

Revisiting postponement: The importance of cross-functional integration to understand tax implications in global supply chains

Andreas Norrman¹  | Lorenzo Bruno Prativiera² 

¹Division of Engineering Logistics,
Faculty of Engineering, Lund
University, Lund, Sweden

²Centre for Logistics, Procurement, and
Supply Chain Management – Cranfield
School of Management, Cranfield
University, Bedford, UK

Correspondence

Lorenzo Bruno Prativiera, Centre for
Logistics, Procurement, and Supply
Chain Management – Cranfield School
of Management, Cranfield University,
Bedford, UK.
Email: lorenzo.prativiera@cranfield.ac.uk

Abstract

As products and supply chains (SCs) evolve, logisticians must revisit their understanding of postponement. The postponement boundary problem acknowledges that value-adding operations' timing and location in global SCs are critical decisions, impacted by taxes and government regulations in different jurisdictions. However, when combining hardware and software objects, software's increasing importance heightens the implications of *when* and *where* value is added. Until now, postponement scholars mostly have overlooked fiscal/legal implications, and current research tied to the postponement boundary decision-making phenomenon has not considered hardware and software combination. Moreover, we lack understanding about how to make cross-functional decisions when interrelatedness between the logistics and fiscal/legal domains increases. We used an abductive approach to elaborate and contextualize postponement decision making for global SCs of product offerings that combine hardware and software objects. A single-case study (with four subcases) was used to explore postponement decisions (and related fiscal and legal implications) and cross-functional integration (CFI) at a global high-tech enterprise. We also elaborated on the contextual drivers of increased postponement boundary complexity to illustrate changes in its decision making. We also emphasized formalized boundary objects' importance in enhancing CFI by developing formal steering documents, creating interdependent organizational structures, and aligning trade-offs and outcomes.

KEYWORDS

boundary object, cross-functional integration, global supply chains, operating model, postponement boundary problem, software supply, tax implications

INTRODUCTION

Postponement is a well-known concept that essentially relates to delaying manufacturing or logistics operations

(Zinn, 2019; Zinn & Bowersox, 1988), often exemplified by combining pre-defined modules in customized assemblies or customizing labels to local languages (Pagh & Cooper, 1998; van Hoek, 2001). Postponement strategies

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2023 The Authors. *Journal of Business Logistics* published by Wiley Periodicals LLC.

broadly help firms cope with uncertainty while being responsive and cost-effective (Boone et al., 2007; Yang & Burns, 2003). However, as products and supply chains (SCs) evolve and increase in complexity, postponement trade-offs are extended, and logisticians must improve their understanding of postponement complexity.

First, modern SCs are increasingly global (Ferdows, 2018), involving multiple jurisdictions with varying fiscal regulations. This renders crucial deciding not only the timing but also the location of value-adding operations, as they influence where and how much a company pays in duties and other taxes (Cohen & Lee, 2020). This geographical perspective must be included with the temporal perspective when designing global postponement strategies (Pratavia et al., 2020; van Hoek, 1996). Specifically, defining *what* to assemble in the factory and *what* to assemble during distribution has been labeled the *postponement boundary problem* (Lee, 2010, p. 182).

Second, many SC flows no longer can consider only physical goods, as the manufacturing industry's servitization trend has grown sharply in recent decades (Zhang & Banerji, 2017). In addition to growth in services, software's importance in delivering customer value is increasing (Favoretto et al., 2022). Software can be easily downloaded or installed at various temporal and geographical points to unlock or add features to a product or service, thereby increasing customers' use value (Norrman & Lundberg, 2005). For example, software has become an essential part of the automotive industry to enhance the vehicle's safety and overall performance. Software updates can unlock features from heated seating to increasing powertrain horsepower until activating full self-driving capabilities, offering additional flexibility and customization. Because this flexibility carries implications for both when and where value can be added, it relates to postponement (Jafari et al., 2022; Zinn, 2019).

Until now, scholars have investigated the feasibility and value of different types of postponement for many decades (Boone et al., 2007; Zinn, 2019), also formalizing the postponement boundary problem (Lee, 2010). However, current discourse requires further theoretical development (Pratavia et al., 2020; Zinn, 2019). First, the fiscal/legal implications related to the postponement boundary problem generally have been overlooked (Pratavia, Moretti, & Tappia, 2022). Moreover, postponement decisions related to solutions that combine software and hardware elements can create new challenges and also provide additional opportunities to lower overall costs, pointing to a promising research area (Norrman & Henkow, 2014).

To develop logisticians' understanding of the postponement boundary decision-making phenomenon, we aim to elaborate on the extant literature more deeply in terms of related fiscal and legal implications in the context of

increasing hardware/software combination. Thus, we propose the following research question (RQ1):

How can global postponement boundary decisions be made in the context of fiscal/legal implications and hardware and software combination?

This interaction highlights potential frictions between logisticians (who rarely are educated in fiscal/legal matters) and lawyers (who are almost never educated in logistics) (Norrman & Henkow, 2014), pointing to cross-functional issues (Enz & Lambert, 2015; van Hoek et al., 2008). Cross-functional integration (CFI) related to logistics has been a topical problem for many years (e.g., Frankel & Mollenkopf, 2015; Pagell, 2004), but still is viewed as an underexamined research area (Kang et al., 2022; Pellathy et al., 2019). Most scholars have investigated CFI between marketing and production/logistics operations (e.g., Ellinger et al., 2006; Enz & Lambert, 2022; Richey et al., 2010), but the functional interface to finance and legal also has been recommended for investigation explicitly (e.g., Pellathy et al., 2019; van Hoek et al., 2008). However, few studies have examined this, mainly addressing the need for a common communication platform (Henkow & Norrman, 2011) or stressing the relevance of joint policies and guidelines that combine logistics and tax principles (Norrman & Henkow, 2014). Previous researchers also pointed out that CFI is difficult to implement in practice (e.g., Ralston et al., 2015), and we currently lack understanding about how to govern and facilitate CFI for the postponement boundary problem. To explore this, we propose a second research question (RQ2):

How can SC/logistics and fiscal/legal domains be integrated cross-functionally for postponement boundary decision making?

To contextualize the postponement boundary decision-making phenomenon and address the RQs, we chose an abductive reasoning approach (Ketokivi & Choi, 2014; Kovács & Spens, 2005) to gain rich and critical insights into a company's context and real-life challenges, and to elaborate the extant theory. Thus, we tackled the problem within a specific empirical domain, resulting in a mid-range theory approach (Craighead et al., 2016; Stank et al., 2017). As qualitative research complements phenomena research well (Schwarz & Stensaker, 2016), we developed a single embedded case study (Ellram, 1996; Yin, 2014) to analyze a high-tech enterprise that

implements global postponement (including software and hardware combination), with four of its global supply hubs (GSHs) serving as subcases. GSHs represent distribution centers where postponed value-adding operations (related to hardware and software) can be performed. Conducting single-case research helped us explore geographical and temporal contextual aspects, and created opportunities for deeper theorizing (Flyvbjerg, 2006; Stake, 2008).

Our study offers an original perspective on global postponement that explicitly considers the geographical footprint and country specifics among multiple jurisdictions, as well as related fiscal/legal implications. It contributes theoretically by contextualizing postponement boundary decision-making and deepening tax implications for product offerings that combine hardware and software objects. The study also contextualizes CFI and broaden its functional scope within the SC/logistics domain to include finance and legal, further proposing boundary objects to govern CFI. We also developed a conceptual framework to summarize CFI's contextualization, further providing a set of propositions that extend and clarify CFI's theoretical boundaries.

For logistics practitioners who might be unfamiliar with tax laws and fiscal principles, the case description offers valuable insights to improve cross-functional interaction between the SC/logistics and fiscal/legal domains, which could advance decision-making capabilities. In the next section, we offer perspectives from the extant literature, followed by a discussion of our methodology. We then discuss our findings and suggest theoretical propositions and managerial guidance before drawing conclusions and providing directions for future research.

LITERATURE PERSPECTIVES

The postponement boundary problem

Postponement emerged 70 years ago as a relatively simple, but powerful idea: *Timing matters in marketing and distribution* (Alderson, 1950; Zinn, 2019). Postponement determines goods or services' place and time utility and typically is related to the customer order decoupling point (Pagh & Cooper, 1998; van Hoek, 2001). By delaying a product's final configuration or movement downstream, firms delay their commitment to a specific customer or market (Alderson, 1950; Zinn & Bowersox, 1988). Thus, postponement helps firms cope with demand uncertainty, leading to higher SC flexibility and responsiveness (Jafari et al., 2022; Zinn, 2019). Postponement enhances companies' flexibility to meet customers' requirements effectively while guaranteeing a quick response, enabling development of different versions of products and

adapting distribution solutions (Brun & Zorzini, 2009; Yang et al., 2004). As firms delay value-adding activities along the SC, they can adapt and react quickly to signals they receive from the market (Jafari et al., 2022). This also improves responsiveness to local market requirements (Prataviera et al., 2020; Yang & Burns, 2003).

Although postponement usually is related to *when* value is added (van Hoek, 2001), other opportunities for implementing global postponement are increasing (Guericke et al., 2012; Prataviera et al., 2020). Multinational corporations (MNCs) must be globally efficient and locally responsive simultaneously (van Hoek, 1996), trading off economies of scale (through centralization of operations) with local customer responsiveness through decentralized operations (Cooper, 1993; Twede et al., 2000). Lee (2010) coined the term *postponement boundary problem* to define which portions of a product are assembled in the factory and in distribution, implying the *when* in the sequence of SC tiers. As Figure 1 indicates, previous literature related to postponement theory primarily has discussed the execution of value-adding operations as driven by factors related to product (e.g., customization degree), market (e.g., delivery lead-time requirements), and process (e.g., distribution lead times).

For example, production at central factories certainly increases scale economies, making quality control easier (Yang & Burns, 2003). However, different countries and continents have different drivers and inhibitors of postponement practices (Lee et al., 1993; van Hoek, 2001), and global SCs also must consider duties, taxes, and various country-related elements. Tariffs associated with increased protectionism make it increasingly attractive to conduct some portion of production—specifically customization—during distribution (Choi et al., 2012). Because components often have lower duty rates than finished products, postponing final assembly until the destination market can elicit significant duty savings (Cohen & Lee, 2020; Prataviera, Moretti, & Tappia, 2022). Consequently, in global contexts, postponement refers to not only *when* value-added operations are performed but also *where* (Prataviera et al., 2020; van Hoek, 1996). Thus, solving the postponement boundary problem requires addressing original trade-offs in terms of tax-related costs (e.g., duties and other taxes) and traditional logistics costs (e.g., warehousing or transportation) (Avittathur et al., 2005; Fernandes et al., 2015).

Tax implications for global SCs

Global SC design, including postponement, determines *how* and *where* a company is established, *what* value-adding operations it performs, and *where* (Norrman &

Product - related	Process - related
Value density (Zinn and Bowersox 1988; van Hoek et al. 1998; Pagh and Cooper 1998; Brun and Zorzini 2009)	Economies of scale (Cooper 1993; Pagh and Cooper 1998; Twede et al. 2000; Yang and Burns 2003; Ribas et al. 2019)
Parts modularity and standardization (van Hoek et al. 1998; Twede et al. 2000; Yang et al. 2004)	Required knowledge and/or capabilities (Pagh and Cooper 1998; Twede et al. 2000; Brun and Zorzini 2009; Pratavia et al. 2022)
Customization degree (Zinn and Bowersox 1988; Cooper 1993; van Hoek 1996; van Hoek et al. 1998; Pagh and Cooper 1998; Twede et al. 2000; Ribas et al. 2019; Jafari et al. 2022)	Process modularization (Yang et al. 2004; Guericke et al. 2012; Ribas et al. 2019)
Size and volume density (Zinn and Bowersox 1988; Twede et al. 2000)	Production and/or distribution lead times (van Hoek 1996; Pagh and Cooper 1998; Brun and Zorzini 2009; Guericke et al. 2012; Ribas et al. 2019; Pratavia et al. 2020)
Life cycle position (van Hoek et al. 1998; Pagh and Cooper 1998; Twede et al. 2000; Yang et al. 2004)	International transportation cost (van Hoek 1996; Yang et al. 2004; Choi et al. 2012; Pratavia et al. 2020)
Product range (Pagh and Cooper 1998; Brun and Zorzini 2009)	Product customization cost (Yang et al. 2004; Brun and Zorzini 2009)
Obsolescence rate (Twede et al. 2000; Ribas et al. 2019; Pratavia et al. 2022)	Quality control procedures (Yang and Burns 2003; Cohen and Lee 2020)
Demand volume (Zinn and Bowersox 1988; Lee et al. 1993; Cohen and Lee 2020; Pratavia et al. 2022)	Duties, tariffs, and trade agreements (Yang et al. 2004; Lee 2010; Choi et al. 2012; Cohen and Lee 2020; Dong and Kouvelis 2020; Pratavia et al. 2020; Pratavia et al. 2022)
Demand uncertainty (Zinn and Bowersox 1988; van Hoek et al. 1998; Pagh and Cooper 1998; Twede et al. 2000; Yang et al. 2004; Jafari et al. 2022)	Tax rates and transfer pricing schemes (Lee 2010; Henkow and Norrman 2011; Fernandes et al. 2015; Shunko et al. 2017)
Delivery lead time requirements and shipment frequency (van Hoek 1996; Pagh and Cooper 1998; Ribas et al. 2019)	Government laws, regulations, and incentives (Lee et al. 1993; Lee 2010; Dong and Kouvelis 2020)
Market adaptation requirements: Brand - Formulation - Peripherals (Zinn and Bowersox 1988; Cooper 1993; Lee et al. 1993; van Hoek 1996; Twede et al. 2000)	Differences in materials and parts cost (Lee et al. 1993; van Hoek 1996; Choi et al. 2012; Pratavia et al. 2022)
	Differences in production factors cost (van Hoek 1996; Lee 2010; Guericke et al. 2012; Pratavia et al. 2022)
Market - related	Country - related

FIGURE 1 Summary of the factors affecting the postponement boundary problem.

Henkow, 2014). Consequently, SC design influences direct and indirect taxes to be paid (Shunko et al., 2017), and the tax implications related to SC design that involves multiple jurisdictions are an increasingly relevant problem that academics and practitioners must examine (Cohen & Lee, 2020). Logistics and SC management (SCM) studies have examined tax implications related to specific topics, for example, manufacturing offshoring (Dong & Kouvelis, 2020; Hammami et al., 2008; Wang et al., 2016), facility location (Arntzen et al., 1995; Mariel & Minner, 2015; Pratavia, Norrman, & Melacini, 2022), firms' structure (Hsu & Zhu, 2011; Shunko et al., 2017), and transfer pricing (Fernandes et al., 2015; Miller & de Matta, 2008; Vidal & Goetschalckx, 2001). However, to understand tax implications for SC decisions better, logisticians first should increase their familiarity with specific terms (Table 1).

A key term is *permanent establishment* (PE) (Petriccione, 2007), which is the creation of a fixed place of business that typically gives rise to direct or indirect tax liability in a particular jurisdiction (Norrman & Henkow, 2014). PE is a cornerstone of international taxation aimed at reducing uncertainty for taxpayers with cross-border operations, leading to fair sharing of taxing rights among jurisdictions (Petriccione, 2007). This relates to the critical concept of *economic (or tax) substance*, which helps determine the foreign entity or transaction's actual operations or role in avoiding an operation

established only for fiscal reasons (Pratavia, Norrman, & Melacini, 2022). Another critical factor is the jurisdiction in which the manufacturing operations are performed, typically indicating the goods' origin. However, origin sometimes is determined by the location of the last substantial transformation (i.e., any operation that changes the product's tax code). Moreover, the concept of substantial transformation is often ambiguous, creating unclear legal boundaries (Adams, 2008).

To improve SC performance and reduce costs, MNCs can divide their enterprises, concentrating high value-adding functions (those bearing the most meaningful risks) into specific organizations or *principal structures* (Bhutta et al., 2003; Shunko et al., 2017). MNCs could locate strategically in different jurisdictions to take advantage of lower tax rates and allocate costs and revenues across them to improve after-tax profits (Pratavia, Norrman, & Melacini, 2022; Shunko et al., 2017), thereby taking advantage of opportune transfer pricing (Fernandes et al., 2015; Vidal & Goetschalckx, 2001). Tax savings obtained by utilizing skillful arrangements of fiscal logistics can be so substantial that from the MNC's perspective, they sometimes justify considerable increases in logistics costs that may result from locating units in more distant states with lower tax rates (Frias et al., 2014; Henkow & Norrman, 2011). For example, trading blocs' preferential trade agreements (PTAs) may entail lower customs duties or special treatment for some products and trading partners

TABLE 1 Tax-related terms considered in the present study.

TERM	Short description
Jurisdiction	A state or other area/territory with a particular court system and laws.
Legal entity	An individual or corporation with separate and distinct legal rights and obligations.
Tax authority	Any governmental authority having jurisdiction over the assessment, determination, collection, or imposition of any tax.
Tax base	The total amount of income, property, assets, consumption, transactions, or other economic activity subject to taxation by a tax authority.
Tax liabilities	The total amount of taxes that individuals and organizations owe to tax authorities from a given period.
Tax code	A series of numbers and letters that correspond to laws governing taxation in a given jurisdiction.
Tax optimization	Reducing individuals or corporations' current and future tax liabilities using legal advantages.
Direct tax	A tax imposed on corporations' (or analogous legal entities') business profits or income.
Indirect tax	A tax levied on goods and services, rather than on income or profits. Some indirect taxes also are referred to as consumption taxes, for example, sales tax or value-added tax (VAT).
Permanent establishment (PE)	A fixed place of business that creates direct or indirect tax liability in a particular jurisdiction.
Economic (or tax) substance	Operations or transactions in a given jurisdiction with purposes other than reducing tax liabilities.
Substantial transformation	Any operation determining a change in products' tax code.
Principal structure	An organizational setting that centralizes value-adding functions into a specific legal entity in a given jurisdiction.
Free-trade zone (FTZ)	A geographical area where goods may be imported, stored, managed, manufactured, or reconfigured and re-exported under specific customs regulations.
Preferential trade agreement (PTA)	An agreement between jurisdictions that reduces tariffs and other barriers for specific products, benefitting the jurisdictions that sign the agreement.

that meet specific requirements (Dong & Kouvelis, 2020). To capture PTAs' impact on customs duties fully, firms must examine the product's complete bill-of-material and compare the implications for components vs. products in relation to trade agreements (Lee, 2010; Sawhney & Sumukadas, 2005). Moreover, operations in a free trade zone (FTZ) can carry further implications, as FTZs may have specific regulations (Lavissière & Rodrigue, 2017).

Hardware and software implications for global SCs

Similar to globalization, the boundary between goods and services recently has been blurring, with customers often buying a "product pack" of combined goods and services (Favoretto et al., 2022; Ribas et al., 2019). In many industries, the hardware part of customer value increasingly is being replaced by software, which manages ever-higher amounts of differentiation, customization, and capacity upgrades (Norrman & Lundberg, 2005). Given this, combining hardware, software, and other product-specific knowledge or upgrades can develop the postponement principle further (Jafari et al., 2016; Seppala et al., 2014). For high-tech products, long lead times might imply high inventory investment, lack of responsiveness to

customers, and potentially increased product obsolescence (Norrman & Lundberg, 2003). Consequently, firms may postpone value-added operations downstream to multiple global distribution points instead of finalizing the complete product in the factory (Lee, 2010; van Hoek, 1996).

However, hardware and software are very different, so transitioning from a hardware-focused SC to one focused on solutions that combine hardware and software creates new challenges (Cohen & Lee, 2020). When hardware and software are combined, two operations become crucial: *bundling*, that is, preconfiguring the combined software and hardware, and *testing*, which might occur before bundling and at a central location or somewhere in the global network (Norrman & Lundberg, 2005). Moreover, software is also critical based on how revenues are collected. As MNCs enter a more software-related business, they face additional challenges, as hardware and software can carry varying implications concerning duties and other elements (Norrman & Henkow, 2014). National agencies often divide hardware and software into different customs classes and tax codes. A product's duty rate can change depending on whether the product refers to hardware alone or to integrated hardware and software (Lee, 2010). Furthermore, various countries define software differently, making it essential to know *where* (point of origin) and *how* value is added (Norrman & Henkow, 2014).

Given the blurring hardware-software boundary, postponing operations (e.g., bundling or testing) might elicit different product offerings, thereby influencing how products are classified for tax codes and customs duties (Henkow & Norrman, 2011) and leading to complex decisions about what object MNCs should consider. Furthermore, the organizational unit or legal entity adding value might shift, so authorities assess them differently. Therefore, it is relevant to investigate these contextual decisions regarding postponement/tax aspects more extensively and to develop alternative scenarios for past or potential future issues (Norrman & Henkow, 2014).

Cross-functional integration (CFI)

As organizations need to bring together different areas of specialization to achieve “unity of effort,” many cross-functional tensions can emerge (Lawrence & Lorsch, 1967). Consequently, CFI is required to counteract diverging interests among functions, as well as allow for communication and coordination between groups with different technical knowledge, language, and ways of working (Ellinger et al., 2006; Pellathy et al., 2019; Richey et al., 2010).

Cross-functional integration has been a key problem for logistics and SCM for many years (e.g., Franke & Foerstl, 2020; Houlihan, 1983; Pagell, 2004; Ralston et al., 2015), eliciting multiple definitions over time (Enz & Lambert, 2015; Frankel & Mollenkopf, 2015). We define it as a process of interdepartmental interaction and collaboration in which multiple functions work together in a collaborative manner to arrive at mutually acceptable outcomes for their organizations (Frankel & Mollenkopf, 2015; Pagell, 2004).

Most of this extant literature has positioned CFI research at the nexus of marketing and production/logistics operations (e.g., Daugherty et al., 2009; Richey et al., 2010), or addressed the alignment between different SC functions (Ellinger et al., 2006; Swink & Schoenherr, 2015). Some scholars also have recommended investigating the functional interface to finance and legal (e.g., Pellathy et al., 2019; van Hoek et al., 2008), but only a few specifically have focused on the interaction between logistics and fiscal/legal domains. Norrman and Henkow (2014) examined the two domains' different fundamental points of departure and guiding action-oriented principles, while also acknowledging existing barriers to integration, suggesting they represent important starting points for cross-functional development. To support development of joint policies and guidelines combining logistics and fiscal/legal principles, they also proposed a common communication platform—a kind of cross-functional map with

icons to operationalize and share SC and fiscal/legal issues (Henkow & Norrman, 2011).

Cross-functional integration requires organizational infrastructures and mechanisms that enable effective and accurate information processing, including its dissemination to appropriate constituents within the firm so that decisions can be made and actions can be taken (Frankel & Mollenkopf, 2015; Richey et al., 2010). Integration mechanisms include formalized communication systems, temporary and permanent cross-functional teams, and individuals with an explicit integrative role (Franke & Foerstl, 2020; Lawrence & Lorsch, 1967). This highlights the relevance of CFI governance, the key elements of which can be summarized as a set of interrelated processes focused on goal collaboration (alignment), activity coordination, and information and knowledge communication (Pellathy et al., 2019). These key elements serve as facilitators of integration (Ellinger et al., 2006) and need to be aligned (with clear governance roles and responsibilities), communicative (oriented toward information sharing), structured (including contracts, risk and reward sharing, and normative guidelines), quantified (expressing numerical amounts for tasks or processes), and interdependent (having a high degree of cross-functional processes, training, and utilization of cross-functional teams) (Richey et al., 2010).

As actors from different (conflicting) social worlds often have shared goals, they can build and use boundary objects to create a common understanding of what they must do without losing their social worlds' diversity (Star & Griesemer, 1989). Boundary objects are defined as “tools, objects, or concepts that allow cooperation across boundaries” (Zeiss & Groenewegen, 2009, p. 82). Organizational scholars recently have argued that boundary objects can play an important role in SCM, allowing for coordination across boundaries between disparate groups (Carlile, 2004). For example, Fabbe-Costes et al. (2020) suggested using the boundary object perspective to examine SC mapping as an iterative process that allows for CFI.

METHODOLOGY

Research design

Consistent with recent research (Cohen & Lee, 2020), we explored the postponement decision-making phenomenon in the context of evolving fiscal/legal implications and increasing hardware/software combination, further deepening the CFI for decision making. Phenomenon-driven research is well-suited with qualitative methods (Naslund, 2002; Schwarz & Stensaker, 2016), as they can provide profound insight into complex and multifaceted

phenomena (Fawcett et al., 2014). To contextualize our phenomenon and contribute to the general body of knowledge (Dubois & Gadde, 2014), we developed a theory-elaborating case study that illustrates empirical examples and investigates the contemporary context's practices and challenges (Corley & Gioia, 2011; Ketokivi & Choi, 2014). Our unit of analysis was "postponement boundary decision making for global SCs of combined hardware/software solutions," with "postponement boundary problem decisions" as sub-units of analysis. To offer both scientific utility and pragmatic insights, we aimed for mid-range theorizing (Craighead et al., 2016; Stank et al., 2017) using an abductive approach (Kovács & Spens, 2005). Mid-range theorizing allowed us to synthesize the rich accumulation of empirical findings about the current phenomenon (Stank et al., 2017), elaborating theory at a more context-specific and managerially relevant level (Frankel & Mollenkopf, 2015). Abductive reasoning typically includes re-contextualizing individual phenomena to improve previous and current understanding (Dubois & Gadde, 2014). In this study, it let us contextualize (and elaborate) the extant postponement theory and, in a later stage, focus on exploring the related governance of its cross-functional decision making.

To provide an *empirical foundation* for our RQs, we developed a single embedded case and investigated postponement decisions across four global SC nodes (the four subcases). Although a single-case approach can limit transferability, it was appropriate for practically investigating unexamined phenomena, similar to recent contributions in the SCM field (e.g., Gligor et al., 2021; Mikkelsen & Johnsen, 2019). Single-case research allowed us to collect rich descriptions, enabling us to develop

an in-depth understanding from a holistic perspective (Yin, 2014). It also allowed us to explore unique geographical and temporal elements that offered rich and critical insights into the company's context and real-life challenges (Stake, 2008) related to global postponement. This let us theorize more deeply (Flyvbjerg, 2006) and identify new theoretical relationships while questioning old ones (Dyer & Wilkins, 1991).

Our biggest embedded design challenge was to achieve a holistic perspective from our analytical sub-units and integrate the elaborated knowledge into a cohesive whole that supports contextualization (Ellram, 1996). Our abductive case study combined general guidelines that Kovács and Spens (2005) (see Figure 2), Gioia et al. (2013) and Yin (2014) proposed. First, we merged previous theoretical knowledge on postponement and CFI with real-life observations of complex decisions in the context of evolving SC fiscal/legal implications and increasing hardware/software combination. We then summarized the extant theory related to the postponement boundary problem, tax-aligned SCs, software-based SCs, and CFI.

This framework guided our first rounds of data collection and analysis, helping us elaborate theory further through research findings. The final rounds of data collection and analysis increasingly were informed by extant logistics theory on CFI. We developed a research protocol that included an interview guide (Appendix 1) with questions about past, present, and future challenges related to the postponement boundary problem, along with motivations for changes and their implications (Voss et al., 2002). The interview guide started with broad, open-ended questions to facilitate discussion, then proceeded to more specific questions (Yin, 2014). This also allowed us to preserve

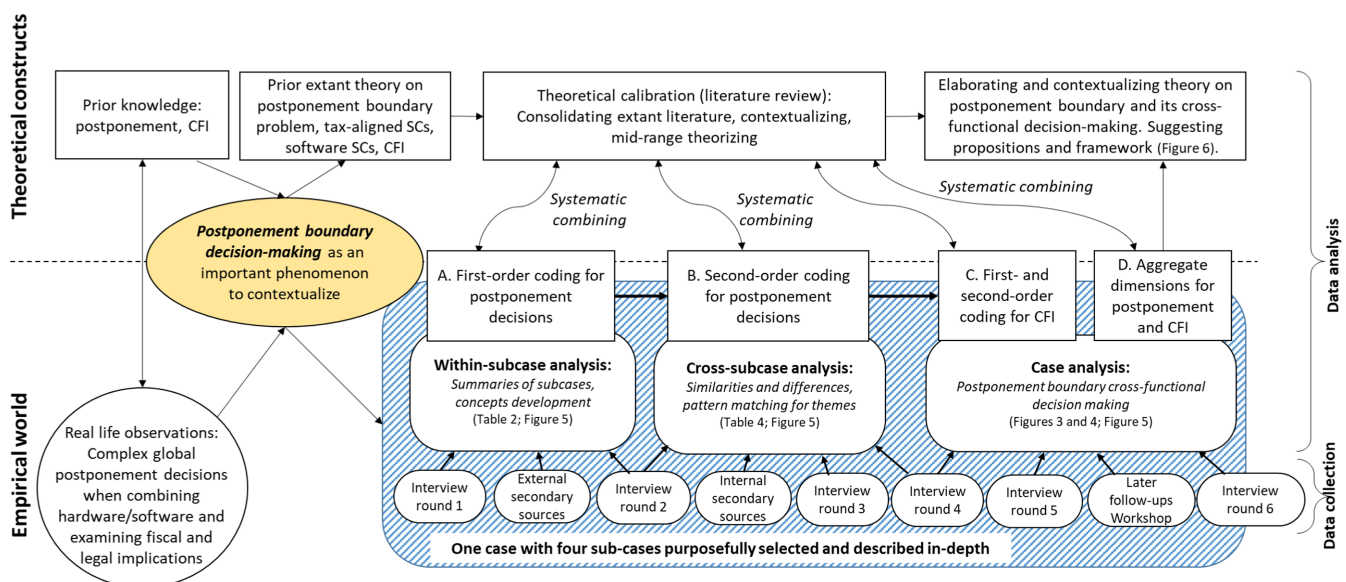


FIGURE 2 Abductive approach.

TABLE 2 Overview of the present study's case and subcases.

Case characteristics	HighCorp			
Company legal structure	Principal structure			
Type of product	Communications infrastructure (hardware, software, and services)			
Subcase characteristics	HighCorp Global Supply Hubs (located in a specific country in each region)			
Region	Latin America	Central Europe (in EU countries)	Middle East	APAC
Hardware parts' origin	EU	EU, China	EU, China	China
Destination countries/regions served (with the related contracting model defined at country level)	US, Canada, Central and South America	EU and part of EMEA	Middle East, Part of Africa, and Saudi Arabia	APAC (except China)
GSH in an FTZ?	Yes	No (but previously yes)	Yes	Yes
Value-adding operations allowed?	Yes	Yes	Yes	No
Hardware-related operations allowed	Manufacturing, assembly, pick, and pack	Any kind of operation	Assembly, pick, and pack	None

flexibility when handling the interview protocol based on the informants' responses (Gioia et al., 2013). Later, a similar approach was used to explore CFI details. To help our informants prepare (Ellram, 1996; Voss et al., 2002), we shared the questions with them before any interviews and progressively updated them.

Case selection and context

We searched for cases of MNCs that met the following three criteria:

1. They applied postponement in their global operations.
2. They had relevant combinations of hardware and software objects and operations.
3. They took a structured approach to fiscal/legal issues (e.g., working to harmonize their global SCs from a fiscal/legal perspective).

We also sought cases and informants that would allow us to maximize conceptual insights and understanding, and we used purposeful sampling (Patton, 1990), rather than generalization properties, to maximize information thickness (Flyvbjerg, 2006). We identified potential MNCs through trade press articles and discussions with practitioners. The MNC that we selected—HighCorp—met all three criteria and also was made accessible. HighCorp is a European high-tech enterprise with a *principal structure* in the country of its headquarters, serving different geographical markets worldwide. As Table 2 indicates, we defined four of HighCorp's GSHs as subcases to explore and contextualize solutions for the postponement boundary

problem of global SCs of combined hardware/software solutions and their tax implications. We selected one GSH from the following four regions: Latin America; Central Europe; Middle East; and Asia-Pacific (APAC). To maintain confidentiality, we identified each GSH by its region, rather than by the specific country in which it is located, although the specific country is what matters.

We purposefully selected the subcases to illuminate relationships and remain within our research scope (Miles & Huberman, 1994), while also representing diverse types (Voss et al., 2002). The four GSHs are similar because they are all part of the same organization (HighCorp) and logically can perform the same SC functionality. Simultaneously, they serve different markets/countries worldwide with different laws and requirements, for example, the same value-adding operation might be allowed or not allowed in a GSH, depending on its fiscal/legal regulatory framework.

Data collection

We collected data via multiple interactions with HighCorp between October 2018 and November 2022 and reviewed internal key documents released from 2005 onward, involving multiple informants from distinct functions and hierarchical layers to increase internal validity and maximize conceptual insights and understanding (Ellram, 1996). The informants were selected based on their potential to provide details related to the phenomenon studied; thus, we used few informants to collect rich descriptions (Gioia et al., 2013). HighCorp had a systematic governance structure with three layers corresponding

to strategy, architecture, and execution (see [Figure 4](#) in the Case Description). They all contributed to the operating model (OM), which was another core element related to our phenomenon. Coherently with our RQs, we looked for informants with a global overview of postponement decision making and found them on the strategy and architecture layers.

The initial contact point was a senior SC/logistics architect with extensive work experience (20-plus years) about developing the interface with fiscal and legal functions. This concerned both hardware/software combinations and CFI, defining and refining HighCorp's key directive on this (the OM) as one of their supporting subject matter experts (SMX; see Case Description).

To minimize single-respondent bias and increase the study's reliability and internal validity, we also invited other informants to participate, including the head of the legal department and a senior OM team manager. We interviewed all the informants several times, and they contributed equally to the research. The head of the legal department was also an SMX with extensive experience (15-plus years) managing global operations at a strategic level and handling related legal risks and implications. Having supervised legal details and procedures for all four subcases, he provided vital information about each subcase's regulatory framework. The senior OM team manager had worked in software development and delivery in several countries worldwide, so he provided key insights and knowledge about the critical implications of combining hardware/software parts and their evolution over time. He worked on the central OM team—the cross-functional team responsible for OM management.

Two investigators conducted joint group interviews with all three informants to enhance the team's creative potential and converge observations to increase confidence in the findings (Eisenhardt, 1989; Voss et al., 2002). Five interview rounds, including two in-person in-depth group interviews (3 h each) on the MNC's premises, and three Skype meetings (an average of 1.5 h each) occurred between October 2018 and February 2019. Although the interviews followed a line of inquiry, conversational questions were asked when needed, which helped reduce potential response biases (Yin, 2014). We recorded and transcribed all meetings and interviews, as well as conducted phone interviews and exchanged documents to clarify issues, when necessary, thereby increasing reliability and internal validity. Documents included corporate directives, presentations, and guidelines related to models for SC and financial flows, organizational charts, etc.

To corroborate the evidence and strengthen a formal chain of evidence, we established a case study database (Ellram, 1996) that included any additional notes taken

outside of the interview guide (Voss et al., 2002). Multiple data sources (e.g., industry reports and other public documents) were triangulated (Yin, 2014). Internal materials that could be relevant to the present study's purposes, for example, company presentations, also were shared and included in the database (Ellram, 1996). Finally, we condensed and returned all collected data to key informants for fact-checking and accuracy verification. All informants were available consistently to answer questions or provide further contextual elements needed for our analysis. We also backtracked to prior informants to elaborate on questions that emerged from subsequent interviews (Gioia et al., 2013), concerning, for example, who made decisions about specific aspects of the postponement boundary problem. Two other senior managers at the corporate level (strategy layer), that is, the head of supply strategy management and the head of contract accounting and governance, thoroughly reviewed (and confirmed) the collected data and its interpretation in the manuscript. Finally, the study's findings and implications (including a version of the manuscript) were presented and discussed at a workshop held at HighCorp in January 2022. The workshop included all the previously involved informants, plus nine other senior representatives from distinct functions who represented strategic, architecture, and execution layers. To examine experiences further and get richer details related to the studied phenomenon (specifically HighCorp's model for CFI), additional interviews and data collection took place during fall 2022.

Data analysis

In keeping with our abductive approach, we examined the extant theory and empirical data simultaneously in a balanced manner (Ketokivi & Choi, 2014) through systematic combining (Dubois & Gadde, 2014). As [Figure 2](#) indicates, we analyzed and coded data in several iterations between the consolidated extant literature and empirical data, including concurrent data reduction, data display, interpretation, drawing, and verification of conclusions (Ellram, 1996; Gioia et al., 2013; Miles & Huberman, 1994). This helped us interpret how and why differences existed between subcases so that we could later reconcile findings from the overall case study's broader perspective. It also helped us better understand the interdependencies between postponement decisions and their implications, as well as cross-functional decision making. During data analysis, we followed well-known qualitative research procedures (e.g., Gioia et al., 2013) to guarantee rigor and ensure transparency on the path from raw data to developing a conceptual framework of aggregate dimensions and contextualizing propositions. Consolidating extant

TABLE 3 Actions taken to improve the study's rigor and trustworthiness.

Quality criteria	Actions taken	Research design	Data collection	Data analysis
Internal validity	Engaged peer researchers to review interview protocols	×		
	Triangulated data using multiple sources of evidence (interviews, internal presentations, industry reports, websites) to triangulate informant responses	×	×	
	Used a nested approach within the considered organization and involved multiple informants (representing different internal functions) to compare and contrast responses	×	×	
	Explained to informants the academic terminology used regarding the postponement boundary problem prior to each interview to avoid misunderstandings		×	
	Transcripts reviewed by both informants and investigators		×	
	Shared preliminary results and conclusions with key informants to compare and contrast views		×	×
	Involved senior figures in strategic positions to review and confirm collected data and their interpretation and analysis in the manuscript		×	×
	Explained data analysis procedures			×
	Illustrated the chain of evidence using matrices, tables, and figures			×
	Presented results to peer researchers familiar with the studied phenomenon to check and obtain feedback about case analysis			×
Reliability	Developed a literature-based, orienting frame of reference	×		
	Selected cases and subcases following a purposeful sampling method	×		
	Involved multiple informants who provided similar answers about the same phenomenon, leading to a rich description		×	
	Displayed data in tabular data forms to facilitate cross-case analysis and pattern matching		×	×
	Explained interrelations between key constructs and triangulated different literature (postponement, tax-related, hardware- and software-related) to interpret cross-case findings			×
	Began building a systematic and iterative explanation			×
	Conducted first-order and second-order coding and mapping to provide explanations on a holistic analytical level			×
External validity	Described the criteria applied behind case and subcase selection to allow for analytical generalization	×		
	Collected data and developed case descriptions to highlight elements in common with other contexts		×	
	Used repetition logic in multiple subcases		×	×
	Conducted a cross-case analysis considering different sub-units of analysis			×
	Presented results and implications to knowledgeable researchers and informants to check for validity			×
Construct validity	Developed interview protocols for data collection across the cases	×	×	
	Conducted systematic data collection		×	
	Developed and continuously updated a case study database (for storing interview transcripts, codes, and memos) to ensure complete documentation of the data analysis procedure		×	×
	Illustrated the logic and frame of reference used and developed			×

literature improved the study's *theoretical calibration*, that is, the degree to which theory is captured in the research design (Craighead et al., 2019). By matching theory with

real-world evidence, we could “systematically combine” them to improve understanding and extend prior theory (Kovács & Spens, 2005).

We characterized the first interview meeting as part of a *preliminary understanding* phase in which we captured the informants' perceptions about the target problem and improved the study's *theoretical contextualization*, that is, the degree to which theory is adapted to the specific industry situation (Craighead et al., 2019). We first coded the collected data for within-subcase analyses—that is, we broke down, examined, and compared the empirical data to strengthen existing constructs and develop new categories (Ellram, 1996) about postponement boundary decisions. These preliminary patterns, findings, and reflections elicited multiple contextual drivers related to logistics or tax domains for each subcase, which we used to support our next interview rounds. We also examined software-related operations, leading to development of first-order concepts (Gioia et al., 2013; Miles & Huberman, 1994) related to both theory-driven constructs (e.g., decisions concerning what operations are involved, on which SC tier, and in which jurisdiction) and context-driven constructs exemplified by our empirics (e.g., decisions about the object offered, or the legal entity in charge of executing operations).

We then conducted a second-order analysis in which we elaborated the four subcases' different postponement boundary decisions, organizing first-order concepts into more abstract second-order themes (Gioia et al., 2013). We compared the findings from individual subcases in a cross-subcase analysis to match patterns (Eisenhardt, 1989; Miles & Huberman, 1994; Yin, 2014). We also grouped issues identified through coding into first- and second-order categories in an iterative (rather than sequential) process, as we systematically compared the emerging patterns and results from the analysis with extant literature and the information that our informants provided (Gioia et al., 2013). Furthermore, by sharing our findings with the diverse informants iteratively, we reduced misunderstandings and better reconciled field data with the extant theory (van Maanen et al., 2007). Thus, we moved from initial concepts via second-order themes to aggregate dimensions describing the key characteristics of changed postponement boundary decision making.

We then identified the primary challenges (e.g., the importance of complying with highly heterogeneous regulatory frameworks) that emphasized CFI's importance. HighCorp informants also shared internal documents that provided essential details about the company's corporate directives, tools, and specific rules, and how they were applied in the various subcases. We developed additional first-order concepts and second-order themes, refining the initial codes based on insights that emerged from the data. We then grouped the second-order themes into higher-level categories (Miles & Huberman, 1994), or "aggregate dimensions" (Gioia et al., 2013). These categories moved

data to a more theoretical and abstract level. To elaborate on extant theory based on our research findings, we compared them through iterative contextualization, then re-contextualized them back and forth with extant literature to help improve on previous understanding (Dubois & Gadde, 2014; Kovács & Spens, 2005), increase the data's significance, and identify undisclosed patterns. From this, we formulated a set of propositions.

Research trustworthiness

To improve research trustworthiness and ensure rigor, we summarized the actions taken during different research phases (see Table 3), triangulating multiple data sources to corroborate evidence, support internal validity, and overcome potential informant bias related to interviewing people (Ellram, 1996). To reduce our impact on the results, we first mapped all analyzed postponement decisions based on the extant literature (e.g., Pagh & Cooper, 1998; Prataiviera et al., 2020; Zinn & Bowersox, 1988), thereby increasing reliability. We strengthened reliability further by searching for patterns among the case study data and building explanations based on patterns and causal links. Despite the measures taken to increase external validity, generalizability limitations are common in qualitative case study research; we address these later in our discussion of further research directions.

THE HIGHCORP CASE

HighCorp is a leading provider of networking infrastructure globally. Here, we first describe HighCorp's product offerings and its decisions about the postponement boundary problem related to the examined subcases (GSHs). We then describe the fiscal and legal implications for HighCorp, followed by its organizational structure and relevant decision makers, to illustrate CFI for decision-making processes between SC/logistics, finance, and legal functions.

Product offerings

HighCorp offers solutions by combining different objects, including hardware, software, services (from internal or external suppliers), civil works, and other locally supplied commodities. HighCorp has a broad portfolio of high-volume and site/consumer-specific ("engineering-to-order") solutions characterized by different life cycles. To keep the scope manageable, we chose one example solution—a radio unit, which is typical for HighCorp and

TABLE 4 HighCorp's postponement boundary decisions.

Operation/ SC tier	Latin America GSH						Central Europe GSH						Middle East GSH						APAC GSH					
	MS			Warehouses (SC/FAS)	Customer site	MS			Ware houses (SC/FAS)	Customer site	MS			Ware houses (SC/FAS)	Customer site	MS			Warehouses (SC/FAS)	Customer site				
	Plant	FTZ	within			Plant	FTZ	within			Plant	FTZ	within			Plant	FTZ	within			Plant	FTZ	within	
0 – raw materials → components	Y	Y					Y	N.A								Y	Y					Y		
1 – components → sub-products	Y	Y					Y	N.A								Y	Y					Y		
2 – «pick and pack»	Y	Y	Y	Y			Y	N.A	Y	Y						Y	Y					Y		
3 – software development	Y						Y	N.A								Y						Y		
4 – software sourcing	Y						Y	N.A								Y						Y		
5 – software test	Y	Y					Y	N.A								Y								
6 – software installation	Y	Y		Y			Y	N.A	Y		Y					Y						Y		
7 – software license activation	Y	N.A	Y	Y			Y	N.A	Y	Y		Y				Y	Y					Y		
8 – sub-products → solution	Y		Y				Y	N.A	Y							Y								
9 – solution test	Y		Y	Y			Y	N.A	Y	Y		Y				Y						Y		
10 – software updates	Y		Y	Y			Y	N.A	Y	Y		Y				Y	Y					Y		

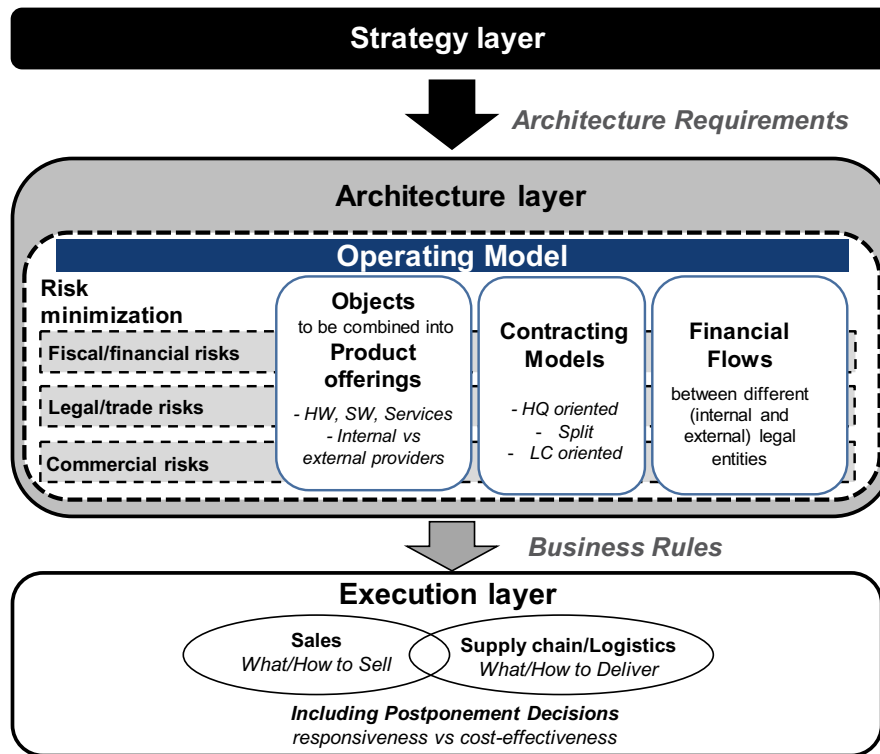


FIGURE 3 HighCorp's organizational structure for cross-functional decision making.

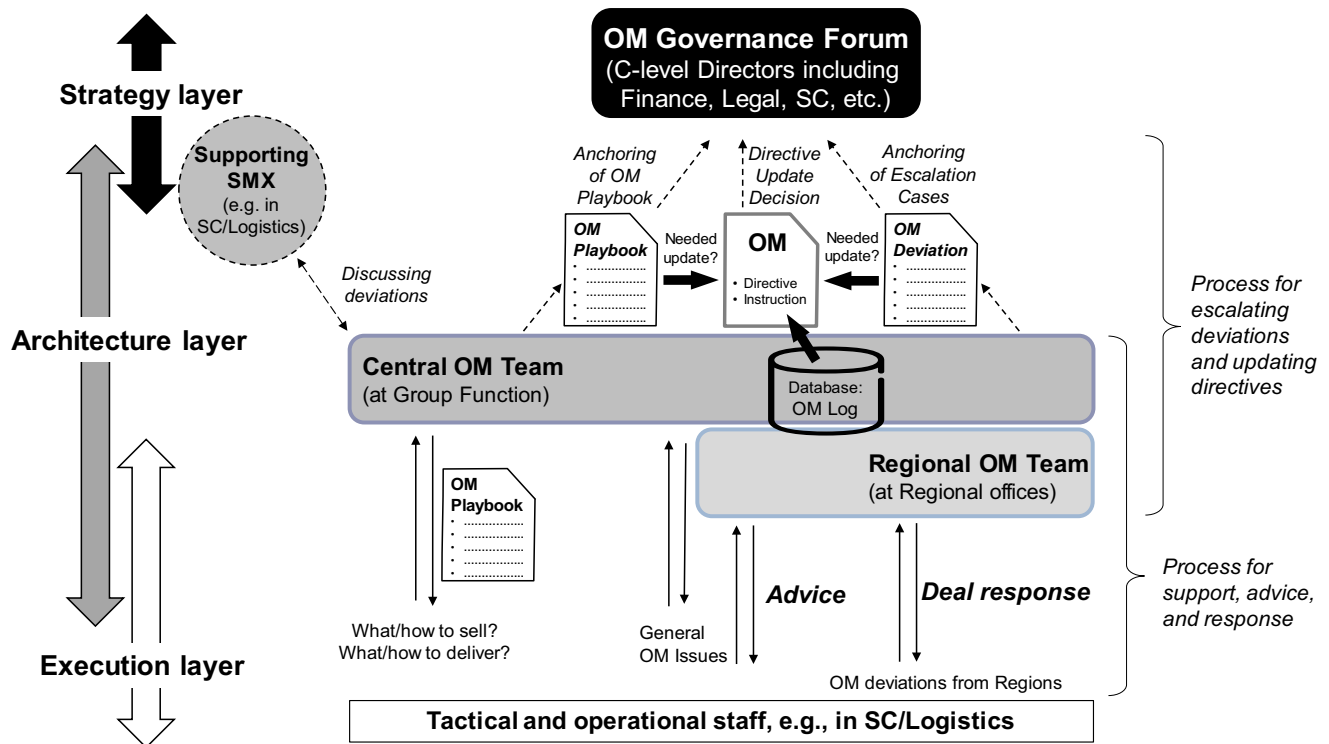


FIGURE 4 HighCorp's OM governance structure for cross-functional decision making.

deemed essential to its future business because of its importance in 5G network development.

Radio units include various hardware with differentiated designs to provide specific functionalities for a given

market or customer-required capabilities. While the same hardware can be delivered to different customers, the software increasingly is important in delivering value, as it handles most of the unit's differentiation, customization,

and capacity upgrades. As HighCorp's senior SC/logistics architect noted, "Hardware is now becoming very generic, and the value is added on the software's local adaptation." Software typically includes license, product keys, and adaptation code, with customization typically achieved using a new software code or right-to-use license.

Customization can refer to hardware, software, or a combination, but the increased software focus has transformed HighCorp's traditional SC into one that better reflects software aspects. Software often is categorized as an intangible, nonstorable product; therefore, its delivery represents either the process of getting the pre-configured software into the hardware or providing customers with licenses, executable codes, and other vital documents. Considering that a mix of hardware and software needs to be sourced, produced, and distributed, they can be combined at different geographical points. For new products, the software typically is combined into the physical product at a central location (usually a factory) before shipment to a site. For installed systems already running or for updates, the software typically is delivered to the customer's site and combined with hardware already in use. Furthermore, while software combinations with hardware might occur at various nodes before the actual build, software license activation typically occurs at the customer site. This geographical postponement enables HighCorp to delay operations until the latest possible moment.

HighCorp's decisions for the postponement boundary problem

GSH locations were traditionally driven by HighCorp's history (i.e., mergers, and acquisitions), and HighCorp assigned countries to different GSHs mainly due to geographical proximity to reduce delivery lead times. However, fiscal and legal regulations recently have increased their importance, rendering them the "key force behind global distribution," the head of the firm's legal department noted. Although tax implications can be related to inventory holding, they are driven mainly by what operations are performed in each distribution network node. Heterogeneous regulations influence which operations are allowed and, thus, where value can be added and by whom. Table 4 summarizes HighCorp's various decisions about the postponement boundary problem for its four GSHs.

For example, HighCorp located a GSH in a Latin American FTZ to supply three markets: the US; Canada; and Latin America (with many jurisdictions). It chose the exact location and jurisdiction after considering labor costs, geographical proximity to the US market (which is

highly important to HighCorp), and because the jurisdiction's tax authorities allow many value-adding operations in their FTZs. However, HighCorp also established a manufacturing site (MS) in the same FTZ and Latin American country where its GSH is located, which an external third-party provider (3PP) contract manufacturer operates. It was motivated to create the MS due to legal constraints and tax liabilities related to where operations occur and what legal entity is accountable for them. If external 3PPs manage and execute operations, HighCorp can comply with local requirements, with no license needed to conduct business in the FTZ. This arrangement also allows the hardware components that European factories supply to be assembled at the MS.

However, our cross-case analysis of the four GSHs (Table 4) illustrates that operations can occur in many ways, creating different postponement boundary decisions and solutions. For example, the Middle East and APAC GSHs also are located in FTZs and are flanked by MSs, but each has its own peculiarities. In the Middle East, where hardware components are supplied mainly from Europe, HighCorp benefits from a somewhat open regulatory environment. Although stricter than in Latin America, local regulations allow for some value-adding operations, although they must occur exclusively at the MS. Some operations are allowed at the GSH, including software license activation and testing. Conversely, the APAC GSH, which uses goods supplied from China, has stricter rules. HighCorp established this GSH to improve logistics flows to serve the APAC region (excluding China, which is served by local factories and distribution centers) and optimize freight costs by improving shipment utilization rates. It also reduces inventory costs by supporting inventory pooling between different APAC countries. However, value-adding operations are not allowed in the FTZ—not even in the MS. If value-adding is not allowed, the factories send the completed hardware subproducts to the GSH. Alternatively, hardware assembly is performed after customs clearance in local warehouses or on the site where the integrated solution is bundled.

Although FTZs can help streamline flow management and offer legal advantages, they also are characterized by strict and sometimes ambiguous regulations. For example, while the Central Europe GSH previously was located within an FTZ, HighCorp later moved it outside the FTZ, as products from a European Union (EU) country can be shipped duty-free to anywhere within the EU. As with all GSHs, deciding where to add value is influenced by tax implications. Operating outside the FTZ releases HighCorp from specific regulations on what is allowed. Today, any operation (manufacturing, assembly, or pick-and-pack) can take place in the GSH without issues relating to tax code changes.

Fiscal and legal implications for HighCorp

The HighCorp case illustrates significant differences between what is allowed for the various GSHs. The subcases demonstrate how fiscal/legal rules influence which postponement solutions are chosen, further stressing the importance of careful centralized cross-border planning. Companies such as HighCorp, from a tax perspective, must design their SCs to comply with various customs and tax authorities. This is complicated because, as the head of HighCorp's legal department said, "Huge gray zones exist, e.g., related to the way FTZs' rules can be interpreted and then applied." Moreover, the logical sequence of software-related operations (highlighted in Table 4) is more flexible than hardware-related ones. Pick-and-pack operations can occur both before and after software installation and might occur in FTZs (at the MS or GSH) or later at the customer site. This also applies to software activation, and many more alternatives exist for testing and updating/upgrading.

Because several tax considerations can arise, as the head of HighCorp's legal department noted, "it is vital that all flows—i.e., hardware and software deliveries, services, invoicing, and payment—are made with due consideration to their fiscal consequences." This highlights the importance of the interdependence between HighCorp's product and financial flows. HighCorp's starting point is that business transactions are performed between legal entities in legal contracts; thus, it must decide which legal entities are conducting business and understand related financial flows' impact. HighCorp legally established a *principal structure* model, in which its headquarters (*HighCorp HQ* or *HCHQ*) is the principal, bears the main entrepreneurial risks, and conducts expensive research and development operations. The principal enters contracts with its local operating companies (LCs) to sell goods or services, enjoying any residual profit and bearing any residual loss. Centralizing operations allows the principal to be a facilitator who owns the inventory and finished goods across the entire SC, while the LCs focus on sales and customer satisfaction.

However, tax regulations differ enormously between countries and vary over time, and HighCorp needs to check constantly whether its legal entities create any PEs (based on specific operations performed in various countries). The head of HighCorp's legal department suggested that a key question is "Which operations mean a change in ownership and/or responsibility, or imply a PE creation?" and warned that "unwise decisions affecting cross-border flows might lead to unnecessary tax consequences." For example, customs duties may apply to hardware, but not software, unless the software has been installed on the

hardware before crossing international borders. Given servers' increasing importance, digital companies might require servers at their PEs and carefully must examine the tax implications accordingly. Because PEs have become increasingly complex, HighCorp expects that new ways to tax companies through PEs will emerge. As the company's senior SC/logistics architect highlights—and the head of the legal department confirms—the "tax base in the country of operation depends on the services under examination," and "risk from a taxation perspective is different from risk from a business perspective." Therefore, the combination of different objects in the product offering must be understood, along with which legal entities are performing what operations and are contracting with each other, as it defines the combination of product and financial flows.

HighCorp's organizational structure and decision makers

Making decisions about the postponement boundary problem requires collaboration between different functions (e.g., SC/logistics, finance, and legal) to handle increased complexities. As HighCorp informants noted, "engineering brains do not usually think in legal terms." To get the needed CFI, HighCorp developed a systematic and hierarchical organizational structure to align decision-making processes across different functions. Overall, three layers connect strategy to execution (Figure 3).

The strategy layer focuses on creating competitive advantages, and strategic decision makers are involved from, for example, the group management team, different market regions and business units, and different group functions, for example, SC, finance, legal etc. Based on strategic intentions, this layer put *architecture requirements* on the architecture layer to develop different systematic models that define *business rules* for the execution layer. These rules describe how HighCorp manages its business via well-defined core elements and work protocols, including the organizational structure (operational, functional, and legal), along with concise steering documents and common processes that systematically govern how the execution layer enforces tactical and operational decisions, for example, about sales (i.e., "what/how to sell") and SC/logistics (i.e., "what/how to deliver"). These decisions also concern postponement, trading off desired responsiveness against operations' cost-effectiveness. As the senior SC/logistics architect explained, decisions are made at the execution layer, but guided by systematic models developed at the architecture layer: "Postponement decisions are made within the execution layer and start with a humble question: Could we do it this way? Then it becomes a

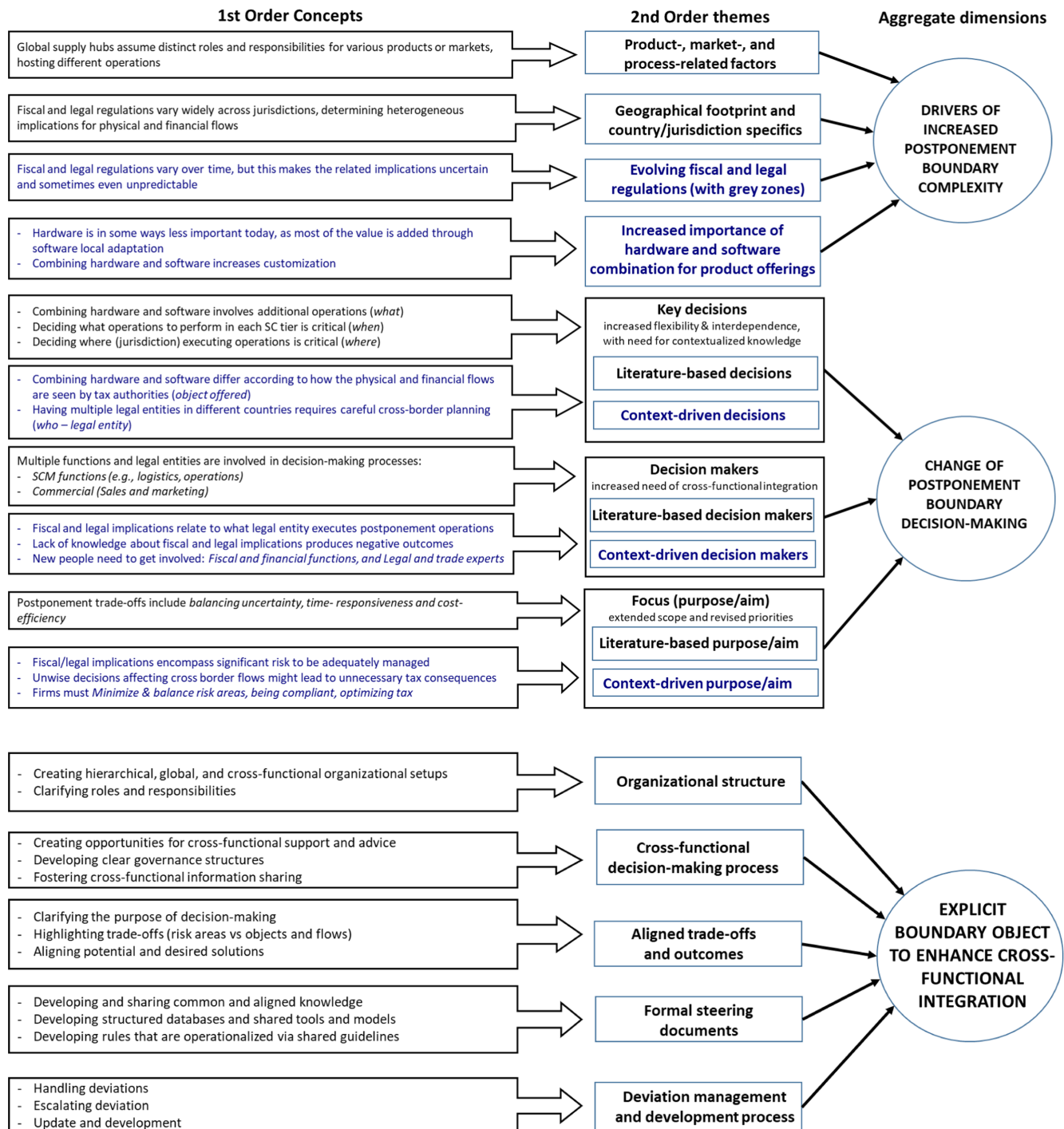


FIGURE 5 Coding tree for data analysis (literature-based elements are offered in black color, while context-driven elements are offered in blue color).

dialogue, which takes place within the boundaries defined by the architecture layer.”

The core element that the architecture layer develops is a directive that HighCorp calls the operating model (OM). HighCorp has worked with this formally and developed it cross-functionally for approximately two decades to support its global growth. Technically, the OM is a formalized corporate directive that regulates contracting

parties' (legal entities) setup in HighCorp. The different product and financial flows between legal entities are important, as transacting and delivering HW, SW, and services through every legal jurisdiction in the world requires several legal entity considerations in the fiscal/financial, legal/trade, and commercial risk areas. As the senior OM team manager noted, “risks and the compliance to fiscal/legal environment are now more important as (a)

starting point (than) operational time/cost optimization.” Therefore, the overall OM’s goal is first to minimize and balance risk from different areas (fiscal/financial, legal/trade, and commercial), then balance SC issues, for example, responsiveness and cost-effectiveness.

Cross-functional integration for decision making

The OM outlines different potential combinations of how different objects (e.g., HW, SW, and services from internal or external provider) can be combined into product offerings, and the OM dictates how they can be sold and delivered. The OM also outlines three specific potential contracting models (HQ-oriented, split, LC-oriented) characterized by an increasing fiscal commitment to foreign markets. They differ in how HighCorp delivers and invoices products to harmonize risk management concerning tax regulations, trade agreements, jurisdiction specificities, local requirements (licenses and work content), and other fiscal aspects, for example, trade compliance for import/export. Finally, the OM defines desired financial flows between internal and external legal entities associated with HighCorp’s business operations. It also serves as the bridge between strategy and day-to-day execution operations. As the senior SC/logistics architect noted:

The OM is an inner boundary, defining the playing field where we are allowed to play. ...

In the supply chain area, there are currently around 5,000 employees, and I will say that all the people that work in the direct operational flow know this [the OM directive] by heart. So, they know what the restrictions are, when they are getting into gray zones, and where they need to ask for permission.

HighCorp constantly needs to align business offerings and SCs to cope with evolving requirements coming from an unpredictable business environment. Because of this dynamic business and legal context, HighCorp developed an OM governance structure (Figure 4) not only to develop and apply the OM but also to update and develop it further.

This OM’s governance structure connects people at different organizational layers and functions. At the strategy layer, we found the cross-functional OM Governance Forum, which includes different C-level directors—for example, finance, legal, SCM, and sourcing. At the architecture layer, HighCorp has a designated OM team of 20–25 people, about 10–15 of whom belong to the central OM team (at the HCHQ), comprising a mix of fiscal and legal experts. A group of 5–10 people then work on regional OM teams dispersed at regional offices, also leveraging a network of mainly finance colleagues dispersed at local offices. The OM team advises the business side (decision makers at the execution layer) and provides guidance for new product offerings.

Organizationally, the OM team is hosted through the corporate finance function (the legal function also reports to the CFO). While most members of the OM team have

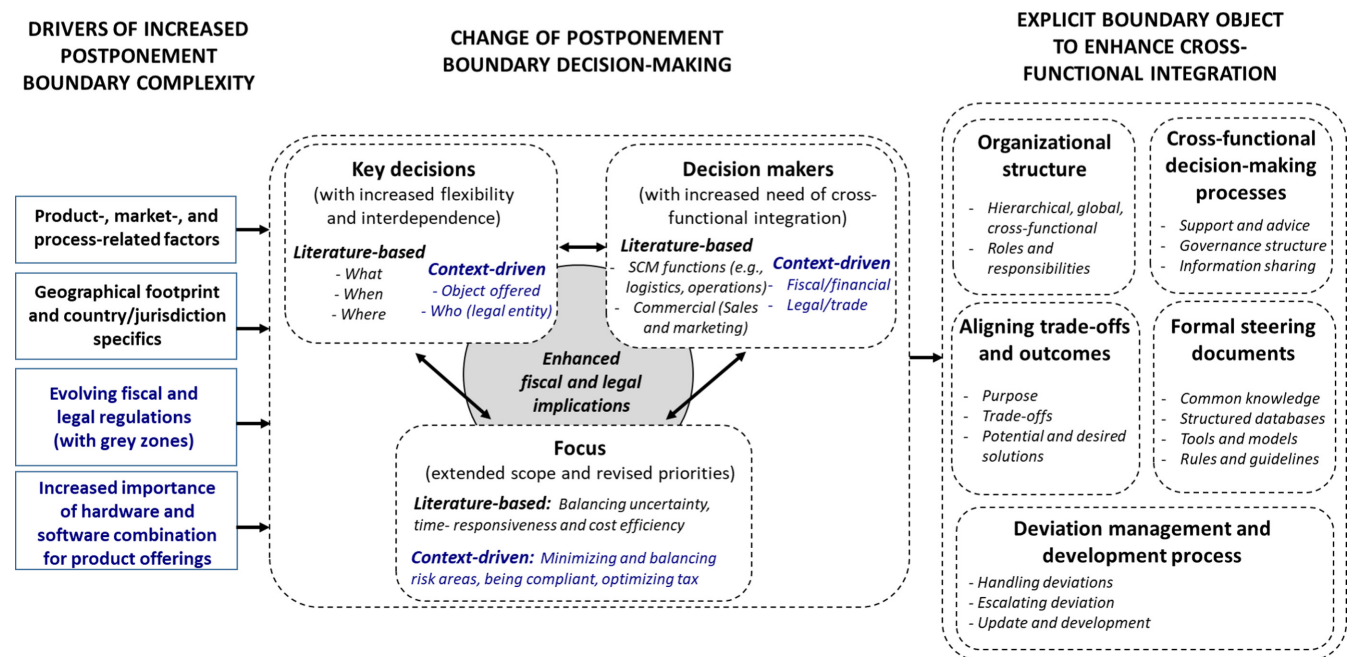


FIGURE 6 Contextualized conceptual framework.

a finance or accounting background, they work closely with supporting subject matter experts (SMX)—who are senior people with an SC/logistics, legal, or technical background—from both the strategy and architecture layers. As HighCorp's senior SC/logistics architect (who is an SMX) explained, contacts mainly occur to discuss potential deviations from directives:

We speak at regular intervals. I speak to them [the central OM team], I will say, whenever something pops up. They call me and say, like, 'Have you seen this before?' And most of the time, you need a whiteboard (to) understand what the heck happened. Who has been innovative here?

The OM Governance Forum CFO formally signs and authorizes the OM corporate directive, but the OM team cross-functionally defines and prepares it in discussions with supporting SMXs. The central OM team develops general guidelines and principles, which are provided in an OM playbook. Regional OM teams then tailor and contextualize them for specific jurisdictions. These guidelines and principles are formalized through steering documents based on detailed supply and financial "flow analysis," providing advice and recommendations related to various risk areas at the execution layer to facilitate quick and compliant decision making on a global scale concerning what/how to sell and deliver. As the senior OM team manager explained:

The idea of having the OM directive is that there should be enough substance so that most decisions can be made locally ... so that you don't have to ask questions every day....

For example, the OM playbook contains business rules and illustrates how to apply them (i.e., decision making) in more operational sell/deliver interactions with customers. It includes simplified and harmonized guidance on making decisions (including postponement ones) that can mitigate challenges related to financial, trade/legal, and commercial risks through contract structures aligned with product flows and already proven and revisited financial flows that provide compliant solutions. The OM directive also states that the OM Governance Forum must approve all potential deviations (e.g., from the contracting models). Due to the complex and changing business and fiscal/legal environment, requests for deviations are increasing in frequency; therefore, HighCorp also implemented a defined escalation process to handle (and learn from) deviations when needed and to institutionalize required changes. As the head of the legal department explained it,

When either you feel you are getting into a gray zone, or someone notices the solution 'looks odd', then it becomes an escalation thing.

The escalation processes also inform whether potential OM directive and tool updates are needed. As a basis for developing the OM directive, all regional OM teams' requests and responses are documented and logged in a database. The central OM team reviews these and then asks the OM Governance Forum for any desired changes to the OM directive and tools. The OM Governance Forum normally meets once per year, but more frequently if the directive needs to be updated due to observed changes in the environment, or when many escalation cases emerge that indicate broader business changes must be handled.

FINDINGS

Our analysis proceeded through different levels from raw data to 1st order concepts, 2nd order themes, and aggregate dimensions. Figure 5 summarizes the data structure (or coding tree) we adopted for coding and categorizing on the various levels. Concurrent with our abductive approach, the coding tree displays literature-based constructs (in black), as well as context-driven elements (in blue).

The extant literature has described how factors related to product, market, and processes drive postponement decisions about *what* operations to perform and *when* (Lee et al., 1993; van Hoek, 2001; Yang & Burns, 2003). Previous scholars also acknowledged that increasing globalization has made factors related to geographical footprints and country/jurisdiction specifics increasingly important in deciding *where* operations could be postponed (Lee, 2010; van Hoek, 1996). However, we have observed how postponement boundary complexity has increased further because of additional contextual drivers. First, evolving fiscal and legal regulations often encompass gray zones which increase uncertainty and ambiguity. Fiscal and legal rules influence postponement decisions, but tax regulations differ between jurisdictions and evolve over time. Second, the case illustrates the amplified importance of product offerings that combine hardware and software, which also increases customization opportunities. Companies should design their SCs to comply with various customs and tax authorities, but combining hardware and software complicates matters further. Customs duties may apply to hardware, but not software, or FTZs could be used to streamline flow management but also involve additional ambiguity related to the interpretation of local regulations.

This increasingly complex context leads to a change in postponement boundary decision making characterized by enhanced fiscal and legal implications. Critical tax implications related to how different authorities assess taxes based on hardware/software content drive the location of various value-adding operations and who is legally accountable for them (Norrman & Henkow, 2014). The empirics also exemplify how duties can vary depending on whether operations are postponed or where distinct objects are combined (Prataviera et al., 2020). Thus, postponement boundary decision making involves new key decisions (e.g., what *objects* to offer and from what *legal entity*) that are related closely and increase postponement flexibility. Combining hardware and software objects extends the traditional postponement scope, as it encompasses many operations that could occur at various SC tiers and, thus, potentially could be postponed (Norrman & Lundberg, 2005).

Moreover, it involves additional decision makers because SC people from logistics and operations (as well as commercial sales and marketing) need to integrate cross-functionally with fiscal/financial and legal experts. This also encompasses a revised focus on postponement with extended scope and revised priorities. The postponement boundary problem requires solving trade-offs between tax-related and traditional logistics costs (Prataviera, Moretti, & Tappia, 2022) that aim to improve time-responsiveness and cost-effectiveness (van Hoek, 2001; Yang & Burns, 2003). However, minimizing and balancing risk areas, and being compliant with regulations to optimize taxes represent new boundaries when addressing traditional logistics/operations and marketing trade-offs.

As challenges related to cross-functional decision making will increase, our study suggests that companies need explicit boundary objects that facilitate and enhance CFI between SC/logistics, finance, and legal functions (Fabbe-Costes et al., 2020; van Hoek et al., 2008). Based on the case insights, such boundary objects clearly could outline organizational structure, support cross-functional decision making, align trade-offs and outcomes, offer formal steering documents, and ultimately guide deviation management and how the boundary object in itself should be developed when needed due to changed contextual circumstances (Pellathy et al., 2019; Richey et al., 2010).

To take a more holistic view of the phenomenon, we abstracted and summarized the interrelated dimensions discussed earlier to provide a more aggregate conceptual framework (Figure 6) that offers a richer understanding of postponement's decision making in the global SCs of offers that combine hardware, software, and other parts/services by illuminating legal and fiscal rules' impact. Concurrent with our abductive approach, the framework displays literature-based constructs (in black), as well as

context-driven elements (in blue). The different postponement boundary decision-making dimensions are then elaborated and discussed in the next section.

DISCUSSION

Connecting drivers of increased postponement boundary complexity with its changed decision making

To address the postponement boundary problem, the extant theory (Lee, 2010; Prataviera et al., 2020) urges companies to decide what manufacturing and value-adding operations should be performed in factories or distribution centers. However, our findings illustrate that combining hardware and software parts complicates related decision making.

First, combining hardware and software extends the postponement scope. For physical objects (hardware), operations to be postponed (temporally and geographically) usually include assembly, packaging, labeling, and distributing the finished product (Pagh & Cooper, 1998; Prataviera et al., 2020; Zinn & Bowersox, 1988). Furthermore, hardware operations typically have a logical sequence, for example, packaging follows assembly, and finished product distribution requires proper labeling (Cooper, 1993; Pagh & Cooper, 1998). However, many additional operations can occur for software—including software development, sourcing/storing, installation, activation, testing, and updating/upgrading (Norrman & Henkow, 2014). Moreover, the HighCorp case indicates that combined solutions' increasing software content boosts the number of value-adding combinations that companies can implement. Companies can apply postponement in different ways, for example, delay testing or license activation, and sometimes provide and install software updates and upgrades even after concluding the sale. Therefore, the logical sequence of software-related operations is more flexible temporally and geographically than that of hardware-related operations. Thus, we present our first proposition:

- P1. With increasing software importance for product offerings, the ability to postpone hardware and software combination across SC tiers and cross-border locations increases flexibility in key postponement decisions.

This postponement flexibility multiplies opportunities for MNCs to optimize tax liabilities by shaping global postponement strategies accordingly. However, HighCorp's various subcases illustrate that value-adding operations might be allowed differently depending on

country-specific regulations. When addressing related fiscal and legal implications, postponing software-related operations makes a big difference, depending on how customs authorities view cross-border flows which creates many ambiguous “gray” zones. Postponed software installation positively implies that later updated versions of software can be used, but the negative implication is that hardware could be shipped separately with potentially higher customs duties. Duties impact hardware assembly and software upgrades differently, as software imports have usually been duty-free in many countries. As various tax authorities and customs policies consider software releases differently, MNCs must make complex tax-related decisions about where operations should be performed (Dong & Kouvelis, 2020). Varying perspectives on tax authorities must be understood because the jurisdiction in which software operations occur may or may not involve creation of a PE or duty liabilities. As combining hardware and software objects enhances fiscal and legal implications related to global postponement, we present a second proposition:

P2. Knowledge about the fiscal and legal implications of postponement boundary problem decisions creates opportunities for firms to leverage postponement flexibility and optimize global product flows’ taxes and duties.

The complex jurisdictional and legal framework, as well as enhanced fiscal and legal implications, also transforms postponement decision making focus. MNCs usually apply postponement strategies to be globally efficient and locally responsive (Boone et al., 2007; Yang & Burns, 2003), while also delocalizing operations worldwide (Lee, 2010; van Hoek, 2001). However, the HighCorp case illustrates the significant tax differences across jurisdictions, whereas the tax base in each country is based on what operations occur and who executes them. The combination of different objects in the product offerings must be understood along with which legal entities are performing what operations and contracting with each other, which could create trade compliance issues and introduce new risks. The HighCorp case highlights how risk from a taxation perspective requires careful attention and specific knowledge. Key implications relate to where and how much taxes should be paid, creation of corporate PEs in other countries, and the customs duties that should be assessed (Adams, 2008; Henkow & Norrman, 2011). When making postponement decisions, the primary focus can be on minimizing and balancing risks from different areas (fiscal/financial, legal/trade, and commercial), then on trading them off with SC/logistics issues, for example, responsiveness and cost-effectiveness. This changes the

postponement boundary decision-making focus, leading to our third proposition:

P3. With enhanced fiscal and legal implications related to the increasing importance of hardware/software combinations in global product offerings, MNCs first should define their (outer) business boundaries to minimize fiscal and legal risks, which later will frame postponement opportunities for responsiveness or cost optimization.

Elaborating postponement boundary decision making and improving its interrelatedness

As product offerings are the result of a combination of multiple objects, the HighCorp case demonstrates the importance of cross-functional decision making when selling and delivering to customers worldwide. Complex and cross-functional interrelatedness makes decision making about the postponement boundary problem difficult in practice, as the number of possible combinations is considerable. For example, moving value-adding operations between jurisdictions influences tax liabilities on the respective legal entities. As software’s importance increases, MNCs must understand the implications of postponing value-adding operations in countries that lack PEs and how local authorities define the concepts of economic substance and PE. Downloading software into hardware might create a PE in a country, while a fundamental operation, for example, solution testing, might not (as the tax code does not change).

Interconnectedness is a common thread in modern SCs (Dong & Kouvelis, 2020), and software’s peculiarities create additional complexities when aiming to harmonize operations to minimize related risks. The HighCorp case also illustrates the huge cross-functional effort toward aligning internal and external legal entities associated with HighCorp’s business operations, guiding teams at the execution layer into an operationalizing strategy. For approximately two decades, HighCorp has worked to align its operations with the fiscal and legal rules in place in each jurisdiction, as well as harmonize potential risks. This case revealed significant differences in what was allowed in the various GSHs, and companies such as HighCorp must design their SCs to comply with various local customs and tax authorities. However, making these kinds of decisions needs to align people from different domains cross-functionally to reduce friction and improve reciprocal understanding. In a context in which combining hardware and software objects enhances fiscal

and legal implications related to global postponement, we introduce a fourth proposition:

P4. Fiscal and legal implications related to the importance of hardware/software combination for product offerings increase complexities and risks for the postponement boundary problem, enhancing the need for cross-functional decision making between the SC/logistics, legal, and finance functions.

Developing explicit boundary object to enhance cross-functional integration

As the extant literature acknowledged, CFI is difficult to implement in practice (Ralston et al., 2015), but it is crucial to counteract diverging interests among functions (Ellinger et al., 2006; Lawrence & Lorsch, 1967). Moreover, it helps address risks from different areas that require knowledge and skills rooted in different domains (Norrman & Henkow, 2014). The rising emphasis on fiscal and legal risks, and the importance of trade compliance increase SC complexity, and the HighCorp case demonstrates the topicality of developing CFI organizational structures and tools. As this requires a set of elements focused on alignment, coordination, and communication (Pellathy et al., 2019), HighCorp introduced the OM. We argue that the OM represents a boundary object that facilitates CFI (Fabbe-Costes et al., 2020). Boundary objects can foster coordination across boundaries (Zeiss & Groenewegen, 2009), proposing models that improve communication (Carlile, 2004). In a complex scenario in which postponement decisions comprise a combination of hardware and software objects, the related tax implications (and emerging risks) highlight the need for simple and harmonized boundary objects that improve the CFI between the SC/logistics, legal, and fiscal domains (Henkow & Norrman, 2011). Boundary objects can help offer explicit multiple alternatives to resolve issues within a given “playground,” in which risks can be minimized and compliance maximized. Therefore, developing boundary objects (e.g., the OM) allows MNCs to strengthen integration facilitators (Ellinger et al., 2006; Richey et al., 2010). Boundary objects can foster better organizational *alignment* (concerning the governance of roles and responsibilities at different hierarchical levels), defining *structured* processes and tools for coordination activities that support clear *information sharing* and maximize cross-functional *communication*. Such processes and tools can be operationalized via formal steering documents, but also apply to the governance and organizational structure

level. As seen in the HighCorp case, CFI can be enhanced further by creating *interdependent* cross-functional teams that involve firsthand experienced senior managers from different functions (instead of lacking their directions and suggestions). As the rising complexity also encompasses an increasing number of unexpected scenarios, cross-functional teams can work together to manage deviations, prioritize conflicting goals, and define escalation processes. As combining hardware and software objects enhances fiscal and legal implications related to global postponement, necessary further evolution of boundary objects leads to a fifth proposition:

P5. Postponement boundary decision making requires a structured boundary object that formalizes and governs cross-functional integration between SC/logistics, legal, and finance functions (including, organizational structure, cross-functional decision-making processes, aligned trade-offs and outcomes, formal steering documents, deviation management, and development processes).

CONCLUDING REMARKS

Theoretical contributions

This study aimed to extend logisticians' traditional view of postponement by examining the postponement decision-making phenomenon in the context of hardware-software combinations' increasing importance, as well as evolving fiscal and legal aspects. In terms of general theoretical relevance, our study elaborated the extant postponement literature (Pagh & Cooper, 1998; Zinn & Bowersox, 1988) using a mid-range approach to contextualize the postponement boundary problem (Lee, 2010; Pratavia et al., 2020). We adopted an original perspective on global postponement that explicitly considers the geographical footprint and country specifics among multiple jurisdictions, contextualizing postponement boundary decision making and deepening tax implications for product offerings that combine hardware and software objects. We also contextualized CFI to support the related decision-making process, broadening CFI's functional scope within the SC/logistics domain to include finance and legal and proposing boundary objects to govern CFI. We combined constructs from extant theory with our empirical contextual findings into a framework that describes and conceptualizes aggregate postponement boundary decision making. We also elaborated theory by presenting a set of propositions that adapt postponement theory to the underlying industry situation investigated

(Craighead et al., 2016). The study thus contributes to the extant literature on tax-aligned global SCs (e.g., Cohen & Lee, 2020; Henkow & Norrman, 2011; Shunko et al., 2017) by focusing on postponement and explicitly elaborating on how cross-functional decision making between SC/logistics and legal and finance functions can be developed.

Managerial insights

Our research pinpoints what logisticians need to understand to broaden their horizons and diverge from the traditional postponement view. Both logisticians and tax lawyers can make decisions about global postponement, but they are rooted in different domains. To complicate matters further, logisticians rarely are educated in law or tax issues, while lawyers rarely are educated in logistics (Norrman & Henkow, 2014). As HighCorp informants noted, “engineering brains do not usually think in legal terms.” However, these misaligned perspectives can give rise to problems in different areas (Henkow & Norrman, 2011). Tax implications influence postponement decisions, but the latter entails important fiscal and legal considerations. If MNCs want to avoid unexpected tax implications related to tax registration or PE creation, postponement boundary decisions should be made accordingly. MNCs should examine carefully which operations are allowed and which are forbidden in each jurisdiction, taking into account the contextual drivers that shape postponement boundary decision making. This also highlights the need for a focus change, as MNCs first should minimize fiscal and legal risks, then review opportunities for time or cost optimization. Because identified interdependencies change dynamically over time due to changes in national authorities and policies, complexity increases further.

Thus, our study offers practitioners an increased general understanding of and insights into interactions between SC/logistics and fiscal and legal systems. First, the rich case description is in itself an original contribution to an area with limited empirics, displaying important issues (and approaches) from which other companies could learn. As logisticians should better understand the terms *economic substance* and *PE*, and their connection to value-adding operations, we suggest a cross-functional approach to guide decision making. We examined HighCorp's work over two decades to align operations with legal frameworks and develop CFI. HighCorp has developed a well-functioning relationship between its SC/logistics, finance, and legal functions, formulating guiding principles to support globally aligned decision making that adapts to local authorities. Because the regulatory environment impacts postponement boundary decisions, MNCs can

take advantage of heterogeneous regulations to improve their corporate performance. Defining guiding principles enhances MNCs' capacity to address interrelations that characterize the postponement boundary problem. In this regard, the development of a cross-functional boundary object (in the HighCorp case, the OM) allows for making compliant decisions in turbulent and evolving markets involving product offerings that combine multiple objects.

Research limitations and future research recommendations

Given our study's methodological limitations, cross-functional nature, and investigated phenomenon, we propose several avenues for future research. Case studies, like experiments, should not be viewed as representative (Yin, 2014). Instead, findings are best used in connection with theoretical discussions. We achieved this in our contextualizing research by adopting an abductive approach that moved between existing postponement theory and our original empirical data (Ketokivi & Choi, 2014). Our embedded single-case study with four subcases allowed us to explore geographical and temporal elements that created opportunities for deeper theorizing about a currently unexamined phenomenon.

However, with its small sample, our study is limited. To elaborate further and increase our framework and propositions' transferability (Lincoln & Guba, 1985), the postponement boundary problem also should be investigated in other contexts (e.g., other countries and industries). Further research could use a contingency approach to explore formally how different contextual variables influence postponement solutions to shape our propositions further. Furthermore, from a theory-generation perspective, product offerings that combine hardware and software (with increasing software value) require understanding the implications of SCs' various aspects. Pioneering practice often seems ahead of academics, but we also can advance theoretical knowledge by investigating relevant phenomena and issues practically. One example is software-subscription services, which allow customers to pay for programs that unlock features on demand and introduce more flexibility and customization opportunities.

Another limitation of our study is that we considered only stable, nondisrupted SCs. In the wake of the COVID-19 pandemic and increased geopolitical tensions, the current and future global landscape increasingly is uncertain, with recent research indicating a future with more regionalized SCs (Ciravegna & Michailova, 2022), like HighCorp's. Many MNCs are considering reshoring their manufacturing operations closer to their headquarters to cope with worldwide disruption risks, which

may challenge implementation of postponement strategies and lead to changing tax structures (van Hoek & Dobrzykowski, 2021). Therefore, future studies might explore postponement decision-making implications during simultaneous supply and demand shocks, as well as postponement's feasibility to improve (or not) responsiveness to customer demand.

As products and SCs continue to increase in complexity, logisticians must extend their understanding of what dimensions could create unexpected frictions and trade-offs. Using the postponement example, we humbly hope to inspire academics and practitioners to examine these new opportunities and challenges to traditional SC concepts as the context evolves.

ORCID

Andreas Norrman  <https://orcid.org/0000-0002-5201-9809>

Lorenzo Bruno Pratavia  <https://orcid.org/0000-0001-8821-7498>

REFERENCES

- Adams, L. (Ed.). (2008). *Supply chain management. Tax planning international: Special report*. BNA International.
- Alderson, W. (1950). Marketing efficiency and the principle of postponement. *Cost and Profit Outlook*, 3, 15–18.
- Arntzen, B., Brown, G., Harrison, T., & Trafton, L. (1995). Global supply chain management at digital equipment corporation. *Interfaces*, 25(1), 69–93.
- Avittathur, B., Shah, J., & Gupta, O. K. (2005). Distribution center location modelling for differential sales tax structure. *European Journal of Operational Research*, 162(1), 191–205.
- Bhutta, K. S., Huq, F., Frazier, G., & Mohamed, Z. (2003). An integrated location, production, distribution, and investment model for a multinational corporation. *International Journal of Production Economics*, 86(3), 201–216.
- Boone, C., Craighead, C., & Hanna, J. (2007). Postponement: An evolving supply chain concept. *International Journal of Physical Distribution and Logistics Management*, 37(8), 594–611.
- Brun, A., & Zorzini, M. (2009). Evaluation of product customization strategies through modularization and postponement. *International Journal of Production Economics*, 120(1), 205–220.
- Carlile, P. R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science*, 15(5), 555–568.
- Choi, K., Narasimhan, R., & Kim, S. W. (2012). Postponement strategy for international transfer of products in a global supply chain: A system dynamics examination. *Journal of Operations Management*, 30(3), 167–179.
- Ciravegna, L., & Michailova, S. (2022). Why the world economy needs, but will not get, more globalization in the post-COVID-19 decade. *Journal of International Business Studies*, 53, 172–186.
- Cohen, M. A., & Lee, H. L. (2020). Designing the right global supply chain network. *Manufacturing and Service Operations Management*, 22(1), 15–24.
- Cooper, J. C. (1993). Logistics strategies for global businesses. *International Journal of Physical Distribution and Logistics Management*, 23(4), 12–23.
- Corley, K. G., & Gioia, D. A. (2011). Building theory about theory building: What constitutes a theoretical contribution? *Academy of Management Review*, 36(1), 12–32.
- Craighead, C. W., Ketchen, D. J., Jr., & Cheng, L. (2016). “Goldilocks” theorizing in supply chain research: Balancing scientific and practical utility via middle-range theory. *Transportation Journal*, 55(3), 241–257.
- Craighead, C. W., Ketchen, D. J., Jr., & Darby, J. L. (2019). Taking AIM at theoretical and pragmatic impact: A call for actionable, insightful, and measurable research. *Journal of Business Logistics*, 40(4), 289–298.
- Daugherty, P. J., Chen, H., Mattioda, D. D., & Grawe, S. J. (2009). Marketing/logistics relationships: Influence on capabilities and performance. *Journal of Business Logistics*, 30(1), 1–18.
- Dong, L., & Kouvelis, P. (2020). Impact of tariffs on global supply chain network configuration: Models, predictions, and future research. *Manufacturing and Service Operations Management*, 22(1), 25–35.
- Dubois, A., & Gadde, L. E. (2014). “Systematic combining”—A decade later. *Journal of Business Research*, 67(6), 1277–1284.
- Dyer, W. G., & Wilkins, A. L. (1991). Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of Management Review*, 16(3), 613–619.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Ellinger, A. E., Keller, S. B., & Hansen, J. D. (2006). Bridging the divide between logistics and marketing: Facilitating collaborative behavior. *Journal of Business Logistics*, 27(2), 1–27.
- Ellram, L. M. (1996). The use of the case study method in logistics research. *Journal of Business Logistics*, 17(2), 93–138.
- Enz, M. G., & Lambert, D. M. (2015). Measuring the financial benefits of cross-functional integration influences management's behavior. *Journal of Business Logistics*, 36(1), 25–48.
- Enz, M. G., & Lambert, D. M. (2022). A supply chain management framework for services. *Journal of Business Logistics*, 44, 11–36. <https://doi.org/10.1111/jbl.12323>
- Fabbe-Costes, N., Lechaptos, L., & Spring, M. (2020). “The map is not the territory”: A boundary objects perspective on supply chain mapping. *International Journal of Operations & Production Management*, 40(9), 1475–1497.
- Favoretto, C., Mendes, G. H., Oliveira, M. G., Cauchick-Miguel, P. A., & Coreynen, W. (2022). From servitization to digital servitization: How digitalization transforms companies' transition toward services. *Industrial Marketing Management*, 102, 104–121.
- Fawcett, S. E., Waller, M. A., Miller, J. W., Schwieterman, M. A., Hazen, B. T., & Overstreet, R. E. (2014). A trail guide to publishing success: Tips on writing influential conceptual, qualitative, and survey research. *Journal of Business Logistics*, 35(1), 1–16.
- Ferdows, K. (2018). Keeping up with growing complexity of managing global operations. *International Journal of Operations & Production Management*, 38(2), 390–402.
- Fernandes, R., Pinho, C., & Gouveia, B. (2015). Supply chain networks design and transfer-pricing. *International Journal of Logistics Management*, 26(1), 128–146.
- Flyvbjerg, B. (2006). Five misunderstandings about case study research. *Qualitative Inquiry*, 12(2), 219–245.
- Franke, H., & Foerstl, K. (2020). Goals, conflict, politics, and performance of cross-functional sourcing teams—Results from a social team experiment. *Journal of Business Logistics*, 41(1), 6–30.

- Frankel, R., & Mollenkopf, D. A. (2015). Cross-functional integration revisited: Exploring the conceptual elephant. *Journal of Business Logistics*, 36(1), 18–24.
- Frias, L. F., Farias, I. A., Wanke, P. F., Corrêa, H. L., & Santos, L. (2014). Tax-related aspects of logistics network planning: A case study in the Brazilian petrochemical industry. *International Journal of Logistics Research and Applications*, 17(2), 114–135.
- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, 16(1), 15–31.
- Gligor, D. M., Davis-Sramek, B., Tan, A., Vitale, A., Russo, I., Golgeci, I., & Wan, X. (2021). Utilizing blockchain technology for supply chain transparency: A resource orchestration perspective. *Journal of Business Logistics*, 43, 140–159. <https://doi.org/10.1111/jbl.12287>
- Guericke, S., Koberstein, A., Schardwareartz, F., & Voß, S. (2012). A stochastic model for the implementation of postponement strategies in global distribution networks. *Decision Support Systems*, 53(2), 294–305.
- Hammami, R., Frein, Y., & Hadj-Alouane, A. B. (2008). Supply chain design in the delocalization context: Relevant features and new modeling tendencies. *International Journal of Production Economics*, 113(2), 641–656.
- Henkow, O., & Norrman, A. (2011). Tax-aligned global supply chains: Environmental impact illustrations, legal reflections, and cross-functional flow charts. *International Journal of Physical Distribution and Logistics Management*, 41(9), 878–895.
- Houlihan, J. B. (1983). Supply chain management: “The modern approach to logistics.” *BPCS Control*, 3–5.
- Hsu, V. N., & Zhu, K. (2011). Tax-effective supply chain decisions under China's export-oriented tax policies. *Manufacturing and Service Operations Management*, 13(2), 163–179.
- Jafari, H., Eslami, M. H., & Paulraj, A. (2022). Postponement and logistics flexibility in retailing: The moderating role of logistics integration and demand uncertainty. *International Journal of Production Economics*, 243, 108319.
- Jafari, H., Nyberg, A., & Hilletoft, P. (2016). Postponement and logistics flexibility in retailing: A multiple case study from Sweden. *Industrial Management and Data Systems*, 116(3), 445–465.
- Kang, M., Ki-Hyun, U., Shou, Y., & Roh, J. J. (2022). Matching goal-based incentive systems with cross-functional integration to improve operation and innovation performance. *International Journal of Operations & Production Management*, 42(2), 230–254.
- Ketokivi, M., & Choi, T. (2014). Renaissance of case research as a scientific method. *Journal of Operations Management*, 32(5), 232–240.
- Kovács, G., & Spens, K. M. (2005). Abductive reasoning in logistics research. *International Journal of Physical Distribution and Logistics Management*, 35(2), 132–144.
- Lavissière, A., & Rodrigue, J. P. (2017). Free ports: Toward a network of trade gateways. *Journal of Shipping and Trade*, 2(1), 7.
- Lawrence, P. R., & Lorsch, J. W. (1967). *Organization and environment: Managing differentiation and integration*. Harvard Business School.
- Lee, H. L. (2010). Global trade process and supply chain management. In M. S. Sodhi & C. S. Tang (Eds.), *A long view of research and practice in operations research and management science: The past and the future* (pp. 175–193). Springer.
- Lee, H. L., Billington, C., & Carter, B. (1993). Hewlett-Packard gains control of inventory and service through design for localization. *Interfaces*, 23(4), 1–11.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.
- Mariel, K., & Minner, S. (2015). Strategic capacity planning in automotive production networks under duties and duty drawbacks. *International Journal of Production Economics*, 170, 687–700.
- Mikkelsen, O. S., & Johnsen, T. E. (2019). Purchasing involvement in technologically uncertain new product development projects: Challenges and implications. *Journal of Purchasing and Supply Management*, 25(3), 100496.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Sage Publications.
- Miller, T., & de Matta, R. (2008). A global supply chain profit maximization and transfer pricing model. *Journal of Business Logistics*, 29(1), 401–412.
- Naslund, D. (2002). Logistics needs qualitative research—Especially action research. *International Journal of Physical Distribution and Logistics Management*, 32(5), 321–338.
- Norrman, A., & Henkow, O. (2014). Logistics principles vs. legal principles: Frictions and challenges. *International Journal of Physical Distribution and Logistics Management*, 44(10), 744–767.
- Norrman, A., & Lundberg, C. (2003). Key issues for a telecom supplier in the transition toward a software-focused supply chain. In K. S. Pawar & M. Muffato (Eds.), *Logistics and networked organizations: Proceedings of the 8th international symposium on logistics* (pp. 17–28). University of Nottingham.
- Norrman, A., & Lundberg, C. (2005). Software supply chain management: A multiple case study. In D. Ekwall (Ed.), *PLAN's forsknings-och tillämpningskonferens i Borås den 18–19 Augusti 2005* (pp. 178–202). Produktionslogistik 2005: Kvalitet och effektivitet i hela försörjningskedjan.
- Pagell, M. (2004). Understanding the factors that enable and inhibit the integration of operations, purchasing, and logistics. *Journal of Operations Management*, 22(5), 459–487.
- Pagh, J., & Cooper, M. (1998). Supply chain postponement and speculation strategies: How to choose the right strategy. *Journal of Business Logistics*, 19(2), 13–33.
- Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Sage Publications.
- Pellathy, D. A., Mollenkopf, D. A., Stank, T. P., & Autry, C. W. (2019). Cross-functional integration: Concept clarification and scale development. *Journal of Business Logistics*, 40(2), 81–104.
- Petriccione, M. (2007). Supply chain management. In C. Finnerty, P. Merks, M. Petriccione, & R. Russo (Eds.), *Fundamentals of international tax planning* (pp. 183–206). IBFD.
- Pratavia, L. B., Moretti, E., & Tappia, E. (2022). Coping with the postponement boundary problem: An empirical investigation in global food supply chains. *International Journal of Logistics Management*, 33(2), 687–711.
- Pratavia, L. B., Norrman, A., & Melacini, M. (2022). Global distribution network design: Exploration of facility location driven by tax considerations and related cross-country implications. *International Journal of Logistics Research and Application*, 25(7), 1067–1090.
- Pratavia, L. B., Perotti, S., Melacini, M., & Moretti, E. (2020). Postponement strategies for global downstream supply chains:

- A conceptual framework. *Journal of Business Logistics*, 41(2), 94–110.
- Ralston, P. M., Blackhurst, J., Cantor, D. E., & Crum, M. R. (2015). A structure-conduct-performance perspective of how strategic supply chain integration affects firm performance. *Journal of Supply Chain Management*, 51(2), 47–64.
- Ribas, I., Lusa, A., & Corominas, A. (2019). A framework for designing a supply chain distribution network. *International Journal of Production Research*, 57(7), 2104–2116.
- Richey, R. G., Roath, A. S., Whipple, J. M., & Fawcett, S. E. (2010). Exploring a governance theory of supply chain management: Barriers and facilitators to integration. *Journal of Business Logistics*, 31(1), 237–256.
- Sawhney, R., & Sumukadas, N. (2005). Coping with customs clearance uncertainties in global sourcing. *International Journal of Physical Distribution and Logistics Management*, 35(4), 278–295.
- Schwarz, G. M., & Stensaker, I. G. (2016). Showcasing phenomenon-driven research on organizational change. *Journal of Change Management*, 16(4), 245–264.
- Seppala, T., Kenney, M., & Ali-Yrrko, J. (2014). Global supply chains and transfer pricing—Insights from a case study. *Supply Chain Management: An International Journal*, 19(4), 445–454.
- Shunko, M., Do, H. T., & Tsay, A. A. (2017). Supply chain strategies and international tax arbitrage. *Production and Operations Management*, 26(2), 231–251.
- Stake, R. (2008). Qualitative case studies. In N. Denzin & Y. Lincoln (Eds.), *Strategies of qualitative inquiry*. Sage Publications.
- Stank, T. P., Pellathy, D. A., In, J., Mollenkopf, D. A., & Bell, J. E. (2017). New Frontiers in logistics research: Theorizing at the middle range. *Journal of Business Logistics*, 38(6), 6–17.
- Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, “translations,” and boundary objects: Amateurs and professionals in Berkeley’s museum of vertebrate zoology, 1907–39. *Social Studies of Science*, 19(3), 387–420.
- Swink, M., & Schoenherr, T. (2015). The effects of cross-functional integration on profitability, process efficiency, and asset productivity. *Journal of Business Logistics*, 36(1), 69–87.
- Twede, D., Clarke, R. H., & Tait, J. A. (2000). Packaging postponement: A global packaging strategy. *Packaging Technology and Science*, 13(3), 105–115.
- van Hoek, R. (1996). VAL, the functional and spatial organization of businesses. *Tijdschrift voor Economische en Sociale Geografie*, 87(1), 32–43.
- van Hoek, R. (2001). The rediscovery of postponement—A literature review and directions for research. *Journal of Operations Management*, 19(2), 161–184.
- van Hoek, R., & Dobrzykowski, D. (2021). Toward more balanced sourcing strategies—Are supply chain risks caused by the COVID-19 pandemic driving reshoring considerations? *Supply Chain Management*, 26(6), 689–701.
- van Hoek, R., Ellinger, A. E., & Johnson, M. (2008). Great divides: Internal alignment between logistics and peer functions. *International Journal of Logistics Management*, 19(2), 110–129.
- van Maanen, J., Sørensen, J. B., & Mitchell, T. R. (2007). The interplay between theory and method. *Academy of Management Review*, 32(4), 1145–1154.
- Vidal, C. J., & Goetschalckx, M. (2001). A global supply chain model with transfer pricing and transportation cost allocation. *European Journal of Operational Research*, 129(1), 134–158.
- Voss, C., Tsikriktsis, N., & Frohlich, M. (2002). Case research in operations management. *International Journal of Operations and Production Management*, 22(2), 195–219.
- Wang, Z., Gao, W., & Mukhopadhyay, S. K. (2016). Impact of taxation on international transfer pricing and offshoring decisions. *Annals of Operations Research*, 240(2), 683–707.
- Yang, B., & Burns, N. (2003). Implications of postponement for the supply chain. *International Journal of Production Research*, 41(9), 2075–2090.
- Yang, B., Burns, N., & Backhouse, C. (2004). Postponement: A review and an integrated framework. *International Journal of Operations and Production Management*, 24(5), 468–487.
- Yin, R. K. (2014). *Case study research* (5th ed.). Sage Publications.
- Zeiss, R., & Groenewegen, P. (2009). Engaging boundary objects in OMS and STS? Exploring the subtleties of layered engagement. *Organization*, 16(1), 81–100.
- Zhang, W., & Banerji, S. (2017). Challenges of servitization: A systematic literature review. *Industrial Marketing Management*, 65, 217–227.
- Zinn, W. (2019). A historical review of postponement research. *Journal of Business Logistics*, 40(1), 66–72.
- Zinn, W., & Bowersox, D. (1988). Planning physical distribution with the principle of postponement. *Journal of Business Logistics*, 9(2), 117–136.

How to cite this article: Norrman, A., & Prataviera, L. B. (2023). Revisiting postponement: The importance of cross-functional integration to understand tax implications in global supply chains. *Journal of Business Logistics*, 44, 693–718. <https://doi.org/10.1111/jbl.12351>

APPENDIX 1

Interview guide

(A) To explore postponement boundary decisions in the context of fiscal/legal implications and hardware and software combination, the following elements are required to be identified/defined:

- Destination country
- Origin country
- “Focal country” (i.e., the chosen country to adopt a “general perspective,” e.g., Principal location, or where global supply hubs are located, or destination countries)
- Company structure (e.g., Principal structure model)
- Type of product (e.g., hardware, software, hardware/software)
- Position in the product life cycle (mature vs. emergent vs. early adoption)
- Goods ownership issues (who is the owner of the goods in each node/arc)
- Handling issues (who is in charge of handling goods in each node/arc)
- Facility ownership issues
- Sub-contractors and 3PPs involvement
- Differences in managing hardware or software goods
- Trade agreements in place
- Duties (function of goods origin/goods classification [tax code]/goods value)
- Local content requirements and other regulations
- Taxes impact
- Terms of payment
- Transfer price policies
- FTZ (yes/no, then specific regulations [e.g., APAC vs. Latin America])
- Type of distribution network (direct shipment/one-tier/two-tiers)
- Hub location determinants
- Risks other than currency (e.g., obsolescence)
- PE issues and other liabilities
- “Triangulation” practices in place
- Trade channel design (i.e., “how to sell locally?”—distributors/agents/local companies, etc.)

(B) To explore how the SC/logistics and fiscal/legal domains can be integrated cross-functionally for postponement boundary decision making, we would like to know more about how you work cross-functionally between logistics/SC and fiscal/legal to address complex hardware/software, postponement, and tax-issues.

Describe/discuss those figures (showing the Operating Model, taken from your earlier presentations and directives) related to the questions below—for example, who does/decides what, etc.—so we can understand how it works in practice.

- How are postponement decisions made, and by whom? (Where is the “locus of control”?)
- Who is advising “what could be done” vs deciding “what will be done”?
- What is done centrally (HQ) vs locally?
- Who has decision authority?
- How do people from different functions work together?
- How often are things changing (country regulations, tax consequences) so that new logistics/postponement decision have to be taken?
- Is focus more on “cost” (Total cost model) or on “financial/legal risks”?
- What is “programmed/decided” in the OM, and what has to be decided for different new cases?
- How are decisions communicated and shared across the different functions?

Note: Changes and their motivations should be discussed. Further challenges should be explored.

AUTHOR BIOGRAPHIES

Andreas Norrman is Professor in Supply chain structure and organization at Lund University, Sweden. He has a Ph.D. in logistics from Linköping University, Sweden, and has been adjunct/visiting professor in Thailand, Belgium, and Finland. His research includes Omni-channel logistics, SC risk management, SC incentive alignment, Tax-aligned SC, and Change management. He publishes in leading SCM journals, has received multiple awards both as author and reviewer, and serves as Senior Editor for Journal of Business Logistics. At Lund University, he has been awarded Excellent Teaching Practice. He is a fellow of the Royal Physiographic Society (the Academy for the Natural Sciences, Medicine and Technology).

Lorenzo Bruno Pratavia is Lecturer in Logistics and Supply Chain Management at Cranfield School of Management, where he also serves as Deputy Course Director for the Full-Time MSc in Logistics and Supply Chain Management. Lorenzo holds a Ph.D. in Management, Economics, and Industrial Engineering from Politecnico di Milano (Italy). His main research interests concern global supply chain design and supply chain sustainability, with a number of contributions in leading academic journals such as Journal of Business Logistics, Supply Chain Management: an International Journal, International Journal of Physical Distribution and Logistics Management, and International Journal of Logistics Management.