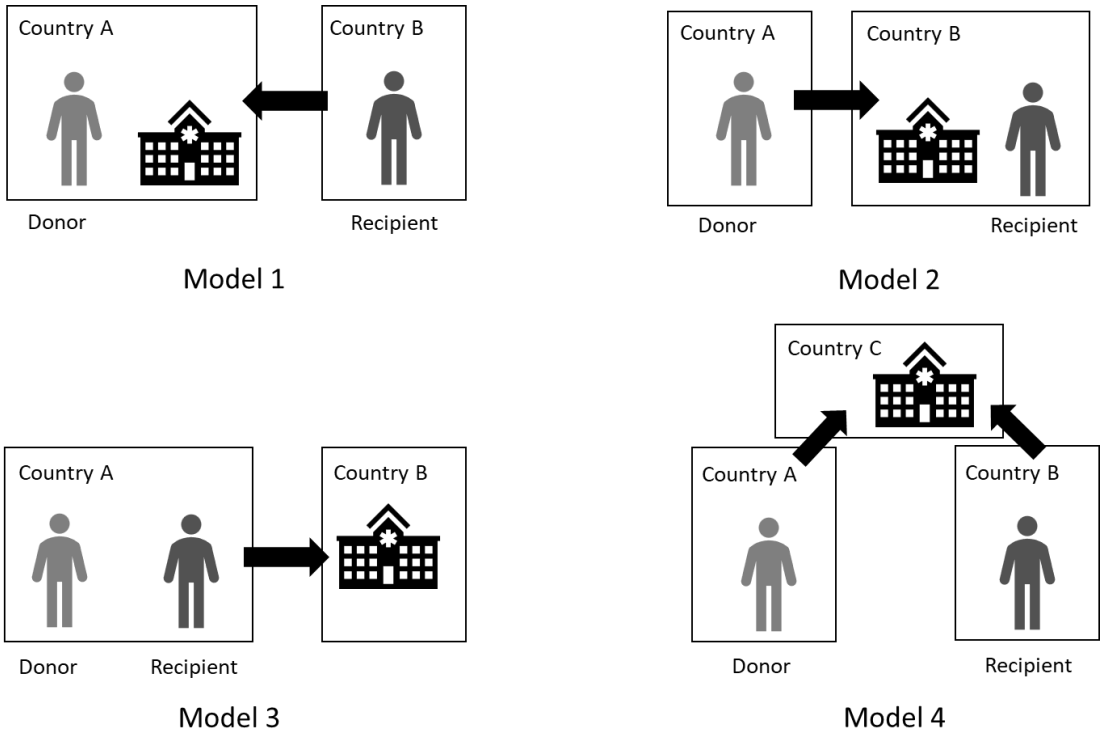
Source: The authors

Trey and Matas (2017) indicated that this process begins with the registration of the transplant tourist's request on an online platform called COTRS (China Organ Transplant Response System). According to the request, the medical team asks the tourist to carry out additional analyses in the tourist's own country. After receiving the tourist's complementary analysis results, the medical team conducts a search on the COTRS database to identify the prisoner compatible with the transplant tourist. The medical team may be obliged to perform additional examinations to confirm the prisoner's compatibility with the tourist; in this case, the medical team goes to the prison to perform additional examinations on the prisoner. Once the potential organ donor has been identified, the medical team gives the green light to the tourist to make the trip to the transplant centre in China. The supply chain model is therefore a pull flow, as indicated in the introduction of the research note: the customer's order "monitores" the logistical process. Following the analysis of Cova (2004), it is possible to speak here of a true "marketisation" of the service relation, which remains fundamentally an activity *outside the market* in the legal system.

A delay of barely two weeks between the request and the completion of the transplant can be noted (Wu *et al.*, 2018), whereas in the context of a legal system, the waiting time for a recipient averages

30 months, sometimes stretching to more than 50 months, depending on the country. To avoid problems related to ischemia time, Sharif *et al*. (2014) noted that organisational stakeholders arrange for the prisoner's execution date to be scheduled on the same day as the transplantation date. Following Schwindt and Vining (1986), even if the authors evoke a very different political reality (democratic countries), it is possible to speak about a "delivery market for transplant organs" in which a recipient spends a supply contract with an organisation dealing with the provision of organs. In addition, the fact that the Chinese transplant centre is predefined upstream of the logistical process avoids problems related to the availability of medical teams and adequate materials. Budiani-Saberi and Delmonico (2008) propose four models of transplant tourism according to the country of the organ donor and the recipient, as well as the one in which the transplant centre is located (see Figure 3). The Chinese coercive transplant system fits Model 1, where the organ donor and the transplant centre are in the same country (A), while the transplant tourist travels from another country (B) to country A.

FIGURE 3
PRISONER ORGAN TRANSPLANT PROCESS IN CHINA



Source: Adapted from Budiani-Saberi and Delmonico (2008)

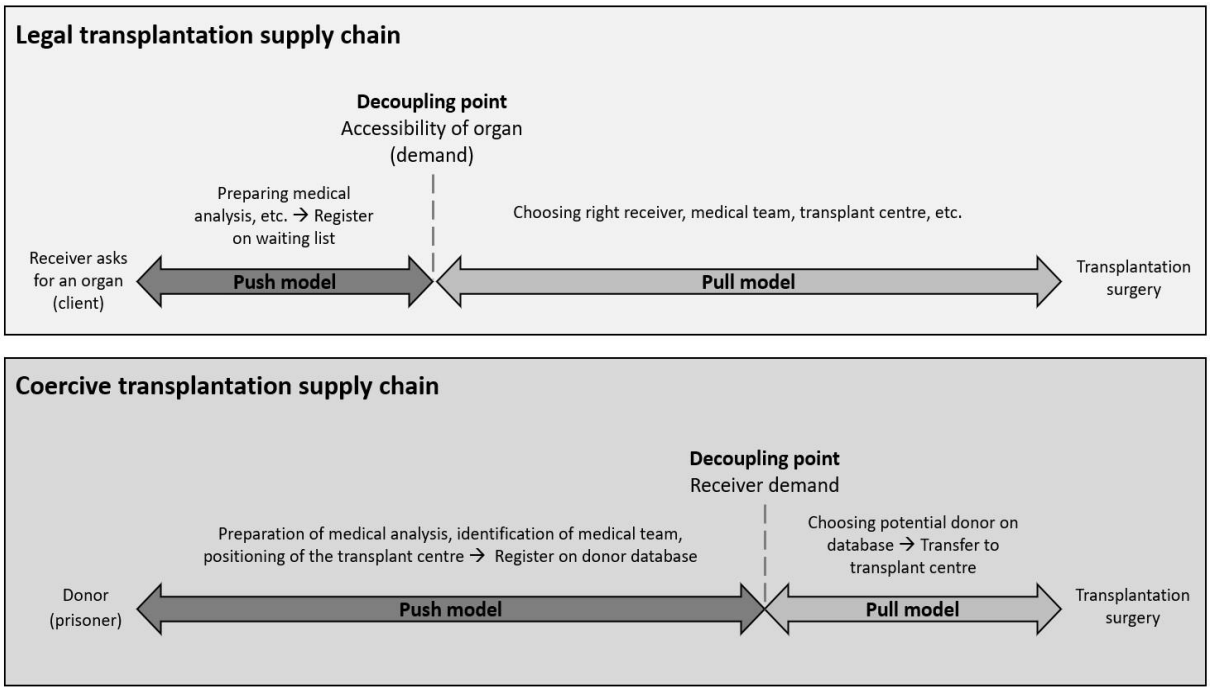
Logistical organisation requires significant coordination between the different corrupt actors to conduct the transplantation within the ischemia time. Some of these actors are transplant surgeons, anaesthesiologists, nephrologists or hepatologists, nursing staff, laboratory technicians and the technical staff responsible for carrying out the examination's medical auxiliaries. Indeed, these different actors must continuously adjust to ensure the proper functioning of the different stages of the supply chain. Furthermore, the success of coercive transplants depends on the support of a range of facilitators, including directors of transplant units, administrators of medical facilities and laboratories, members of law enforcement and public officials and corrupt agents who facilitate the entry of tourists into China. Prior planning and coordination between these multiple actors ensure that the pull flow model will be fully effective. In the absence of this planning, the organ transplant system put in place by the Chinese authorities will be

ineffective, thus risking the loss of foreign clients, who represent a significant source of income for these corrupt actors.

RESEARCH AVENUES

This research note aims to provide a state of the art of the current management of transplant supply chain management. To this purpose, we compared the legal transplantation supply chain and the coercive transplantation supply chain by showing that each type of transplantation follows a specific flow management mode. The contribution also highlights that, at the expense of ethical issues, the coercive approach has better logistical performance than the legal one when comparing both approaches: once a patient comes forward for a transplant, he/she can expect it to take place in just a few days. This is particularly due to the mixed use of push mode and pull mode for logistics management. Let's take the example of a fast-food restaurant again. Although a sandwich is not prepared before a customer's order (pull mode), the restaurateur has already purchased the ingredients making up the sandwiches by following a push mode and based on demand forecasts. The moment when the flows cease to be controlled according to the forecasts (push mode) and begin to be controlled according to the commands received (pull mode) is called "decoupling point" (Wikner & Rudberg, 2005). As highlighted in Figure 4 relating to the two types of transplantation, we can emphasise the existence of a decoupling point in the management of supply chain (going from a push mode to a pull mode).

FIGURE 4
DECOUPLING POINT IN TRANSPLANT LOGISTICAL PROCESS



Source: The authors.

Unlike coercive transplantation, where the request of the recipient (client) indicates the positioning of the decoupling point (as in the case of fast-food restaurant), in legal transplantation the decoupling point is positioned with reference to the random availability of an organ, linked to the accidental death of a donor for example. Moreover, unlike legal transplantation, the decoupling point in coercive transplantation is rather down in the supply chain. This allows the actors of coercive transplantation to prepare the logistical

activities according to the forecast (in a push mode), then to switch with the least possible effort to the pull mode as soon as the recipient's request is received. Therefore, after comparing the two different ways of managing the logistics of transplantation, the following question arises: How, in legal transplantation, shifting the decoupling point downstream in the supply chain can improve the logistical performance?

Understanding the role of the decoupling point in the supply chain organisation of transplantation should make it possible, on the one hand, to improve the performance of legal transplant logistics in order to save lives, and on the other hand, to reduce the transplant tourism which appears to be the main origin of coercive transplants (Rhodes & Schiano, 2010). To answer this question, it is necessary to question the actors of legal transplantation and to collect secondary data with regard to coercive transplantation, given that the sensitivity of the subject makes it difficult to collect primary data. The result of such research would offer new knowledge to researchers from multiple disciplinary fields, including medicine, law, information systems and operational research, in order to better understand the issues and mechanisms of transplantation supply chain management. While research has been devoted to the logistics of organ transplants within the legal system, this is not the case for the coercive system, no doubt because it is a highly political subject. Our investigation is a first clearing step, and in-depth research is needed to better understand how the flows are organised within this major component of health management.

CONCLUSION

Supply chain management research often indicates that improving logistical performance is a key element of consumer satisfaction and can thus enable access to an enormous product portfolio under excellent service quality conditions. Furthermore, during the two major external shocks of the COVID-19 pandemic and the war in Ukraine, the major problems in the supply of materials, components and finished products underlined that logistics tool and management are essential for the functioning of market economies. However, it should not be forgotten that logistical tools are sometimes at the service of illegal exchange systems: heroin and cocaine trafficking logistics, terrorism support logistics, human trafficking logistics, etc. In other words, we should not refrain from understanding deviant phenomena with reference to what we can learn from business economics and management science. It is possible to consider that the coercive system associated with organ transplantation is a deviant phenomenon, and that it is based on a pull flow model that cannot be ignored.

If the logistical issue is reduced to its technical aspects, the organ transportation is often privileged in the analyses of practitioners and researchers. It is true that organs delivered for transplantation are subject to rigorous transportation constraint. They must be kept at a constant temperature, requiring the carrier to use specific refrigerated and isothermal containers. In addition, it is essential that the organ transportation should be carried out under optimal hygienic conditions, so that the organ removed and then transported is kept free of any possible source of contamination. Finally, even if the conservation conditions are optimal, a delivered organ deteriorates rapidly, and an organ carrier must therefore offer perfectly controlled collection, transportation, and delivery times. This explains why for three decades, research on supply chain of organ transplantation has focused on operational dimensions, while neglecting organisational dimensions. The research note suggests the existence of a research agenda in this direction, underlining how relevant the supply chain perspective is to analyse a societal phenomenon in all its complexity.

REFERENCES

Aghhavani-Shajari, B., & Brion, S. (2021). Proposition d'une échelle de mesure de la transparence informationnelle: Le rôle clé de la compréhension de l'information partagée. *Logistique & Management, 29*(4), 212–227.

Ahmadvand, S., & Pishvaee, M.-S. (2018). An efficient method for kidney allocation problem: A credibility-based fuzzy common weights data envelopment analysis approach. *Health Care Management Science, 21*(4), 587–603.

Akan, M., Alagoz, O., Ata, B., Erenay, F.-S., & Said, A. (2012). A broader view of designing the liver allocation system. *Operations Research*, *60*(4), 757–770.

Allam, A. (2022). Institutional theory: Relevance to supply chains. *American Journal of Management*, *22*(2), 21–28.

Beliën, J., De Boeck, L., Colpaert, J., Devesse, S., & Van den Bossche, F. (2012). Optimizing the facility location design of organ transplant centres. *Decision Support Systems*, *54*(4), 1568–1579.

Bramstedt, K., & Xu, J. (2007). Checklist: Passport, plane ticket, organ transplant. *American Journal of Transplantation*, *7*(7), 1698–1701.

Brüggenwirth, I.M.A., Mueller, M., Lantinga, V.A., Camagni, S., De Carlis, R., De Carlis, L., . . . de Meijer, V.E. (2022). Prolonged preservation by hypothermic machine perfusion facilitates logistics in liver transplantation: A European observational cohort study. *American Journal of Transplantation*, *22*(7), 1842–1851.

Budiani-Saberi, D., & Delmonico, F. (2008). Organ trafficking and transplant tourism: A commentary on the global realities. *American Journal of Transplantation*, *8*(5), 925–929.

Christopher, M., & Ryals, L. (2014). The supply chain becomes the demand chain. *Journal of Business Logistics*, *35*(1), 29–350.

Cohen, G. (2013). Transplant tourism: The ethics and regulation of international markets for organs. *Journal of Law, Medicine & Ethics*, *41*(1), 269–285.

Cole, H. (2021). The organ supply chain: Geography and the inequalities of transplant logistics. *Transactions of the Institute of British Geographers*, *46*(4), 1008–1021.

Cova, V. (2004). Marchandisation et démarchandisation de la relation de service. *Economies & Sociétés, série Economie et Gestion des Services*, *6*, 1701–1726.

Genc, R. (2008). The logistics management and coordination in procurement phase of organ transplantation. *Tohoku Journal of Experimental Medicine*, *216*(4), 287–296.

Gutmann, E. (2014). *The slaughter: Mass killings, organ harvesting, and China's secret solution to its dissident problem*. Buffalo (NY): Prometheus Books.

Huang, J.F., Zheng, S.S., Liu, Y.F., Wang, H.B., Chapman, J., O'Connell, P., . . . Delmonico, F. (2014). China organ donation and transplantation update: The Hangzhou Resolution. *Hepatobiliary & Pancreatic Diseases International*, *13*(2), 122–124.

Kargar, B., Pishvaee, M.-S., Jahani, H., & Sheu, J.-B. (2020). Organ transportation and allocation problem under medical uncertainty: A real case study of liver transplantation. *Transportation Research Part E: Logistics & Transportation Review*, *134*, 101841.

Katinienė, A., Jezerskė, Živilė, & Vaičiūtė, K. (2021). Research on competencies of logistics specialists in transport organisations. *Journal of Business Economics & Management*, *22*(5), 1308–1322.

Kempf, M.C., Andres, A., Morel, P., Benhamou, P.Y., Bayle, F., Kessler, L., . . . GRAGIL group (2005). Logistics and transplant coordination activity in the GRAGIL Swiss-French multicenter network of islet transplantation. *Transplantation*, *79*(9), 1200–1205.

Mamzer-Bruneel, M.-F., & Hervé, C. (2016). Trafic d'organes. *Cités*, *65*, 41–52.

McCleskey, J. (2020). Forty years and still evolving: The theory of constraints. *American Journal of Management*, *20*(3), 65–74.

Meng, M., & Clarke, R. (2020). Filling the organ donor pool by giving priority. *Journal of Health Politics, Policy & Law*, *45*(1), 49–71.

Merminod, N., Nollet, J., & Paché, G. (2014). Streamlining humanitarian and peacekeeping supply chains: Anticipation capability for higher responsiveness. *Society & Business Review*, *9*(1), 4–22.

Paganelli, F., Mantecchini, L., Peritore, D., Morabito, V., Rizzato, L., & Costa, A.-N. (2019). Evaluation on the use of Italian high-speed rail to support transportation network for transplantation activities. *Transplantation Proceedings*, *51*(9), 2873–2879.

Parent, B., Moazami, N., Wall, S., Carillo, J., Kon, Z., Smith, D., . . . Caplan, A. (2020). Ethical and logistical concerns for establishing NRP-cDCD heart transplantation in the United States. *American Journal of Transplantation*, *20*(6), 1508–1512.

Park, C., Jones, M.-M., Kaplan, S., Koller, F., Wilder, J., Boulware, E., & McElroy, L. (2022). A scoping review of inequities in access to organ transplant in the United States. *International Journal for Equity in Health, 21*(1), Article 22.

Paul, N., Caplan, A., Shapiro, M., Els, C., Allison, K., & Li, H. (2018). Determination of death in execution by lethal injection in China. *Cambridge Quarterly of Healthcare Ethics, 27*(3), 459–466.

Prebilič, V. (2006). Theoretical aspects of military logistics. *Defense & Security Analysis, 22*(2), 159–177.

Rhodes, R., & Schiano, T. (2010). Transplant tourism in China: A tale of two transplants. *American Journal of Bioethics, 10*(2), 3–11.

Rouhani, S., Pishvaee, M., & Zarrinpoor, N. (2021). A fuzzy optimization approach to strategic organ transplantation network design problem: A real case study. *Decision Science Letters, 10*(3), 195–216.

Russell, R., & Taylor, B. (2023). *Operations and supply chain management* (11th ed.). Hoboken (NJ): John Wiley & Sons.

Savaser, S., Kinay, O.-B., Kara, B.-Y., & Cay, P. (2018). Organ transplantation logistics: A case for Turkey. *OR Spectrum, 41*(2), 327–356.

Schwindt, R., & Vining, A. (1986). Proposal for a future delivery market for transplant organs. *Journal of Health Politics, Policy & Law, 11*(3), 483–500.

Shafran, D., Kodish, E., & Tzakis, A. (2014). Organ shortage: The greatest challenge facing transplant medicine. *World Journal of Surgery, 38*(7), 1650–1657.

Sharif, A., Trey, T., Schwarz, A., Fiatarone Singh, M., & Lavee, J. (2016). Truth and transparency. *American Journal of Transplantation, 16*(11), 3299–3300.

Shin-Hong, P., DuPont, H., & Nelson Kotton, C. (2019). Transplant tourism: A "pervasive" and dangerous "shadow world of medicine". *Infectious Disease News*.

Syam, S.-S., & Côté, M.-J. (2012). A comprehensive location-allocation method for specialized healthcare services. *Operations Research for Health Care, 1*(4), 73–83.

Trebinjac, S. (2020). Chine et Ouïgours: Un colonialisme interne civilicide. *L'Homme: Revue Française d'Anthropologie, 236*, 191–204.

Trey, T., & Matas, D. (2017). State-organized criminal forced organ harvesting. *Journal of Trafficking & Human Exploitation, 1*(2), 175–186.

van der Vliet, A., & Warlé, M. (2013). The need to reduce cold ischemia time in kidney transplantation. *Current Opinion in Organ Transplantation, 18*(2), 174–178.

Waelli, M., Terrier, L., & Minvielle, E. (2021). Customizing care pathways… yes but how? Contribution of hospitality management to healthcare organizations. *European Review of Service Economics & Management, 11*, 147–157.

Webb, G., & Mcdonald, D. (2019). Influential article review: Patient-centred medical tourism. *American Journal of Management, 19*(6), 1–28.

Wikner, J., & Rudberg, M. (2005). Integrating production and engineering perspectives on the customer order decoupling point. *International Journal of Operations & Production Management, 25*(7), 623–641.

Wu, Y., Elliott, R., Li, L., Yang, T., Bai, Y., & Ma, W. (2018). Cadaveric organ donation in China: A crossroads for ethics and sociocultural factors. *Medicine, 97*(10), e9951.

Zahiri, B., Tavakkoli-Moghaddam, R., Mohammadi, M., & Jula, P. (2014). Multi-objective design of an organ transplant network under uncertainty. *Transportation Research Part E: Logistics & Transportation Review, 72*, 101–124.