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Intra-organizational logistics and human-machine relations

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Abstract:

The purpose of this paper is to provide a conceptual review of the literature and connect the concepts of people, machines, and logistics within a theoretical framework. It aims to establish connections between previously unexamined theoretical perspectives (Sandra Pettit and Florence Durieux in Thiétart et al., 2007). The research examines the nature of interactions within intra-organizational logistics to develop a conceptual framework for these interactions.

The paper analyzes intra-organizational logistics through an examination of the interactions within this function. Interactions within organizations create limits as individuals are faced with interactions with machines and with other people. This requires us to categorize our observations into interactions between individuals and interactions between individuals and machines. The research is situated within the field of internal logistics.

Three distinct theories are presented. Two theories place the individual at the center of their analysis, focusing on interactions between people, the exchange relationship, and its implications for the daily operations of an organization. The third theory examines the role of machines in the daily operations of a company in collaboration with human employees.

Keywords: Intra-organizational logistics, information technology (IT), information systems (IS), social exchange theory, resource dependency theory (RDT), socio-technical systems theory.
JEL Classification : M15
Paper type: Theoretical Research

Résumé :

À travers ce papier, nous présentons une revue conceptuelle de littérature. Il s'agit pour nous de mettre en relation des concepts tels que les hommes, les machines, la logistique avec des théories. C'est par conséquent, une démarche d'exploration théorique qui vise à mettre en lien des théories qui n'ont pas été abordées ensemble dans des travaux antérieurs (Sandra Pettit et Florence Durieux in Thiétart et al. 2007). Dans ce sens, notre recherche s'interroge sur les types d'interactions qui interviennent au sein de la logistique intra-organisationnelle, afin de définir le cadre de référence qui pourrait s'adapter à ces interactions.

Elle présente la logistique intra-organisationnelle en passant par les interactions qui s'opèrent au sein de ladite fonction. En effet, les relations au sein des organisations, nous imposent certaines limites, étant confrontées d'une part aux machines et d'autre part aux hommes. Ce qui nous conduit à répartir notre observation en deux, d'un côté, il y a les interactions Hommes – Hommes et de l'autre, les interactions Hommes – Machines. Tout ceci évoluant dans un domaine d'étude qui est celui de la logistique interne.

Ce sont trois théories qui sont présentées. Deux ont la particularité chacune de mettre l'homme au centre (les interactions entre homme, la relation d'échange et ce qu'elle engendre dans le quotidien d'une organisation). Tandis que la troisième insiste sur la considération ou l'apport de la machine dans le quotidien de la vie en entreprise en collaboration avec l'homme.

Mots clés: Logistique intra-organisationnelle, technologies et systèmes d'information (TSI), théorie de l'échange social, théorie de la dépendance en ressources (TDR), théorie des systèmes socio-techniques.
Classification JEL : M15
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1. Introduction

The function of logistics has undergone significant evolution and growth in importance over decades. The significance of logistics is evidenced by the interest expressed by countries such as France and Morocco in optimizing their supply chains (Fulconis, 2022; Duong & Paché, 2015). The academic community is also engaged in this discourse on logistics to facilitate continuous improvement. It seeks to identify methods by which practitioners can enhance their performance. The enhancement of logistics performance commences at the organizational level, with the implementation of effective flow coordination. In other words, internal logistics affects external logistics and ultimately determines the company's success.

Attaining this level of performance also necessitates acknowledgment of the interdependence between theoretical and practical approaches. As commonly said, "Good theories come from good practices, and good practices come from good theories" (Lewin, 1945). Indeed, the development of good practices can facilitate the emergence of new theoretical fields. Moreover, it can be argued that effective theoretical frameworks assist practitioners in developing their approach to practice (Simon, 1967; Van de Ven, 1989).

In light of these considerations, researchers are exploring theoretical frameworks that could inform the advancement of logistics. The researchers rely on theories that have been demonstrated to be effective in the social and management sciences (Shook, Adams, Ketchen, & Craighead, 2009). Some have even postulated the possibility of developing a unified theory dedicated to logistics (Mentzer, Min, & Michelle Bobbitt, 2004). Some researchers, however, assess the maturity of the discipline by taking stock of the theories used in logistics (Clifford Defee, Williams, Randall, & Thomas, 2010).

In this study, we follow the methodology of previous researchers who sought to identify theories relevant to intra-organizational logistics. To achieve this, we analyze the interactions that occur within the context of intra-organizational logistics to derive theories that support our conceptualization of this discipline. Moreover, we establish connections between disparate theories, three of which have not been previously associated in prior research (Sandra Pettit and Florence Durieux in Thiétart et al., 2007, p. 70). The novelty of our approach lies in the manner in which we have linked these disparate theories.

The objective is to identify the types of interactions that occur within the context of intra-organizational logistics. Secondly, it is necessary to define the frame of reference that can be adapted to these interactions.

To respond to these queries, we present, in the initial section, the context in which the conceptual framework is developing, namely logistics. In this section, we revisit the historical roots of logistics, which can be traced back to two distinct fields: mathematics and the military. Subsequently, we recall its emergence in the business world. Furthermore, we wish to emphasize the pivotal role of humans in this "management philosophy," as well as the indispensable contribution of machines.

The second section presents the theoretical frameworks that inform our analysis of human interaction, including social exchange theory and resource dependency theory. This section permits an examination of the ideas put forth by the theorists responsible for these concepts.

The third section of this paper is devoted to an examination of the relationship between humans and machines. In this section, we contrast the anthropocentric and the technocentric worldviews and derive a theory, namely, the socio-technical theory.

The concluding section presents a discussion on the complementarity between the aforementioned theories and an alternative theory that could be employed.

2. Conceptual framework

The context in which the frame of reference evolves is that of intra-organizational logistics, given the considerable turbulence and interactions that characterize this domain. Indeed, in the context of internal logistics, there are both human-human and human-machine interactions. These interactions facilitate the effective functioning of the management philosophy (Joëlle Morana, 2003).

The theory of socio-technical systems, which posits that an organization is a set of agreements between individuals (Pasmore, 1988), allows us to assert that there are two types of interaction within an organization. Firstly, interactions between individuals are represented by the social system. These are buttressed by the tenets of social exchange and resource dependence. Secondly, the interactions between individuals and machines reveal the interface of the technical system, but more importantly, they demonstrate the cohabitation and collaboration between the social system and the technical system.

In this section, we will examine the historical development of logistics, tracing its roots to two distinct fields: mathematics and the military. Subsequently, we will examine its emergence within the business sector. We seize this opportunity to underscore the importance of humans in this "management philosophy," as well as the importance of machines.

2.1. Logistics

The term "logistics" comes from the Greek "*logistikos*" (Leighton, R. M. , 2023). In its original sense, it refers to "*the art of reasoning*", and designates a person "*who practices reasoning*" (Pierrel, 2023). Reasoning is a set of arguments put forward to support or refute an idea. So, in its first orientation, logistics was similar to logic, and logic immediately takes us back to ancient Egyptian and Greek philosophy (the art of convincing). When we think about it further, we realize, as Lièvre (2006) says, that logistics also refers to mathematical logic. A logic applied in the army to move troops.

From the above, we can trace the origins of logistics back to two fields of analysis: firstly, to mathematics; secondly, to the army (Colin, 1996; Jokar, et al., 2002; Lièvre, 2006; Lièvre, 2007; Tixier et al. , 1998). We should take into account that corporate logistics has its origins in military logistics.

2.2. Logistics and mathematics

The assertion that logistics has its roots in mathematics is based on the premise that logistics encompasses a set of calculation techniques. This viewpoint was initially put forth by Antoine Augustin Cournot (1912) and subsequently reinforced by Alain Rey (2011). In his book « *Essai sur les fondements de nos connaissances et sur les caractères de la critique philosophique* », the philosopher and mathematician Antoine Augustin Cournot introduces the concept of "syllogistics" through Aristotle's syllogistics. Aristotle's syllogistic is the reasoning commonly known as deductive reasoning. It is the process of drawing valid inferences from a general view, with the assumption that if the premises are true, then the conclusion must also be true. For example, all men are born of women; I am a man; therefore, I was born of a woman. Similarly, Cournot regards syllogistics as a form of reasoning. He differentiates it from logistics, which he defines as a method of calculation analogous to arithmetic and algebra.

This viewpoint is endorsed by Rey Alain (2011), who likens logistics to calculus insofar as it refers (in 1611) to the four fundamental operations of addition, subtraction, division and multiplication.

2.2.1. Logistics and the army

To assert that logistics has a military provenance is to imply that logistics constitutes the art of war, or at the very least, a component of the art of war. The term "art of war" is a concept

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frequently employed by military strategists, including Clausewitz (1889) and Sun Tzu (Amiot, 1772), to signify the necessity for a specific expertise (a technique) in order to successfully engage in warfare. From that point onward, a conductor is required who will distinguish himself by arranging each element in its proper place. This conductor was frequently the Maréchal des logis ("Marshal of Lodgings") or Major General des logis, as Jomini (1994) states in his work, which was later referenced by Colin (1996). This Marshal was responsible for providing housing for the troops (Pierrel, 2003). Subsequently, with the evolution of warfare from a camp-based to a mobile conflict, the role of logistics in the military context underwent a significant transformation, acquiring greater prominence.

Consequently, the former Maréchal des Logis will become Chief of Staff ("Chef d'État-Major"), assuming greater and more far-reaching responsibilities. The field of logistics is evolving, shifting from a primarily operational focus to encompass strategic and even tactical considerations. Indeed, it is at this level that the conflict is conducted and resolved. In other words, the successful implementation of military logistics is a decisive factor in the outcome of military conflicts. This was exemplified during the Second World War with the invasion of Great Britain by German troops, which could have been a success had the Germans implemented the requisite logistical resources. Conversely, the Germans were subject to Allied domination as a result of successful Allied logistics (Colin, 1996).

Jacques Colin's analysis of the history of logistics demonstrates that the characteristics of logistics as we understand them today were already evident during the period of the solidification and fortification of French naval forces. Indeed, as Colin (1996) asserts, 18th-century military logistics were distinguished by a capacity for anticipation and reactivity, as well as by the continuity and reliability of arsenal supplies.

As defined, military logistics encompasses all activities undertaken by armed forces units in roles supporting combat units. These activities include but are not limited to, transportation, supply, signal communication, medical aid, and others (Leighton, 2023). In summary, within the context of military operations, logistics can be defined as "the science of war preparation," as articulated by Colonel Thorpe (1986).

2.2.2. Corporate logistics

Notwithstanding the endeavors of French naval forces in the 18th century, the contributions of Jomini to the field of logistics, and the insights articulated by Colonel Cyrus Thorpe, it was not until the Second World War that logistics emerged as a distinct and indispensable element in military operations, and subsequently, in the everyday life of society (in this case, the business world). Indeed, the conclusion of the Second World War gave rise to a number of documents (books and treatises) which demonstrated the significant contribution of logistics to the success of the war by the United States and its allies. For example, *Logistics in the National Defense* and *Logistics in World War II* are two such documents.

The advent of logistics in the corporate realm bears resemblance to that of marketing and advertising. Indeed, just as propaganda and public relations were created by Edward Bernays and originated in the political sphere, they were subsequently extended to the corporate world under the designation "marketing" through the influence of the latter, logistics followed a parallel path (Bernays, 2007). After the Second World War, the generals who had led the wars subsequently assumed managerial roles within corporations, applying the principles of military logistics to the business world (Colin, 1996; Lièvre, 2006; Jokar et al., 2002). To comprehend this transition from military logistics to corporate logistics, it is first necessary to gain an understanding of the evolution of the market. This is what Jokar et al. (2002) have done by distinguishing three types of logistics: "separate", "integrated" and "cooperative".

The "separate" logistics period is distinguished by a surplus of demand relative to the available supply, with the resulting discrepancy left to the discretion of the producer. Consequently, all

produced items are sold on the market. Despite the lack of demanding customers, the available options are constrained. The primary objective of producers was to reduce costs. Indeed, the disparate logistics functions pursue a cost reduction strategy, yet there is a dearth of communication between them (hence the designation of this period as "separate logistics"). This approach capitalizes on customers' lack of demanding quality and lead times.

With the advent of globalization, a shift occurs in the manner by which companies establish themselves in other territories. This results in an increase in competition, which subsequently leads to an expansion in supply. The situation is transformed, necessitating an improvement in quality, adherence to strict deadlines, and a shift in focus towards the customer. It is of the utmost importance to foster customer loyalty. The principle of supply and demand necessitates a shift in management style and strategy. In light of these developments, military strategy becomes a pertinent consideration, offering avenues for exploring new avenues for differentiation (Jacques Kembeu, 2009). The concept of "integrated" logistics is emerging as a topic of discussion. This signifies the unification of logistical operations, encompassing procurement, production, and distribution. This facilitates the management of logistics costs through the application of operational research, planning, and procurement methodologies.

The process of integration swiftly gave rise to a spirit of collaboration. The fostering of collaboration facilitates a more expansive, global perspective on logistics. The focus has shifted from internal logistics to encompass activities beyond the company's immediate operational boundaries. This is due to the influence of market forces, where customer demands are increasing and the intensity of competition is becoming more pronounced. This "cooperative logistics" entails collaboration with external entities, including suppliers and even their respective suppliers, as well as customers and even their customers. The fostering of cooperation is contingent upon the establishment of communication and trust, while not excluding the necessity of control. This cooperative logistics approach gave rise to the concept of "supply chain management," as described by experts in the field.

In this sense, Joëlle Morana (2003) asserts that corporate logistics precedes SCM, as it is the preceding stage in the evolution of logistics. The objective of SCM is to meet customer needs promptly while maintaining the highest standards of quality. Effective communication between the company and its customers can facilitate cost reduction by enabling a more accurate identification of the customer's needs. Similarly, effective communication between the company and its supplier enables the fulfilment of customer deadlines. Accordingly, the logistics system is responsible for ensuring the supply of companies, the execution of production plans, and the physical distribution (Feres Sahid, 1987).

The supply chain can be defined as a set of interdependent elements. It is a process that adheres to a meticulous and delineated logic. In this sense, it is described as a management philosophy, with the human element and machines at its core.

2.3. The importance of man

The concept of man is at the core of all management philosophies, and it is therefore impossible to conceive of a philosophy that does not take man as its starting point. This is where Descartes' "I think, therefore I am" (1850) becomes relevant, as it is the human being who thinks and establishes theorems. The human element is integral to the functioning of any company, including those engaged in logistics and supply chain management.

It is impossible to discuss logistics without considering the role of people, as it is individuals who are responsible for designing, implementing, and controlling logistics processes. Consequently, logistics is contingent upon human action and is susceptible to fluctuations in human behavior (Sahid, Logística, 1987). The human being is situated at both the inception and conclusion of the process. In this work environment, the individual engages with other individuals in a collaborative effort for the collective benefit of the company.

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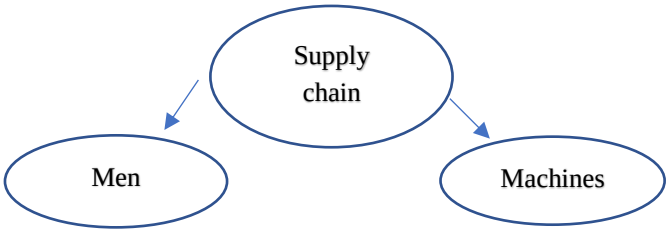
2.4. The importance of the machine

In this context, the term "machine" is used in its broadest sense to encompass all aspects of information technology systems.
The transition from an "integrated" to a "collaborative" logistics market would not have been feasible without the integration of information and communication technologies (ICT). Indeed, it is this utilization and advancement of technology that have facilitated the establishment of a viable framework for supply chain management. In other words, it is the collaboration of the various parties involved in the supply chain.
This is the argument put forth by Wang & Pettit (2016), who state:
"[…] *Many business concepts would not have been successfully implemented without the aid of ICT, for instance just-in-time (JIT), time compression, collaborative planning forecasting and replenishment (CPFR), vendor-managed inventory (VMI) and cross docking. Contemporary global manufacturing and distribution would not be able to take place without design, sourcing, marketing, manufacturing and, ultimately, sales all being linked through the use of information technology (IT) applications*." (p. 3).

Figure 1 - Components of a supply chain



Source: Authors

Yingli Wang and Stephen Pettit (2016) trace the evolution of ICT in logistics, arguing that it began in the 1960s with MRP, which later became MRP 2, and then moved on to ERP. Subsequently, ERP underwent a series of enhancements before progressing to EDI (Electronic Data Interchange). This was followed by the advent of electronic marketplaces, particularly e-commerce and e-logistics marketplaces. Consequently, any discussion of corporate logistics must encompass both the human element and information technology. The proposed frame of reference encompasses two forms of interaction: human-human and human-machine.

3. Human interaction

The subject of human interactions is treated in two parts. This section introduces two key theories: social exchange theory and resource dependence theory.

Figure 2 - Human interactions

Source: Authors

3.1. Social exchange theory

The theory of exchange has its roots in multiple disciplines. Indeed, numerous researchers from a variety of disciplines within the social sciences have made significant contributions to its development. These include contributions from the fields of anthropology (Marcel Mauss), sociology (George Casper Homans, Alvin Gouldner, and Peter Blau), and social psychology (John Thibaut and Harold Kelley).
In the field of logistics, some researchers employ exchange theory to elucidate the social dimension of supplier relations (Davis-Sramek, Hopkins, Richey, & Morgan, 2020). Others

employ it to highlight the importance of innovation within the supply chain (Mandal, 2020), while still others utilize it to draw attention to the critical issue of supply chain resilience (Saglam, Çankaya, Golgeci, Sezen, & Zaim, 2022). We have elected to emphasize this aspect within the context of internal logistics, thereby underscoring the social dimension of the collaborative relationship.
This section of our study will facilitate the tracing of the genesis of this theory to its fundamental sources, thereby providing insights that can be applied to our present work.

3.1.1. Origins

In this study, we present two prominent authors who have contributed to the theory of social exchange: Mauss (1990) and Blau (1964).

3.1.1.1. Social exchange according to Marcel Mauss

Marcel Mauss is regarded as one of the seminal figures in the field of social exchange theory. Indeed, in his work, he examines the phenomenon of social exchange as a gift that is offered freely but is always returned in so-called archaic societies. He raises questions about the manifestation of gifts and the obligation that binds the person or group of people who receive them to return them. In these societies, it is typically groups of individuals who "[…] *impose obligations of exchange and contract upon each other* [...]" (Mauss, 1990, p. 6). As Mauss notes, these exchanges are based on a range of activities, including "[…] *banquets, rituals, military services, women, children, dances, festivals, and fairs* [...]" (Mauss, 1990, p. 6). This extensive list of activities is what leads the author to describe this system as a "*system of total services*" (Mauss, 1990, p. 7).
The obligation to reciprocate is accompanied by obligations to give and receive. These obligations are associated with traditions, but more significantly, with the spiritual aspects of these traditions. The mores of these societies exert a compelling influence on individuals, prompting them to engage in the act of giving, receiving, and returning the gift in question. This manifests as a belief that the recipient may suffer negative consequences if they do not reciprocate the gift. Consequently, individuals are constrained by a traditional system that is intertwined with their established habits and customs.
Mauss's work underscores the fundamental tenet that all gifts are ultimately returned. Indeed, in his study of communities in the American Northwest, the author emphasizes that gifts made by the local population are the subject of loans, credit, and, on occasion, interest-bearing loans that are returned in subsequent years. In the event of the death of the person who made the loan, they also serve as a guarantor for the financial security of their children. In a similar vein, one might posit that a gift creates a bond between the recipient and the donor, whereby the recipient is obliged to return the gift in some form.

3.1.1.2. Social exchange according to Blau

In his work, Peter Blau builds upon the concepts put forth by Georges Casper Homans (1958; 1974) to differentiate between two forms of exchange: social exchange and economic exchange. The former differs from the latter in that it necessitates a certain degree of trust between individuals and involves obligations that are not explicitly formulated. In this context, "unspecified obligations" refer to the tendency of social exchange "[...] *to engender feelings of personal obligation, gratitude and trust* [...]" (p. 94, 1964). Such sentiments of obligation engender a sense of indebtedness in the recipient towards the provider of assistance. If the latter is in need, they must return the favor. In this sense, Blau posits that social exchange "[…] *can be considered to underlie relations between groups as well as those between individuals* […]" (Ibid., p. 4).

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Daily, individuals or groups of individuals are obliged to each other, exchanging intangible things that lead them to feel a moral debt. This may occur at the national scale, between companies, or even between work colleagues.
In contrast to social exchange, economic exchange is more formal and may take the form of a written contract. For example, an employment contract or a mortgage contract both contain stipulated clauses and the two parties committing themselves to sign are subject to material or even scriptural obligations.

3.1.2. Implications

This theory permits the consideration of the exchange framework in its formal and informal aspects or, its economic and social dimensions, as articulated by Blau. The objective is to ascertain the impact of these organizational aspects on logistics performance.
Furthermore, exchange facilitates intra-organizational learning by stimulating ideas, enabling those who are less knowledgeable to learn, and allowing the company to retain a certain degree of authenticity. Through the above formal and informal exchange, the company is able to establish an organizational culture.

3.2. Resource dependence theory

The Resource Dependency Theory (RDT) was developed by Pfeffer and Salancik. The theory has been demonstrated to have merit in the sciences and has made a significant impact on the scientific community, in large part due to the extensive research devoted to it. Indeed, some authors have dedicated an entire work to it, providing a comprehensive review of the conceptual development, empirical research, and applications of RDT (Hillman, Withers, & Collins, 2009). Others have gone further, developing existing models to provide a more comprehensive explanation of inter-firm actions (Casciaro & Piskorski, 2005).
The theory has been applied to the field of logistics, although this is not a particularly prominent aspect of its evolution, given its longstanding relationship with this discipline. This illustrates the degree of confidence that researchers have in it. Indeed, in a post-pandemic approach, some scholars have emphasized that RDT helps us to better understand the relationship between a firm's resources and the resilience of the supply chain (Nandi, Sarkis, Hervani, & Helms, 2021). Others apply RDT from a logistics integration perspective (Kim, Lee, & Hwang, 2020). Bode, Wagner, Petersen, and Ellram (2010) adopt a resource dependency perspective to analyze supply chain disruptions. In conclusion, Xiao, Petkova, Molleman, and van der Vaart (2019) investigate the impact of decision-making processes among different supply chain actors.
The majority of the research cited above emphasizes its use in an inter-organizational approach. Nevertheless, this theory can be used to support the question of power relations at the intra-organizational level, since it enables organizational actions to be explained (Drees & Heugens, 2013; TORGALÖZ, 2018). In light of these considerations, Sandra Petit and Florence Durieux (Thiétart, 2007) urge researchers to retain the portion of the theoretical field that is most pertinent to their research object. Accordingly, this section will examine RDT in the context of intra-organizational relations.
RDT presents itself as a crossroads theory, integrating concepts from disparate theoretical perspectives and partially encompassing them. These include social exchange theory, resource-based management theory (RBV), transaction cost theory, and institutional theory (Nienhüser, 2008). This leads us to discuss one author in particular, Richard M. Emerson, whose ideas are at the foundation of resource dependency theory (Smith & Hitt, 2005; Davis & Cobb, 2010). In addition to Emerson, we will also examine RDT according to Salancik and Pfeffer.

3.2.1. Resource dependence theory according to Richard Emerson

Emerson (1962) developed his theory of relational power, basing his ideas on the theory of

social exchange, which studies interactions between individuals. Consequently, he incorporates the concepts of social relations, reciprocity, dependence, and power that were previously outlined in the aforementioned theory.

In Emerson's view, the concept of social relations is inextricably linked to that of power. In this sense, he asserts that "[...] *power is a property of the social relation; it is not an attribute of the actor* [...]" (p. 32, 1962, Power-dependence relations). This notion of power is closely associated with the notion of dependence, as in any relationship, one party will seek to exert control over the other in order to gain the greatest benefit. This dependency manifests when an individual is in need and requires the assistance of another individual to address that need. As Emerson states, "[...] *power resides implicitly in the other's dependency* [...]" (p. 32, 1962). The power exercised by one individual over another is relative to the latter's dependence on the former. Inequality of power in the relationship is understandable insofar as one of the individuals is much more dependent on the other, which encourages the exercise of power and dominance by the less dependent. This inequality often leads to cost-cutting in order to please the other. As a result, one individual is more likely to abandon some of his or her values if this is necessary to preserve the relationship.

However, balanced relationships can also exist, in which case the relationship is one of mutual dependence or equality of power. This is because individuals exert influence upon one another. In intra-group relations, the concept of power gives rise to the question of the hierarchy of status. In order to consider authority within a structure, it would have to be a legitimate authority, established by well-prescribed standards.

3.2.2. Resource dependence theory according to Salancik & Pfeffer

Salancik & Pfeffer (1977) define power as "[…] *the ability to get things done the way one wants them to be done* […]" (p. 4). They distinguish between vertical and horizontal power (Salancik & Pfeffer, 1974). The former, which refers to the influence exerted by one individual over another, is most often illustrated by the relationship between a superior and a subordinate. The second refers to the distribution of power between individuals or departments belonging to the same hierarchical structure. They propose focusing on this second type of power, which they define as follows: "[…] *the use of influence among coacting peers to obtain benefits for themselves* […]" (ibid., p. 453, 1974).

They investigate the factors that contribute to the disparity in power between sub-units and conclude that the acquisition of power is contingent upon the provision of "critical" resources, which are defined as those that are indispensable for the organization's operational efficacy (Ibid., 1974). Furthermore, it not only acquires power but also seeks to maintain it, thus prolonging its durability by influencing decisions (Salancik & Pfeffer, 1977).

3.2.3. Implications

An examination of the internal organization of the logistics function reveals the influence or distribution of power between sub-units, which is contingent upon the possession of critical company resources. Such a situation inevitably gives rise to a conflict of power, which may have a positive or negative impact on the company's performance. As Aldrich (1979) notes, individuals within an organization may possess disparate objectives and priorities. Conversely, an individual in a position of authority will invariably endeavor to maintain their influence and control (Salancik & Pfeffer, 1977).

4. Human-machine interaction

In examining the relationship between humans and technology within an organizational context, the scientific literature (Gunia, 2002; Duquette, 2006; Banks & de Graaf, 2020) presents two distinct worldviews: anthropocentrism and technocentrism. This choice between

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technocentrism and anthropocentrism also prompts us to consider the implications of technological and organizational determinism. Advocates of technocentrism are therefore aligned with technological determinism, while those who espouse anthropocentrism are associated with organizational determinism (Jacob & Ducharme, 1995, cited by Duquette, 2006).

This section presents the two paradigms, delineating their conceptualizations of the human-machine relationship. It then introduces socio-technical theory as a means of integrating these perspectives.

Figure 3 - Human and machines interactions

Source: Authors

4.1. Anthropocentrism

The term "*anthropo*" is derived from the Greek word for "*man*". The term is univocal, retaining the same meaning regardless of whether it is associated with different prefixes or suffixes. In this manner, we indicate the formation of combining forms such as anthropocentrism. In the latter, the prefix "*anthropo*" is derived from the Greek word "*ánthrōpos*", which denotes the term "human" (Merriam-Webster, 2024). The suffix "ism" denotes a "movement" (Imaginario, 2022). Anthropocentrism posits humankind as the focal point of the universe (Pierrel, 2023). If humanity is situated at the center of the world, it is also at the center of movement, change, and progress. As a developing entity, humanity has devised techniques, methodologies, and technologies to facilitate its flourishing. Anthropocentrism thus gives rise to the question of organizational determinism, insofar as the utilization of technology is contingent upon humanity that is to say, upon the organization in which it evolves (Batazzi-Alexis, 2002). The central question is: "*What can individuals do with technology?*" (Papert, 1987).

Based on the human-machine relationship, Nass, Lombard, Henriksen, and Steuer (1995) assert that anthropocentrism has three dimensions. These include physical anthropomorphism, which is the belief that machines possess the same physical capabilities as humans; psychological anthropomorphism, which is the belief that machines possess the same psychological capabilities as humans; and the acceptance of machines in various activities in place of individuals (Nass et al., 1995). This third dimension of anthropocentrism gives rise to concerns about the use of machines. The question thus arises as to whether the machine will completely replace man in all these tasks, or not. This question is particularly pertinent in the context of Industry 4.0 and connected factories.

4.2. Technocentrism

The term "technocentrism" is derived from the prefix "*techno*", which, as defined by Pierrel (2023), encompasses all aspects related to technology. In this context, "*centrism*" denotes a perspective wherein technology occupies a central position. This represents an alternative perspective on the world, which can be viewed through a different lens. In this context, the pivotal question is not about the capabilities of individuals in relation to technology, but rather about the potential of technology to benefit individuals (Papert, 1987).

The technocentric perspective lends support to the concept of technological determinism. In other words, technology exerts influence over the organization, imposing its culture, its modus operandi, and its perspective on the organization and the individuals within it. In this context, Schmoldt (1992) characterizes this perspective as "mechanocentric," stating: "*When a technology is introduced in such a way that people must conform to the style, methods and*

models of that technology, then the technology becomes the center of focus; it's mechanocentric [...]" (p. 66)
This mechanocentric perspective, also referred to as technocentric, differs from anthropocentrism, which places humans at the center of attention.

4.3. Socio-technical systems theory

The theory of socio-technical systems posits an interdependence between the employees of a firm, the technology utilized by that firm, and the environment in which the organization operates (Muller, 1989). The theory recognizes that every organization is a socio-technical system (Pasmore, 1988). Together with the social system, which represents the individuals within the organization, these individuals utilize the tools, techniques, and knowledge that comprise the technical system (Pasmore, 1988). This theory is founded upon a study conducted by Trist and his colleagues on the British coal mine (Trist, 1981).
In the post-war era, coal served as the primary source of energy for reconstruction efforts. However, the British coal mine was experiencing challenges, including employee turnover due to the availability of more lucrative opportunities elsewhere, absenteeism among those who remained, and internal discord within the workplace. The primary source of these issues was the alienation of employees resulting from the Taylorist concept of work.
Following the observation of a novel work organization that prioritizes group autonomy and interchangeability, Trist and his colleagues embarked on the development of a theory of work organization (Trist, 1981). This stands in contrast to the Taylorian and bureaucratic conceptualizations of the firm. The theory unites the social and technical systems. It is inherent to both systems that they are independent of one another. However, the organization requires these inputs to be transformed into outputs (Trist, 1981).
This is the objective of research in the field of logistics based on the aforementioned theory. For example, Liu (2021) presents a discussion of the socio-technical transition in the logistics sector. Or Vlachos (2021) examines the implementation of a supply chain control tower from a socio-technical system perspective. In a related vein, Kim, Ramkumar, and Subramanian (2019) developed a decision model using the socio-technical system to define the criteria that lead humanitarian aid organizations to collaborate with specific logistics service providers.
The theory of socio-technical systems is comprised of seven principles, including the principle of complementarity between the individual and the machine.
This sixth principle directs our attention away from a logic of comparison and toward a logic of complementarity. In the performance of tasks, man and machine are mutually complementary (Jordan, 1961). In this sense, Jordan (1961) makes the following assertion: "[...] *men are good at doing that which machines are not good at doing and machines are good at doing that which men are not good at doing* [...]" (p. 4 - 5).
This results in an integrated vision that complements the two paradigms of technocentrism and anthropocentrism. In the contemporary era, the coexistence and collaboration between humans and machines are inevitable and crucial. The two entities exert a mutual influence and conditioning effect on one another. Similarly, the organization's modus operandi influences and orients the machine towards the organization's objectives. Concurrently, the configuration of the machine prompts the company to undergo a process of reconfiguration and adaptation, whereby the machine exerts an influence on the company's culture and the organization's established modes of operation.

5. Discussion

5.1. A complementarity between theories

The theory of social exchange, which views human relationships as an exchange where, one gives and another receives, fails to acknowledge the possibility of relationships where one gives

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without necessarily expecting anything in return (Ramírez Paredes, 2023). In Greek thought, three kinds of love are distinguished, one of which is "*agapao*". It denotes a form of love that is selfless (Bromiley, 1979). The motivation behind our actions of loving and caring for others is not necessarily driven by the expectation of personal gain, but rather by an intrinsic force that surpasses our capabilities. The exchange is based on a solid foundation of selfless love rather than on interest. In an exchange based on interest, the individual who receives the desired outcome may withdraw from the relationship. Conversely, if the desired outcome is not achieved, the individual may engage in negative behaviors towards the other person to undermine their position.

In contrast, the theory of social exchange posits that requesting assistance is perceived as a burden due to the potential for humiliation. This conceptualization offers no assistance in the advancement of human relations (Alexander, 2000). It is therefore evident that if one does not solicit assistance, one will not gain the requisite knowledge. Furthermore, when individuals do take the initiative to request assistance, those who are benevolent will not subject them to humiliation.

Furthermore, this exchange of assistance is also perceived as a conduit for power, given that it engenders a sense of dependency. It is, therefore, necessary to supplement the theory of social exchange with the theory of resource dependence, not only to address the limitations of the former but also to examine the hierarchical dynamics of human relations within organizational contexts.

5.2. An alternative to the socio-technical systems theory

An additional avenue for discourse on the nexus of human and machine interactions in the corporate realm is the Socio-Economic Approach to Management (SEAM). SEAM posits that humans and machines are complementary factors, with the human factor occupying a superior position to the machine factor.

We have decided to eschew the utilization of SEAM in the context of our present work. This decision is predicated upon our conceptual framework, which prioritizes examining human interactions as a means of underscoring the pivotal role of the human element within the corporate realm. The theoretical lenses employed in this domain are inherently social, with the human subject at the core. After that, the significance of the machine is underlined. Finally, we address the topic of human-machine interactions. But to our knowledge SEAM find it crucial to relocate the interactions between man and machine without focusing on it, as SEAM is an economical theory which means that SEAM underpins his thought on economical thinking (that is why it talks about hidden cost), and the social part comes to remind us that human being is an important element to the corporate world and recommend managers to invest in the human being as well as the buying of machines, because they are complementary; with human as the active factor who gives value to the machine (Bonnet, Savall, Savall, & Zardet, 2018; Savall & Zardet, 2021; Conbere & Heorhiadi, 2015).

6. Conclusion

This research is part of a process of theoretical exploration and aims to establish connections between previously unexamined theoretical perspectives (Sandra Pettit and Florence Durieux in Thiétart et al., 2007). The study focuses on the interactions that occur within the context of intra-organizational logistics. In this regard, the concept of socio-technical systems theory is employed to substantiate the assertion that there are two distinct categories of interaction within an organizational context. Firstly, there are the interactions between individuals, which are represented by the social system. This is supported by theories of social exchange and resource dependence. Secondly, there are the interactions between individuals and machines, which

elucidate the interface of the technical system. Of particular importance is the cohabitation and collaboration between the social system and the technical system.
The selected theories have been demonstrated to be effective within the field of logistics. These theories have been selected based on their alignment with the evolution of logistics and their compatibility with the explanation of organizational phenomena associated with this function. Our approach builds upon the findings of previous research. The contribution of this study is to integrate these three theoretical fields to gain insight into the most effective means of explaining organizational reality. From an open-minded perspective, *what is the extent and manner in which these interactions influence the performance of intra-organizational logistics?*
This investigation is occurring at a time when the field of logistics is experiencing rapid technological advancement. Just a few years ago, the concept of a new industrial era, designated as Industry 4.0, was first introduced. In the present era, we observe a proliferation of robots in numerous logistics warehouses. Some of these robots have supplanted human workers in the tasks they previously performed. This phenomenon serves as a cautionary reminder that the organization remains, and will continue to be a socio-technical system. The pursuit of profit may indeed motivate managers and company directors to make certain decisions. However, we must not lose sight of the individuals around us. If the machine replaces the human worker, let's not oust it. But let's redefine its tasks and objectives within the company.

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