



Necessary conditions in international business research—Advancing the field with a new perspective on causality and data analysis

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ABSTRACT

Many researchers in international business (IB) refer to necessity when they theorize about the relationships between different concepts. However, necessary conditions involve a specific causal logic: they represent constraints, bottlenecks, or critical factors that must be overcome for a desired outcome to exist. Usually, this logic is not fully acknowledged, neither in theoretical thinking nor in empirical research. In this paper, we demonstrate the relevance of necessary conditions in IB research and discuss how an adequate consideration of necessity logic can advance the field. Furthermore, we introduce necessary condition analysis (NCA) as a new analytical technique that identifies necessary conditions in data sets. We illustrate its application by analyzing whether certain institutional factors are necessary conditions for inward foreign direct investment. Finally, we assess the value of necessity logic and NCA as novel approaches to think about causality and to analyze data in IB.

Introduction

When theorizing about the relationships between two or more variables, researchers explicitly or implicitly refer to different causal logics. The most-used logic is *additive logic*. The aim of this logic is to explain an outcome by several determinants. Additive logic is implicit in different forms of regression or structural equation analyses. In these analyses the individual determinants are sufficient but not necessary for changing the outcome, and thus they can compensate each other. For example, in their study of the influence of institutions on foreign direct investment (FDI), Holmes, Miller, Hitt, and Salmador (2013) hypothesized, among others, that regulatory institutions promoting a friendly business environment, including democratic political institutions that provide stability and predictability, could attract FDI. They examined the relationships between these institutions and inward FDI by using a regression-based research method. This approach represents an additive logic since each of the institutional determinants is assumed to contribute to higher inward FDI. In this approach, since the absence of an institutional determinant can be compensated by another and will not prevent inward FDI, none of them are deemed necessary.

A second logic is *configurational logic*. This logic builds on the assumption that an outcome is usually not produced by a single determinant but by a combination of different determinants, which are called

configurations. Within these configurations, the presence or absence of different determinants are decisive for the outcome. Thus, in contrast to regression analysis, the focus is not on individual determinants (and on the question which determinant has the highest impact), but on configurations of determinants (and on the question which conditions need to be present or absent to enable the outcome). Thereby, researchers assume that multiple configurations can lead to the same outcome (i.e., equifinality), which makes each configuration sufficient but not necessary for the outcome. Configurational logic is implicit in the different forms of qualitative comparative analyses (QCA). For example, in his study of the influence of institutions on FDI, Pajunen (2008) used this logic to argue that a country's ability to attract FDI depends on several different combinations of institutional conditions. Rather than assuming that several institutional conditions contribute to inward FDI (as done in Holmes et al., 2013), he proposed and analyzed whether combinations of institutional determinants, such as the combination of political stability, flexible labor regulation, and corruption, are jointly sufficient for a country to attract FDI.

A third logic is *necessity logic*. Necessity logic implies that a determinant is necessary but not sufficient for an outcome. If the necessary cause is not in place, the outcome will not materialize. Necessity logic differs from the previous logics in two key respects: First, it does not aim to explain how changes in a determinant change an outcome but aims to

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explain why an outcome does not occur if certain determinants are not in place (Goertz, 2017). For example, it does not aim to explain why more political stability may lead to higher FDI but aims to explain why there is no FDI when there is no political stability. Second, its focus is on single conditions that are necessary ('critical') for an outcome. Since a necessary condition cannot be compensated by other factors, its absence will guarantee failure. For example, if we assume that political stability is a necessary condition for FDI, there is no FDI without political stability, even if the country exhibits other strong configurations of institutional factors such as political rights and favorable taxation.

As we will show in this paper, necessary conditions and necessity logic are widely referred to in International Business (IB) research. Two prominent areas in which theoretical arguments follow a necessity logic are studies that discuss necessary conditions of (successful) internationalization processes (e.g., Filatotchev, Liu, Buck, & Wright, 2009; Johanson & Vahlne, 2009), and studies that discuss necessary conditions for successful knowledge transfer in IB (e.g., Minbaeva, Park, Vertinsky, & Cho, 2018; Noorderhaven & Harzing, 2009). Necessary condition analysis (NCA) is a technique to test this necessity logic and to identify necessary conditions in data sets (Dul, 2020b). NCA has been applied in a few management studies with an international flavor (e.g., global virtual teamwork, see Richter, Martin, Hansen, Taras, & Alon, 2021; expatriation intention, see Richter, Schlaegel, van Bakel, & Engle, 2020, innovation management in buyer-supplier relationships, see van der Valk, Sumo, Dul, & Schroeder, 2016) and in studies that refer to theoretical arguments that are likewise prominent in IB research (e.g., firm capabilities and performance, see Tho, 2018). Apart from these notable exceptions, it has not yet received much attention in IB research and its core outlets. However, NCA is a powerful approach that can benefit the IB field and its responses to specific challenges (Aguinis, Ramani, & Cascio, 2020; Fainshmidt, Witt, Aguilera, & Verbeke, 2020).

We argue that necessity logic and NCA, as the methodological toolset to test necessity arguments, can aid IB researchers in tackling the interdisciplinary and complex nature of IB phenomena, can lead to more rigor in theoretical thinking, can improve the theory-method fit in the field, and can produce results of high relevance to IB practitioners. Theory wise, additive, configurational and necessity logic offer different viewpoints on theoretical mechanisms. Being more attentive to these different logics can advance theorizing on associations and underlying mechanisms in the field and can assist in identifying theoretical explanations (stemming from different disciplines) that best fit IB phenomena in general and in specific contexts (e.g., in different countries, cultures, institutional environments, or periods). In addition, as we will demonstrate in our review of IB studies (that often apply regression-based procedures to test necessity arguments), disentangling logics and related research methods increases theoretical rigor and improves the theory-method fit in IB. Furthermore, NCA can reduce the complexity of IB challenges by identifying the critical factors that must be in place to prevent failure. Therewith, analyzing necessary conditions can advance the field by producing results of high practical value. Given these considerations, the aim of this paper is to familiarize IB scholars with necessity logic and NCA and to discuss how their application advances the field.

Fundamentals of necessity logic and NCA

Researchers use different phrases to express that condition X is a necessary cause for outcome Y. Common expressions are "X is needed for Y", "Y requires X", "X is critical for Y", or "X must be present for Y to succeed". All these expressions refer to necessity logic and imply that outcome Y (e.g., FDI) can only be achieved if the specific condition X (e.g., political stability) is present (Dul, 2016, 2020b). Thus, a necessary condition constitutes a constraint, a bottleneck, or a critical factor that must be overcome or satisfied so that a desired outcome can exist. The absence of the necessary condition results in the absence of the desired outcome. Hence, the analysis of necessary conditions is useful to explain

Table 1

Mechanisms to be explained in necessity logic theorizing.

Priority	Question to be answered	Example
1	Why will Y be absent if X is absent?	Argue why there is no FDI to politically unstable countries
2	Why will X always be present if Y is present?	Argue why there is FDI to politically stable countries
3	Why can other concepts not compensate for the absence of X?	Argue why a country without political stability cannot compensate for this lack of stability by utilizing other (e.g., institutional) advantages to attract FDI

Source: Created, based on Goertz, 2017 and Dul, 2021.

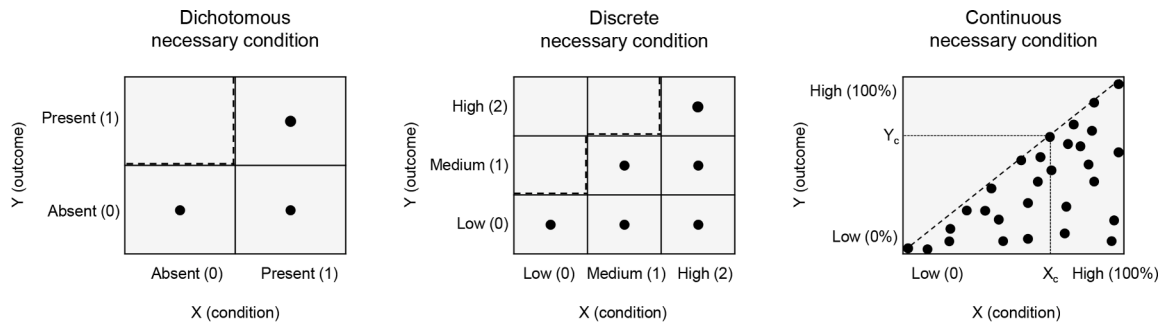
why a desired outcome did not materialize and, accordingly, to identify the required 'must-have' factors in order to avert guaranteed failure (Goertz, 2017). Notably, when talking about a necessary cause, we refer to a direct relation between X and Y. Thus, necessity logic should not be confused with moderating effects where the (average) effect of X on Y depends on a third variable (Hauff, Guerci, Dul, & van Rhee, 2021).¹

Analyzing necessary conditions should always start with theory. At the outset, authors (or researchers) need to develop a logical argument or a theoretical mechanism that explains why X is necessary for Y. Building on Goertz (2017) and Dul (2021), authors can develop this logic by following three steps (see Table 1): First, argue why the absence of X results in the absence of Y. For instance, develop a logic as to why there is no FDI to a country without political stability. Second, argue that in cases where Y is present X is also present. For instance, argue that there is FDI to politically stable countries. And third, discuss why there is no substitutability of X to enable Y. For instance, discuss why political stability cannot be substituted by other institutional factors (such as favorable taxes) when it comes to attracting FDI.

Necessity arguments can be translated into causal statements in the form of hypotheses. For instance, a necessity hypothesis can be formulated as "X is necessary for Y" or "A high level of X is necessary for a high level of Y". A necessity hypothesis can also be specified by adding a theoretical domain where it is supposed to hold true. For instance, if the hypothesis is that political stability is necessary for FDI, then the idea is that this applies to any country in the world. Adding a theoretical domain, such as a geographical or other delimiter, specifies that the causal statement is supposed to hold within the given domain (see Dul, 2020b). For example, an IB researcher could delimit the political stability hypotheses to specific economies (e.g., those of developed versus developing countries) or to firms that follow certain motives in their FDI. Further delimiters could relate to specific periods of time during which a certain necessity hypothesis holds.

Necessity logic can be applied to conditions and outcomes that are measured on different levels. Fig. 1 (left) illustrates the necessity logic for dichotomous conditions and outcomes. In this example, the presence of X (X = 1) is necessary for the presence of Y (Y = 1). If X is absent (X = 0), Y is also absent (Y = 0). The dichotomous case is the simplest form of a necessary condition and refers to necessity *in kind* where a condition is either necessary or not for an outcome (Vis & Dul, 2018). However, necessity statements can also refer to a certain level of the condition and a certain level of the outcome. For instance, instead of assuming that political stability is necessary for FDI (a binary statement), the presumption could be that a certain level of political stability (e.g., high political stability) is necessary for a certain level of FDI (e.g., high FDI). Thus, with variable scores with more than two levels (beyond

¹ We illustrate this with reference to a regression line with an interaction term: $Y = a + b_1 \bullet X + b_2 \bullet M + b_3 \bullet X \bullet M + \epsilon$. In this formula M represents the moderator, a is the intercept, b_1 to b_3 are the slopes, and ϵ is the error term. Based on this formula we see that M can influence the effect of X on Y. The moderator is, however, not a necessary condition for the outcome, because Y can still be positive when M is zero. Hence, even if there is no M, there can be Y.



Source: Dul 2016.

Fig. 1. Types of necessary conditions.
Source: Dul, 2016.

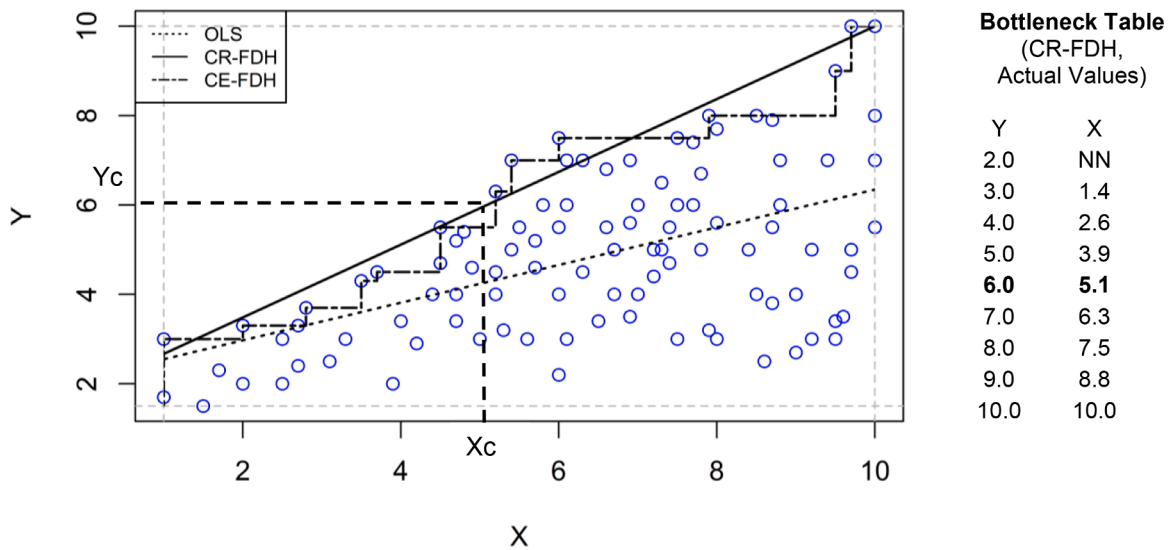


Fig. 2. Ceiling lines and bottleneck table.

dichotomous), necessary conditions *in degree*, i.e., more precise necessity statements, can be formulated. Fig. 1 (center) shows a discrete example where a medium level of X is necessary for a medium level of Y, and a high level of X is necessary for a high level of Y. Finally, Fig. 1 (right) shows a continuous example where a certain level of X (X_c) is necessary for a certain level of Y (Y_c). In all instances necessity is indicated by an empty space in the upper left corners of the tables or scatter plots.

NCA identifies these empty spaces in scatter plots to determine the presence of a necessary condition. More specifically, NCA draws a *ceiling line* which separates the space without observations from the space with observations. This ceiling line determines the level of condition X that is necessary to reach a certain level of outcome Y. Two default ceiling lines are Ceiling Envelopment – Free Disposal Hull (CE-FDH) and Ceiling Regression – Free Disposal Hull (CR-FDH). The CE-FDH ceiling line is a step-wise linear line that is recommended for discrete data or when the pattern of observations near the ceiling line is irregular (Dul, 2020b). Since this ceiling line disallows points above it, it produces the largest empty space. The CR-FDH ceiling line is a trend line through the CE-FDH line and is recommended for continuous data or when the pattern of observations near the ceiling line is approximately linear.

Fig. 2 illustrates the CE-FDH and the CR-FDH ceiling lines. The ceiling lines are on top of the data. They do not represent an average trend (like the regression line shown in Fig. 2) but indicate which level of the condition is necessary for a specific level of the outcome. For example, outcome level Y_c cannot be achieved at levels of X that are

below X_c .

Fig. 2 also shows the *bottleneck table* (for the CR-FDH line in the graph, left), which is a tabular representation of the ceiling line. The first column of a bottleneck table represents different levels of the outcome, and the next column represents (and additional columns represent) the corresponding required level(s) of the condition(s). These levels can be expressed as a percentage of the range, as actual values, or as percentiles. They indicate that higher levels of Y can only be achieved with higher levels of X. For example, to achieve a level of $Y = 6$, X must at least be 5.1.

NCA calculates several parameters to assess if a necessity hypothesis is supported. The main parameter is the *necessity effect size* d , which is calculated by dividing the empty space (called the *ceiling zone*) by the entire area that include observations (called the *scope*). Per definition, d can range between 0 and 1. Dul (2016) labels $0 < d < 0.1$ as a small effect, $0.1 \leq d < 0.3$ as a medium effect, $0.3 \leq d < 0.5$ as a large effect, and $d \geq 0.5$ as a very large effect. Previous studies used the threshold of $d = 0.1$ to consider an effect as practically meaningful (e.g., Karwowski et al., 2016; van der Valk et al., 2016). In addition, NCA allows an evaluation of the statistical significance of the effect size in terms of a p-value, indicating the probability that the effect size could be a random result of unrelated variables, which should also be considered when deciding whether or not to reject a necessity hypothesis (Dul et al., 2020).

There may be multiple necessary causes, but the necessity of a single X for Y does not depend on the absence or presence of other causes; other

determinants cannot compensate for the absence of a necessary condition. Thus, NCA is fundamentally a bivariate analysis. If researchers are interested in more than one necessary condition, a separate analysis is made for each of these conditions. This is possible because a necessary condition operates in isolation from the rest of the causal structure, i.e., the necessity of X_1 on Y does not depend on the necessity of X_2 on Y . This also implies that NCA models are parsimonious and do not need control variables (as do regression analyses) as there is no omitted variable bias (Dul, 2020b).

Necessity logic and the Use of NCA in IB research

To assess the relevance and usage of necessity logic and NCA in IB research, we searched the *Journal of World Business* and the *Journal of International Business Studies* since 2010 for commonly used keywords (including plurals and combinations) that express necessity (Dul, 2020b), among others ‘necessary’, ‘but not sufficient’, ‘but insufficient’, ‘condition/ prerequisite/ requirement/ precondition’, and ‘sine qua non’. By focusing on these explicit formulations of necessity, we provide a rough estimate of the relevance of necessary conditions in IB research: admittedly, researchers may also implicitly follow a necessity logic without explicitly using these keywords. As the identification of the latter would involve a higher level of speculation about the implied logic, we concentrated on studies that used the more explicit formulations of the keywords. Furthermore, since some researchers might have used these keywords unintentionally, we carefully evaluated the context in which they were used to avoid an overestimation of the relevance of necessary conditions. Hence, our review underestimates rather than overestimates the relevance of necessity logic in IB research, which seems acceptable for our purposes.

We found 54 articles that refer to necessary conditions (see the overview in Appendix 1). Of these 54 articles, 41 refer to a necessity logic to develop their theoretical arguments. Therein, two noticeable sub-fields relate to these necessary conditions. The first concerns a core

area in IB research: 16 articles refer to necessary conditions in the context of explaining *internationalization* (patterns) and the existence and performance of the multinational firm. For instance, Filatotchev et al. (2009) outline that R&D investment and network membership are necessary but insufficient conditions for internationalization; Henisz (2003) refers to effective cooperation with host governments and capital scarcity in the domestic market as necessary conditions for international activities; and Johanson and Vahlne (2009) refer to ‘insidership’ in relevant networks as a necessary but insufficient condition for successful internationalization. Second, 11 articles refer to necessary conditions in the context of *knowledge sharing/ transfer and creation*. For example, Minbaeva et al. (2018) assume that a foreign partner’s ability to codify and articulate knowledge is a necessary but insufficient condition for successful knowledge acquisition by local partners; Noorderhaven and Harzing (2009) argue that social interaction is a necessary condition for knowledge exchange in the multinational enterprise (MNE); and Reiche, Harzing, and Pudelko (2015) refer to shared language among subsidiaries and headquarters as a necessary condition for identity construction and knowledge flows. Another four articles refer to *foreign entry mode (success)*, and 10 articles relate to a diversity of topics that we did not cluster (such as brand identification, ecological sustainability).

Seven of the 13 remaining articles refer to necessary conditions when discussing their findings, but they do not actively engage in using necessity logic to develop a theoretical line of argument. Finally, six articles refer to necessity in the context of applying a configurational logic and a form of QCA (Crilly, 2011; Judge, Fainshmidt, & Lee Brown, 2014; Kim, 2013; Pajunen, 2008; Schneider, Schulze-Bentrop, & Paunescu, 2010; Witt & Jackson, 2016). These studies focus on combinations or configurations of different variables that are sufficient for an outcome. From the above, we conclude that necessity logic is of high relevance to IB research.

Based on our review, we identify two pressing aspects that IB researchers should pay more attention to in future. First, even if authors refer to certain causal mechanisms as necessary conditions, they are

Table 2
Examples of necessity statements in empirical IB research.

Source	Topic	(Selected) Necessity statements in theorizing section, analysis technique and discussion of findings
Minbaeva et al., 2018	Knowledge sharing/ transfer/ creation; sender’s abilities as necessary conditions (NCs)	‘Consistent with the previous research, we argue that the sender’s ability is a necessary but insufficient condition for successful knowledge acquisition by local partners.’ (p. 713) ‘Hypothesis 1. In the context of IJVs, the higher the foreign partner’s ability to codify and articulate knowledge, the higher the extent of knowledge acquisition by the local partner.’ (p. 715) Analysis technique: Structural equation modeling. Interpretation of findings: ‘Hypothesis 1 proposes that ability, knowledge articulation and codification have a direct positive effect on knowledge acquisition. For the relationship between codification ability and knowledge acquisition, the standardized regression coefficient is not significant and so Hypothesis 1 is not supported.’ (p. 719)
Filatotchey et al., 2009	Internationalization; R&D and network membership as NCs	‘(...) investment in R&D and network membership may represent necessary but not sufficient conditions for internationalization.’ (p. 1007) ‘Hypothesis 1a: Export orientation of the SME is positively associated with R&D intensity.’ (p. 1008) ‘Hypothesis 2a: Export orientation of the SME is positively associated with the presence of global networks.’ (p. 1009) Analysis technique: Regression-based analysis technique. Interpretation of findings: The possession of global networks is significantly associated with export orientation and export performance; ‘R&D intensity is significantly associated with export performance.’ (p. 1016–1018)
Noorderhaven & Harzing, 2009	Knowledge sharing/ transfer/ creation; social interaction as NCs	‘To the extent that knowledge is indeed socially constructed, social interaction should be seen not primarily as a means for transferring existing knowledge, but rather as a necessary condition for the social production of knowledge.’ (p. 725). ‘Hypothesis 1: Social interaction between a subsidiary and other parts of the MNE will be positively related to knowledge exchange (inflows as well as outflows).’ (p. 725). Analysis technique: Regression-based analysis technique. Interpretation of findings: ‘(...) intensity of interaction has a consistent positive effect on all four types of knowledge flow. This confirms Hypothesis 1, our baseline hypothesis’ (p. 733). ‘Our analyses were guided by the ideas developed in two different perspectives ... Based on both perspectives we expected (as our baseline hypothesis) a positive effect of social interaction intensity on all intra-MNE knowledge flows.’ (p. 735)

seldom translated into necessity research hypotheses. Minbaeva et al. (2018), for instance, who argued in favor of the necessity of a foreign partner’s ability to codify and articulate knowledge as a necessary condition for knowledge exchange in a partnership, switched to a hypothesis that fits a sufficiency logic and contended that the “higher the foreign partner’s ability to codify and articulate knowledge, the higher the extent of knowledge acquisition by the local partner” (Minbaeva et al., 2018: p. 715). Hence, the presented hypothesis does not reflect the necessity logic applied in theorizing (see Table 2 for further examples of hypotheses and research designs that do not correspond with the formulated necessary conditions).

Building on this finding, we argue that IB research can be advanced by incorporating more rigor in differentiating between additive, configurational and necessity logic. Specifically, when using expressions like “X is a condition for Y”, “X is a prerequisite for Y”, “X is a requirement for Y”, researchers must ensure that they translate their theoretical arguments into hypotheses that reflect this necessity logic. It is crucial to consider the reasons why a specific condition is a necessary condition, namely why the absence of (a certain level of) the condition will prevent the existence of (a desired level of) the coveted outcome, why the outcome is present when the condition is present, and why no other determinant can compensate for the absence of the necessary condition (Goertz, 2017). Acknowledging the specifics of necessity logic will lead to greater precision and more theoretical clarity in IB research.

Second, researchers tend not to use empirical designs that appropriately consider the necessity logic of their theory. Following the unnoticed translation of necessity arguments into sufficiency logic hypotheses, authors typically refer to different variants of the general linear model (e.g., correlation, regression, or structural equation modeling) which are unable to identify necessary conditions. Thus, while the methodology might fit the hypotheses, it does not fit the theoretical argumentation behind it. Of the 41 articles that refer to a

necessity logic, 26 are empirical studies (while 15 are conceptual articles). Of the 26 empirical studies, 22 use a regression-based method, one uses simple correlations (while the remaining three use a qualitative design, an experiment, and chi-square tests). None of them use NCA. Hence, we identify a misfit between theory and method that may be induced by the simple unavailability of NCA in the past. We believe that our study is a timely response to recommendations made on the use of NCA regarding IB-related questions (see Aguinis et al., 2020; Fainshmidt et al., 2020). For example, Fainshmidt et al. (2020) – discussing the contributions of QCA to IB research – state: “As a general recommendation, research seeking to identify necessity should also rely on alternative methods, such as Necessary Condition Analysis.” We could not agree more since NCA is (currently) the best available methodology to analyze necessary conditions.

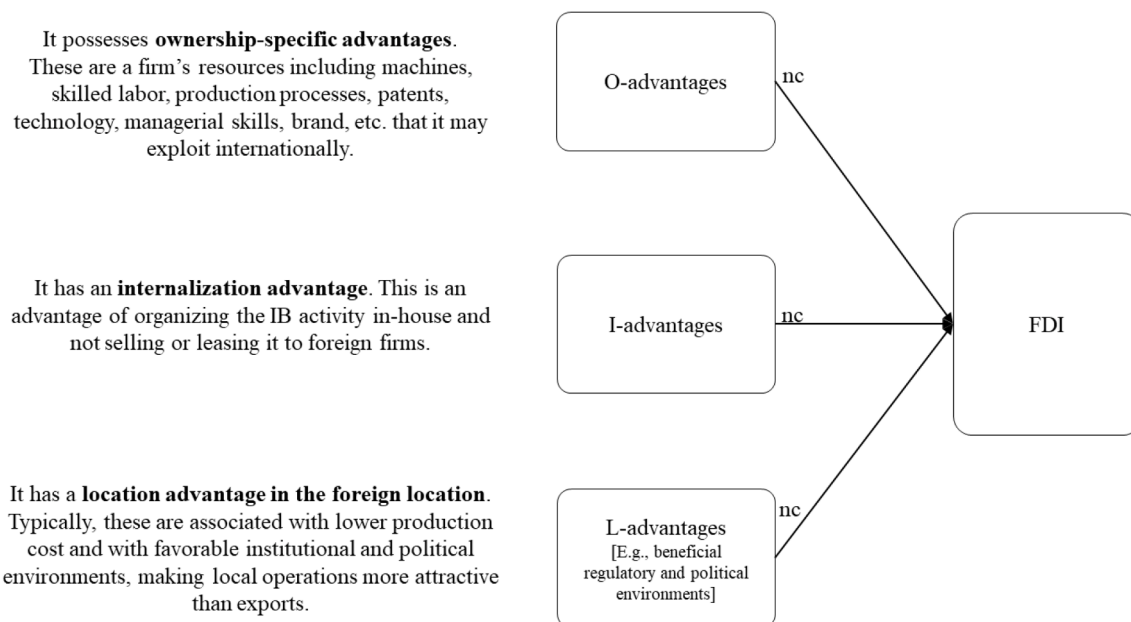
Illustrative case: Institutional environments and FDI

To illustrate the application and value of NCA in IB, we analyze whether institutional environmental factors are necessary conditions for FDI. Not only is the topic of ongoing relevance in this field (see Bailey, 2018; Nielsen, Geisler Asmussen, & Dohmann Weatherall, 2017), but it also enables us to demonstrate the value of NCA in comparison to the past use of additive and configurational approaches.

Theoretical Foundations

The ownership, location, and internalization (OLI) framework (Dunning, 1988, 2001), which builds on necessity thinking, is a main theoretical framework that explains FDI flows. Indeed, Dunning (1988) asserts that “a firm will engage in foreign value-adding activities if and when three conditions are satisfied” (Dunning, 1988: p. 45). These conditions are the possession of ownership-specific advantages,

A firm will engage in FDI if three conditions are satisfied:



Source: own illustration building on Dunning, 1988; Nielsen et al., 2017.

Fig. 3. Necessary conditions in the OLI framework.
Source: own illustration building on Dunning, 1988; Nielsen et al., 2017.

internalization advantages, and location advantages (see Fig. 3).

When it comes to explaining the location of firms' FDI, current research focuses on the influence of the L-factor and usually adopts an institutional perspective of location characteristics (e.g., Holmes et al., 2013). Following the necessity thinking of the OLI framework, an L-advantage, such as a beneficial regulatory and political environment, is considered as a necessary condition for firms to invest in a country. Other studies also refer to the notion of necessity. Bailey (2018), for instance, states that "governments most successful in attracting FDI will provide at a minimum a stable political environment where market-based institutions are reliable and predictable" (Bailey, 2018: p. 140). By introducing the notion of a minimum level, Bailey (2018) implicitly refers to necessity logic. Similarly, Pajunen (2008) focuses on the idea of necessity, indicating that a minimum level of an institutional factor is a prerequisite for FDI.

The idea that beneficial institutional environments are necessary location factors for FDI inflows are substantiated by our use of the framework outlined in Table 1. First, we contend that inward FDI will not materialize without beneficial institutional environments, as firms lack the incentive to use FDI instead of other modes to enter and serve the market. For example, it would be unrealistic to assume that firms will invest in a new manufacturing site in a country which is involved in a war (i.e., a country that lacks political stability), as this would pose considerable investment risks: thus, without political stability there is no FDI. Second, we argue that firms invest in countries with beneficial institutional environments as it is in their interest to exploit this favorable environment to their advantage. For example, in countries with a high level of political stability, firms profit from the stability in the environment without fear of expropriation or harm to their investments. Finally, in line with the OLI framework, a beneficial location cannot be compensated for by other advantages to the firm. Since we consider specific location factors, their substitutability is a matter of debate. We contend that they are not arbitrarily substitutable. That is, favorable taxation cannot compensate for the political instability of a country. Likewise, political stability cannot be a substitute if a country is imposing exorbitantly high tax burdens on foreign firms. Building on these arguments, we hypothesize that *beneficial institutional environments are necessary location factors for FDI inflows (H1)*.

Research design

Similar to using other data analysis procedures, researchers need to devote attention to the testing of necessary conditions in relevant samples (Dul, 2020b). For instance, it would be misleading to derive practical implications for small, emerging countries if the focus is on large, developed economies. In our theorizing, we did not specify a domain to ensure that the hypothesis would only hold in specific subsamples of countries or within certain periods. Accordingly, we collected data on 55 countries, presenting a representative set of both developed and developing countries (thereby covering those listed in previous studies: Holmes et al., 2013; Pajunen, 2008). Our data covers the period from 2010 to 2017.

Moreover, research needs to ensure a reliable and valid measurement of the relevant research constructs. Our variables are single items that have proved to be useful in various previous studies in the same field (although NCA can also be applied to multi-item or latent constructs, see Richter, Schubring, Hauff, Ringle, & Sarstedt, 2020). Our dependent variable is the inward FDI performance index, i.e., the ratio of a country's share of global FDI inflows to its share of global GDP. Our independent variables are the institutional factors listed in Table 3 (building on the shortlist of Bailey, 2018 and the measurements that were implemented, among others, in Holmes et al., 2013 and/or Pajunen, 2008).

We performed an outlier analysis prior to our analyses, following the procedures outlined in the literature (e.g., Aggarwal, 2017; Dul, 2021). None of our cases had to be removed from the dataset. We point out that

Table 3
Measurements of institutional factors.

Institutional Factor	Measures and Sources
(Non-)Corruption Unethical and illegal activities such as bribery, patronage, and graft (Pajunen, 2008).	Corruption perceptions index (2010–2017) provided by Transparency International Ranging from 0 (highly corrupt) to 100 (very clean) Following the procedure in Pajunen, 2008.
Tax (burden) The financial impact of government taxation policies on organizations and individuals (Holmes et al., 2013).	Tax burden measure of overall taxation (2010–2017) provided by The Heritage Foundation Ranging from 0 (high) to 100 (small) Following the procedure in Holmes et al., 2013.
Labor regulation The extent to which governments interfere with free labor market transactions (Holmes et al., 2013).	Labor freedom measure (incl. e.g., minimum wages, layoffs, restraints on hiring, hours worked) (2010–2017) provided by: The Heritage Foundation. Ranging from 0 (not free) to 100 (free). Following the procedure in Holmes et al., 2013 (here it is a part of a more comprehensive index on government control over wages and prices).
Political stability "The likelihood of violent threats to, or changes in, government" (Pajunen, 2008: p. 654).	Political stability index (2010–2017) provided by the World Bank Ranging from (approximately) -2.5 (unstable) to 2.5 (stable) Following the procedure in Pajunen, 2008.
Political rights "Extent to which the country's laws allow citizens to participate in government through, for example, voting and running for office" (Holmes et al., 2013: p. 545).	Political rights (2010–2017) provided by Freedom House. Ranging from 1 (completely free) to 7 (not free); rescaled for the analysis Following the procedure in Holmes et al., 2013, and Pajunen, 2008.

Note: There is no consistency in IB studies as regards the measurement of the institutional environmental factors. For some factors studies indicate no systematic difference in findings when using different measures (i.e., corruption, political rights), but for others there seems to be a difference caused by the measures used (i.e. taxation), while again for others this is not evident (e.g. political stability; see the discussion in Bailey, 2018). We opted for measures predominantly used in the field (see Aguilera & Grøgaard, 2019) or that were also used in Holmes et al. (2013) and/ or Pajunen (2008). These two studies address the same research questions from an additive logic and a configurational logic.

NCA is sensitive to outliers since a single case can reduce or even eliminate the empty space and, thus, reduce the necessity effect size. Therefore, researchers should always check for influential cases on or close to the ceiling line (Dul, 2020b). If these outliers are due to measurement or sampling error, they should be excluded from the analysis. If there is no measurement or sampling error, researchers should carefully consider how to deal with these influential cases. More specifically, researchers can examine the sensitivity of findings on potential outliers. That is, they can examine the influence of a potential outlier case on the effect size and its p-value to evaluate if a found necessity (or a lack of necessity) remains approximately the same or not (see Dul, 2021). In terms of a deterministic view of necessity, any single case can falsify a necessity theory. Indeed, an influential case could even be a 'best case' where a highly desired outcome is achieved without (or with a minimum level of) the condition. Such an insight is of significant practical value and can trigger theory building as it defies expected cause-and-effect relationships (Gibbert, Nair, Weiss, & Hoegl, 2020). The probabilistic view of necessity allows a few exceptions above the ceiling line. Accordingly, necessity statements are more flexible and cloaked in terms like 'practically', 'virtually', and 'almost always' necessary to indicate that, in most cases, a condition poses a constraint to the desired outcome.

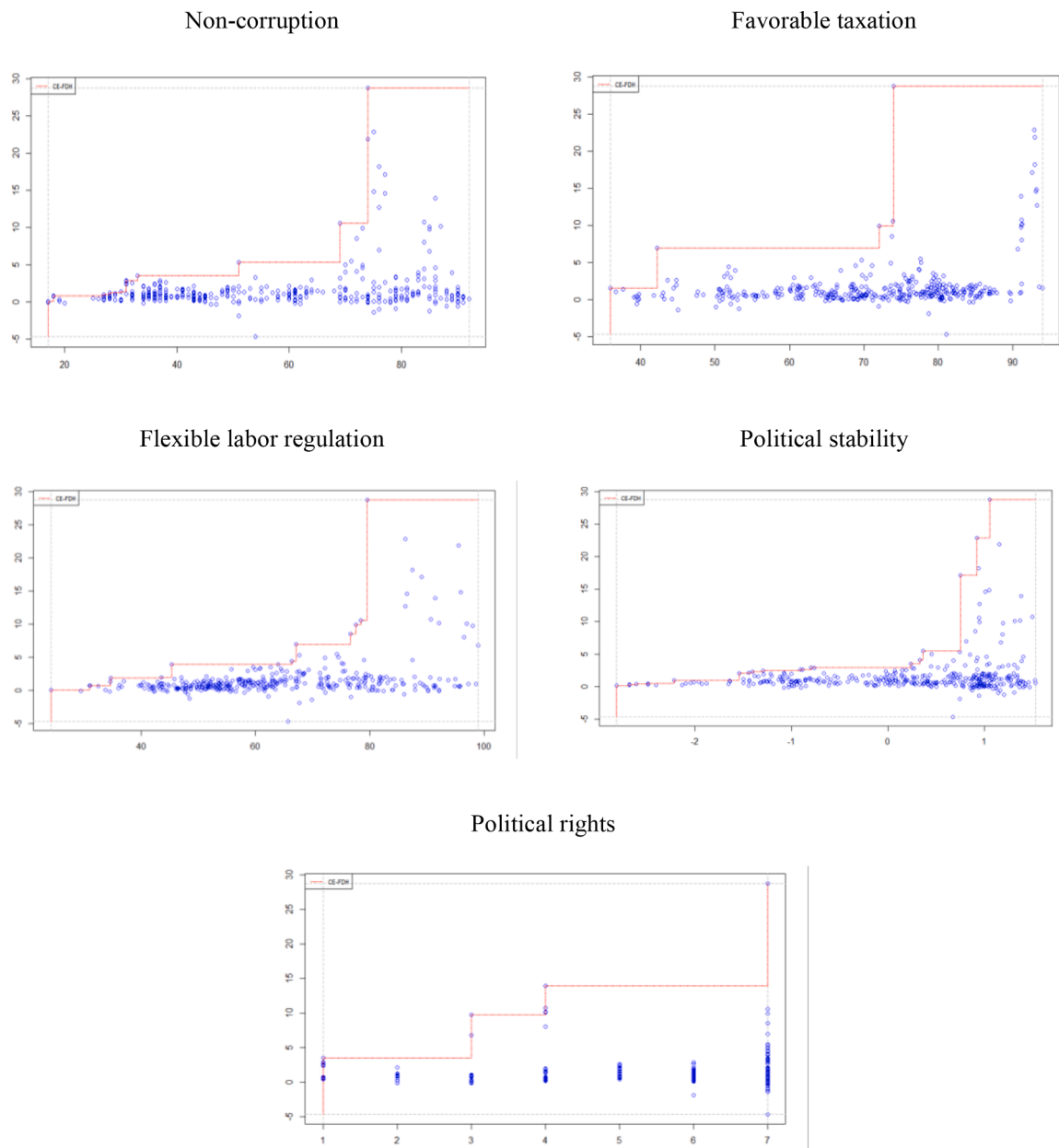


Fig. 4. Scatter plots: institutional environmental factors and FDI.

The data can be used in different formats. One approach is to average the annual data, following the line of argument that FDI entails a long-term relationship involving slow changes over time (e.g., Pajunen, 2008). Another approach is to use a time-lag perspective, namely to measure the institutional variables at time t and the outcome variable at time $t+1$ (e.g., Holmes et al., 2013). We included both formats in our analyses. Hence, we performed an NCA on both formats, i.e., on the averaged data and on the time-lagged data.²

² Note that there is no panel-data specific NCA. A recommendation is to enrich the pooled analyses by individually analyzing each year using the standard NCA approach.

Results

Fig. 4 shows the scatter plots for each institutional factor.³ The empty spaces in the upper left corners of the scatter plots show that several institutional factors may indeed present necessary conditions for FDI attractiveness. This is supported by the necessity effect sizes (Table 4). Since the pattern of observations near the ceiling line is irregular, we refer to effects sizes based on the CE-FDH ceiling lines (Dul, 2020b).

For non-corruption, favorable taxation, flexible labor regulations, and political stability we find large ($d > 0.3$) or very large ($d > 0.5$) effect sizes with low p -values. All these factors can be considered necessary conditions for FDI. By contrast, we conclude that political

³ The scatter plots show very few influential cases. These cases were not excluded since they were not the result of measurement or sampling error.

Table 4
Results of NCA.

	Time-averaged data	Time-lagged data
	Effect size d (p-value)	Effect size d (p-value)
Non-corruption	0.678 (0.038)	0.562 (0.000)
Favorable taxation	0.708 (0.013)	0.443 (0.014)
Flexible labor regulation	0.724 (0.004)	0.555 (0.000)
Political stability	0.791 (0.019)	0.668 (0.000)
Political rights	0.333 (0.788)	0.569 (0.369)

Number of permutations for estimating the p-value: 10.000 permutations; effect size related to the CE-FDH ceiling line

Table 5
Bottlenecks CE-FDH on time-lagged data (Percentage/ Actual, Equidistant).

FDI-performance Percentage (Actual value)	Non corruption Percentage (Actual value)	Favorable taxation Percentage (Actual value)	Flexible labor regulation Percentage (Actual value)	Political stability Percentage (Actual value)
0% (-4.663)	NN (NN)	NN (NN)	NN (NN)	NN (NN)
10% (-1.313)	NN (NN)	NN (NN)	NN (NN)	NN (NN)
20% (2.038)	18.7% (31)	10.8% (42)	28.2% (45)	29.4% (-1.537)
30% (5.389)	69.3% (69)	10.8% (42)	57.4% (67)	73.2% (0.364)
40% (8.740)	69.3% (69)	62.3% (72)	71.4% (78)	82.1% (0.751)
50% (12.090)	76.0% (74)	65.6% (74)	74.0% (80)	82.1% (0.751)
60% (14.441)	76.0% (74)	65.6% (74)	74.0% (80)	82.1% (0.751)
70% (18.792)	76.0% (74)	65.6% (74)	74.0% (80)	86.1% (0.923)
80% (22.143)	76.0% (74)	65.6% (74)	74.0% (80)	86.1% (0.923)
90% (25.494)	76.0% (74)	65.6% (74)	74.0% (80)	89.1% (1.053)
100% (28.844)	76.0% (74)	65.6% (74)	74.0% (80)	89.1% (1.053)

rights do not present a necessary condition as its necessity effect size is smaller and could be a random result (as indicated by the high p-values).⁴

Table 5 provides the bottleneck table for both percentage ranges and actual values of the FDI performance index (ranging from -4.663 to 28.844). The table is created along equidistant steps, along the whole value range. For instance, it shows that to achieve an outstanding FDI performance index of 25.494 (i.e., 90%), the following minimum levels (actual values) on the institutional factors need to be satisfied: non-corruption (74), favorable taxation (74), favorable labor regulations (80), and political stability (1.053).

The FDI performance of countries is unequally distributed. A few countries perform high on inward FDI, but most countries fall short of an outstanding FDI performance; hence, not all equidistant ranges in Table 5 are meaningful to policy makers. To offer interpretations of the FDI performance scores relevant to policy makers, we present a selection of specific FDI performance levels in a bottleneck table that is fine-grained within this meaningful range (see Table 6). To find these levels, we used the mean value and standard deviation of FDI performance to create categories. That is, we posited that an FDI unattractive or attractive country is a country that is more than one standard deviation below or above the mean FDI performance. For those in between

these ranges, we used equidistant intermediate levels. Accordingly, the bottleneck table indicates that in order for a country to achieve an FDI performance index of 3.714, which we deem mainly attractive, it needs to have a non-corruption perception index of 51, a favorable taxation index of 42, a flexible labor regulation index of 42, and a political stability index of 0.331 (all actual values). Policy makers must overcome these bottleneck, institutional index values to elevate their countries to a comparatively high level of attractiveness for FDI inflows. We will further discuss these results and their implications in the following.

Discussion

IB is a relatively young research field that faces complex and interdisciplinary research dilemmas. In addition, IB research is dynamic over time with constant change stemming from the dynamism of the international environments and business systems. This increases complexity (e.g., Eden & Nielsen, 2020). Understanding IB phenomena requires researchers to “combine theories, concepts, data and methods from multiple disciplines to explore the scope or boundary conditions of multiple disciplinary perspectives” (Cheng, Henisz, Roth, & Swaminathan, 2009: p. 1072). In the recent past several researchers have outlined a number of approaches and toolsets that fit the specific challenges posed by IB (e.g., Aguinis et al., 2020; Cuervo-Cazurra, Andersson, Brannen, Nielsen, & Reuber, 2016; Fainshmidt et al., 2020). In this paper we argue that necessity logic and NCA can contribute to coping with the challenges of specific relevance to IB.

Implications for IB Theorizing

First, IB researchers often face alternative explanations that fit the IB phenomenon under investigation (e.g., Cuervo-Cazurra et al., 2016). These explanations involve alternative theoretical frameworks (among others, borrowed from other management disciplines) and alternative logics that underly the theoretical mechanisms. Necessity logic is one of these alternatives. In this regard, the OLI framework presents an interesting case. Dunning (1988), in his summary of the OLI framework, outlines that a firm will only engage in international activities if three conditions are satisfied. First, the firm must have net ownership-specific advantages vis-à-vis other firms when serving markets. Second, it must be more beneficial for the firm to use these advantages itself, rather than to sell or lease them. Third, it must be in the firm’s interest to use these advantages in conjunction with the locational advantages of countries (Dunning, 1988). The OLI framework is not only popular, but it also dominates the field. Many authors refer to its key arguments, among others that “the possession of firm-specific assets is a necessary condition for the successful internationalization of MNEs” (Kirca, Fernandez, & Kundu, 2016: 628). Hence, the prevailing wisdom in the field is that MNEs do not exist if these conditions are not satisfied, i.e., there is no Y (the MNE) if the O, L, and I conditions (X) are not satisfied. However, recent voices raise the issue whether the extant literature is correct in assuming that competitive advantages constitute a necessary condition for the emergence of MNEs. Among others, Hashai and Buckley (2014) discuss certain conditions under which MNEs exist without possessing such advantages and conclude that firms “do not need a competitive advantage to become MNEs” (Hashai & Buckley, 2014: p. 46). We believe that a further differentiation of O, L, and I arguments along additive, configurational and necessity logics would advance the field. Therefore, this serves as an example of alternative explanations that can be tested using NCA. The addition of NCA to existing toolsets creates the

⁴ We complemented these analyses with a year-by-year analysis, provided in Appendix 2. This analysis supports the outlined findings.

Table 6
Bottlenecks CE-FDH on time-lagged data (Actual values, Classified).

Classification	FDI-performance	Non corruption	Favorable taxation	Flexible labor regulation	Political stability
unattractive	-1.648	NN	NN	NN	NN
mainly unattractive	-0.307	NN	NN	NN	NN
more or less unattractive	0.698	18	NN	31	-2.211
neither nor	1.703	31	42	35	-1.537
more or less attractive	2.708	31	42	45	-0.795
mainly attractive	3.714	51	42	45	0.331
attractive	5.054	51	42	67	0.364

possibility of testing dominant against alternative theoretical viewpoints that include and challenge the necessity logic of popular paradigms.⁵ Indeed, in addition to more traditional logics (i.e., additive and configurational logics), more attention to necessity logic can advance theorizing on associations and underlying mechanisms in the field. It can rule out some of the alternative explanations and provide more clarity on theories that fit specific IB-related issues (see also [Aguinis et al., 2020](#)).

Second, most IB theorizing is contextual. So, an explanation that fits a particular country or cultural context does not necessarily fit other countries. In fact, several authors in IB call for the further contextualization of IB research (e.g., [Meyer, 2013](#); [Teagarden, Von Glinow, & Mellahi, 2018](#); [Tsui, 2007](#)). Necessity logic and NCA benefit this contextualization endeavor because they enhance our understanding of necessities that may be involved in some but not all country and/or cultural contexts. Hence, they advance the field by understanding the theoretical necessity mechanisms that, among others, apply to specific countries, sub-regions, cultural clusters, and institutional environments.

Third, IB research – and practice – is extremely complex. Research on IB phenomena is characterized by complex conceptual models that include many determinants influencing an outcome (e.g., [Eden & Nielsen, 2020](#); [Richter, Sinkovics, Ringle, & Schlaegel, 2016](#)). This complexity can be overwhelming. Necessity logic and NCA address this complexity as they provide an understanding of the critical factors that must be present to prevent failure. This assists researchers in creating parsimonious models that not only reduce complexity, but that also provide results that are of value to researchers, business practitioners and policy makers (see also the subsequent discussion of practical implications). Notably, theorizing on necessity logic might be more difficult than expected. The reason is that we are familiar with dominant sufficiency logic thinking according to which an outcome usually depends on multiple determinants, where one determinant may complement another. Authors who want to engage in relevant theorizing can use the framework provided in [Table 1](#). Importantly, NCA, like any other data analysis procedure, cannot conclusively prove causality. The requirements for causal interference are the same as for any other type of cause-effect relations, i.e., a necessary cause is more plausible if the cause precedes the outcome, the cause is related to the outcome, and no other variable is responsible for the observed relationship. Accordingly, it is important that the identified necessary conditions are theoretically justified, i.e., researchers must discuss the causal mechanisms that explain the necessity ([Dul, 2020b](#)). More intuitively formulated necessary conditions in IB (as outlined in our literature review) sometimes lack this specific theoretical thinking.

⁵ When applying NCA to a field that presents both theoretical arguments for and against necessity, the detailed insights into the bottleneck levels could show that necessity depends on the level of the outcome and therewith may help to resolve the theoretical conflict. For instance, there may be a necessity relationship at high levels of an outcome, but not at lower levels of the outcome.

Implications for IB research

Our review revealed a mismatch between theory and method: while we found many indications of necessity logic in the theoretical arguments, researchers often applied a regression-based procedure which is misleading. Researchers should be aware of the different logics implied by the different methodologies, since ignoring them bears the risk of inappropriate conclusions. Thus, we strongly recommend that when researchers theoretically refer to necessity logic, they should translate this into necessity hypotheses and apply NCA to test for necessity. Pure necessity theories can be tested with NCA as a stand-alone method, allowing a clear narrative and a straightforward analysis ([Dul, 2021](#)).

Using NCA as a stand-alone method allows the addition of a necessity view to specific research questions (which previously might have been studied within a sufficiency perspective). However, in some instances the goal may be to test both necessity and sufficiency relations simultaneously. Whenever this is theoretically justified, in line with [Nielsen et al. \(2020\)](#) suggestion to make more use of triangulation in IB research, we recommend the use of NCA in combination with established methods like OLS, SEM, or QCA. Additive, configurational and necessity logics each address a specific perspective, which implies that each individual logic is ignorant of the perspectives of the others. For example, analyzing necessary conditions reveals the determinants that can prevent the existence of an outcome, but not the predictors that produce a desired outcome. Hence, the analyses of our illustrative example revealed that countries should ensure a minimum level of non-corruption, favorable taxation, flexible labor regulations, and political stability to make FDI possible. However, none of these factors can individually contribute to increasing FDI or ensure FDI if combined. Methodological triangulation “expands the scope of inquiry by allowing for a greater range of research questions to be addressed, and a more holistic understanding of the phenomenon obtained” ([Nielsen et al., 2020](#): p. 1494). Thus, using NCA along with other methodologies makes it possible to address a phenomenon in different ways that complement each other.

For example, the NCA results can complement the findings of regression-based approaches (and vice versa). Studies using additive sufficiency logic (e.g., [Holmes et al., 2013](#); and the overview in [Bailey, 2018](#)) indicate that institutional factors are significantly related to FDI. For example, in his meta-analysis [Bailey \(2018\)](#) demonstrates that most studies find a positive relationship between political stability and inward FDI. Hence, the higher the level of political stability in a country the higher the inward FDI. We find that political stability is a necessary condition for FDI. Thus, for a country to attract inward FDI, political stability needs to surpass a certain level. As in this example, the analyzed factors can be both significant determinants from an additive logic and necessary conditions. In this situation, the findings confirm that a minimum level of the institutional factor must be surpassed and that increasing the institutional factor has the potential of increasing FDI. Likewise, other combinations of findings are possible: an institutional factor can be a non-significant determinant from an additive logic, but a necessary condition. In this case, although a minimum level of the institutional factor must be satisfied to achieve a certain level of FDI, any further increase in the institutional quality of this factor will not result in

more FDI. If an institutional factor is neither a necessary condition nor a significant determinant, researchers combining these two logics would conclude that it is not relevant to FDI.

Another example is the combination of NCA and QCA. Using fuzzy-set QCA, Pajunen (2008) indicates that policy makers in central-eastern European countries, such as Bulgaria, concur that either “political stability, political rights, civil liberties, and [a] just judicial system” or “political stability, political rights, civil liberties, and property rights” will ensure FDI attractiveness. The NCA can complement these results by identifying the necessary levels of the individual components in these configurations. For instance, in our illustrative analysis the NCA demonstrated that a political stability score (actual value) of at least -1.537 is necessary for average FDI attractiveness. Hence, the NCA offers an added level of precision. It identifies the specific levels of the condition that are necessary for various levels of the outcome. In addition, it can complement the configurational logic by identifying necessary AND-configurations (i.e., multiple, single necessary conditions that are each individually necessary) (Vis & Dul, 2018). For instance, we find that there are four minimum levels of necessary conditions for average FDI attractiveness: non-corruption (31), favorable taxation (42), flexible labor regulation (35), and political stability (-1.537). There are first ideas worth exploring on how, technically best, to complement QCA with NCA (see Dul, 2020a).

In sum, we strongly recommend using NCA (as a stand-alone method) whenever researchers use necessity logic in their theoretical arguments, and we furthermore recommend a combination of NCA and other methodologies. The latter allows researchers to identify the factors and their respective levels that must be present for an outcome (i.e., necessity logic), and the factors or combinations of factors that contribute to achieving an outcome (i.e., additive and configurational logics). Nielsen et al. (2020) point out that it is easy to make claims about triangulation, but that it is difficult to implement triangulation. Indeed, not being feasible on account of time, resource, or manuscript length restrictions, it is unrealistic to expect that every study should use different methodologies. However, beyond the context of a single study, we believe that adding NCA to the toolset of IB research can advance the entire field. This application of a novel perspective on causality and data analysis adds to existing studies that use more traditional logics and analytical approaches.

Implications for IB practice

The IB community is increasingly concerned about research that has meaning beyond academia; IB research needs to be transferable to practice, policy and society (Aguzzoli, Gardner, & Newburry, 2021). Practitioners and policy makers typically focus on factors that are crucial for success instead of all the factors that can influence an outcome (represented in complex models). NCA delivers results that provide input on these ‘must have’ factors; factors that should be taken care of at the outset. Even if, according to traditional analyses, certain factors exert a significant influence on the outcome on average, this effect will not materialize without satisfying the necessary conditions.

The practical relevance of NCA is illustrated by the specific case of Bulgaria. If Bulgarian policy makers are interested in making their country a ‘mainly attractive’ market for inward FDI (according to our interpretation of specific FDI performance levels), they need to ensure the fulfillment of the must-have necessary levels. According to our analyses, Bulgaria presents a non-corruption perception index of 41 ($41 < 51!$), a favorable taxation index of 91 ($91 > 42$), a flexible labor regulation index of 72 ($72 > 45$), and a political stability index of 0.077 ($0.077 < 0.331!$; the numbers are from 2016). As a result, the Bulgarian policy makers face two critical bottlenecks, namely too much corruption

and insufficient political stability. Thus, Bulgaria cannot improve its inward FDI by, for instance, granting further tax benefits. It first needs to improve the corruption perception of their country (to a level of non-corruption perception of 51) and their political stability (to a level above 0.331) to attract FDI. These results show that researchers, by including NCA in IB, can produce results which are of considerable practical value (in this case for policy makers).

Conclusion

Necessary conditions and necessity logic are extensively referred to in IB research. We encourage IB researchers to carefully position their theoretical arguments when they refer to necessity logic and to pay more attention to the translation of their theoretical arguments into necessity hypotheses, as this would advance conceptual thinking in IB. Moreover, we encourage researchers to apply NCA to support or falsify their necessity hypotheses and to ensure a theory-method fit.

We found numerous necessity statements in our review of the IB literature. Many of them were present in studies that aimed to explain internationalization. More specifically, the authors of these statements discussed the necessity of network advantages and ‘insidership’ in networks for internationalization, the necessity of location factors in internationalization, and the necessity of firm-specific assets, resources, and dynamic capabilities as conditions for the internationalization patterns and outcomes in IB. In addition, necessary conditions were often found in transaction cost-related theories that address internationalization processes or entry modes. Likewise, a more recent research topic that engages necessity arguments is knowledge sharing. The authors in this domain discussed necessity in the context of knowledge sharing related to innovation, headquarter and subsidiary relationships, and organizational learning. These are key topical areas that can significantly benefit from precision in the applied logic, as well as from more specificity in necessity thinking and the application of NCA.

Although IB researchers consider the ‘determinants of success’ in various subfields, thinking about the critical factors that induce failure could be a fruitful avenue to enrich our understanding of the mechanisms that explain the failure of, among others, institutions, MNEs, strategic alliances, and international teams. Finally, considering that necessity logic and NCA has the potential to benefit IB research more generally, especially by ruling out alternative, interdisciplinary explanations, by assisting the theorizing process on contextual domains in which certain explanations hold, and by reducing the complexity of IB research phenomena, we recommend their explicit use to confront future grand challenges of IB research.

Data Availability

Data will be made available on request.

Acknowledgements

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Appendix

Appendix 1

Necessary conditions in IB: Logic, hypotheses, analysis techniques, and interpretations.

Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
Topic: Explaining internationalization (patterns) and the existence and performance of the MNE (total: 16)						
Hennart, 2019 (C)	OLI; network advantages as NCs	The article discusses the application of internalization theory with reference to digitalized firms. In this context, traditional OLI thinking involving the necessity (but not sufficiency) of firm specific advantages (FSAs), and the necessity of location advantages for FDI are discussed. Moreover, to explain internalization, these are contrasted to a conceptual model developed by the author who concentrates on interdependency and not the firm. Ultimately, the author explicitly argues against specific necessary conditions that are prevalent in traditional theories. '(...) the rationale for internalization is not only the safeguarding of firm specific advantages by intangible-exploiting firms, but more generally the greater profits that can sometimes be achieved by organizing interdependencies through control of behavior than through exchange of outputs. This explains why the <u>possession of firm specific advantages is not a necessary condition for FDI.</u> '; 'Note also that <u>market failure is not a necessary condition for the emergence of MNEs.</u> Even if organizing an interdependence within an MNE is more profitable than doing it on the market, the benefits of doing so must be higher than the costs.' (p. 1392)	not applicable (n.a.)	n.a.	n.a.	n.a.
Smit, Pennings, & van Bekkum, 2017 (E)	Internationalization success; location factors as NCs	The article discusses how growth options are influenced by transactional uncertainty stemming from institutional voids (e.g., property rights, business regulations, contract enforcement) and economic uncertainty. 'Transactional uncertainty leads to less option investments and decreases growth options value.' 'A <u>country's institutions limit external uncertainty by creating the necessary conditions for properly functioning markets</u> in, e.g., products, talent, ideas, and capital. Hence transaction costs decrease as institutions eliminate uncertainty (...), which is why we call such uncertainty "transactional uncertainty due to institutional voids."' (p. 625)	'Hypothesis 1: <u>Transactional uncertainty stemming from institutional voids decreases the proportional value of growth opportunities</u> (...).' (p. 626)	Regression-based [Transactional uncertainty is tested using, e.g., business regulations, property rights, contract enforcement as measures].	'Institutions are positively (and transactional uncertainty is negatively) correlated with growth, lending support to Hypothesis 1.' (p. 636) 'Filling institutional voids significantly increases a firm's proportional growth opportunities' '(...) <u>institutions, such as property rights, business regulations, and contract enforcement are important preconditions for companies to appropriate growth option value</u> ' (p. 639)	No
Witte, Burger, Ianchovichina, & Pennings, 2017 (E)	Internationalization (location choice); location factors as NCs	The article studies the relationship between political violence and greenfield FDI. '...scholars tend to agree that political violence has a detrimental effect on expected returns, reducing the propensity to invest. (...) The average effect of (...) political risk on FDI is	'Hypothesis 1: Total greenfield FDI flows in developing countries are <u>negatively associated with political conflict.</u> ' (p. 868)	Regression-based	'We find support for the first hypothesis, namely that political conflict has a negative effect on FDI' (p. 873). 'We <u>argued in the theoretical</u>	No

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Appendix 1 (continued)

Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
		consistently found to be negative (...)' (p. 866) 'Both a <u>high level of impact and a high degree of risk continuity are necessary conditions for political violence to affect location choice</u> '; '(...)' the risk of political violence has to be relatively continuous to affect location choice. In other words, the underlying event needs to be fairly persistent and predictable. (...) Oetzel and Oh's study also showed that a recent terrorist attack does not significantly affect the probability of entry, <u>confirming our statement that a certain level of continuity is a necessary condition for political violence to have a direct effect on location choice strategies.</u> ' (p. 867)			section that there are two <u>necessary conditions</u> for political violence to affect FDI inflows. ... <u>political conflict is the only type of political violence that meets these conditions</u> (...); '(...)' we include measures for terrorism, political terror and assassinations in our regression models to test our assumption that political violence must be both relatively continuous and detrimental to returns on economic activity'; 'The results confirm that terrorism, political terror, and assassinations do not affect FDI inflows' (p. 876–877) '... our results suggest that a certain level of continuity and impact are necessary conditions for political violence to affect FDI. Only political conflict, a continuous and high impact type of political violence, has a significant effect on FDI. ...' (p. 884)	
Kirca et al., 2016 (E)	Internationalization success; firm specific assets as a necessary condition (an NC)	The article examines the multinationality and performance relationship with a focus on FSA and MNCs in emerging markets, drawing upon internalization theory. 'According to internalization theory, the <u>possession of firm-specific assets (FSAs) is a necessary condition for the successful internationalization</u> of multinational companies (MNCs) (...)' (p. 628)	'H1. Technological assets <u>strengthen</u> the positive effects of multinationality on financial performance more strongly for manufacturing [firms] than for service [firms].' (p. 630) 'H2. Marketing assets <u>strengthen</u> the positive effects of multinationality on financial performance more strongly for service [firms] than for manufacturing [firms].' (p. 630)	Regression-based [They measure FSA using advertising intensity and R&D intensity; both as independent and moderator variables]	'...we demonstrate that emerging MNCs do indeed possess traditional FSAs and these FSAs are critical for success in foreign markets. ... our findings imply that marketing assets are critical to ... operate profitably in foreign markets..., as predicted by internalization theory' (p. 637) [Conclusions are based on the moderation tested].	No
Lin, 2016 (E)	Internationalization success; resources as an NC	The article analyses the relationships between equity stakes in group-affiliated firms on FDI decisions. 'To be successful, firms must have appropriate resources for international expansion. However, <u>possession of such resources is a necessary but insufficient condition to achieve a competitive advantage</u> . To achieve a competitive advantage, especially in international markets, such resources must also be managed effectively (...) The human capital of the firm's managers performs this managerial	[The necessity arguments are not key to hypotheses testing; Hypothesis 3: Business-group headquarters are less likely to hold higher equity stakes in group-affiliated firms that have human capital, than they have in group-affiliated firms that have no human capital.]	n.a.	n.a.	n.a.

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Appendix 1 (continued)

Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
Ma, Ding, & Yuan, 2016 (E)	Internationalization; knowledge and exploitation of institutional environments as NCS	<p>role.' (p. 527)</p> <p>'(...) managers of group-affiliated firms with human capital represent a potential source of competitive advantage. The resources of the business-group headquarters become less relevant as group-affiliate firms with human capital have an adequate level of resources and capabilities' (p. 527)</p> <p>The article investigates the influence of institutional environments and firm-level capital on internationalization.</p> <p>'(...) the literature emphasizes <u>two requirements for the exploitation of institutional advantages</u>: having broad knowledge of institutions and the capability of utilizing these institutions' '(...) although <u>understanding the institutional environment is a necessary condition for firms to gain access to institutional benefits, it is not sufficient</u>' '(...) The second requirement is that firms must have the <u>capability of exploiting and utilizing the opportunities</u> the institutional environment offers.' 'The institution-based view speaks to MNCs' location advantages (...) However, these advantages might not materialize if firms lack the relevant capability of recognizing institutional variation (...) and proactively managing the institutional environment and (...) differences (...) ' (p. 845)</p>	<p>'Drawing from the institution-based view, we suggest that the home country subnational institutional environment affects internationalization decisions (...) 'H1. The development of subnational institutions in the home country exerts a positive effect on emerging economy entrepreneurial firms' degree of internationalization.' '(...) some firms are more capable than others in spotting, recognizing, and exploiting the opportunities in the subnational institutional environment.' '(...) <u>political capital improves entrepreneurial firms' capability of gaining access to resources from subnational institutional environments by enhancing their credibility and legitimacy.</u>' (p. 846–847)</p>	Regression-based [They measure political capital as an independent and moderator variable.]	<p>'Political capital No enhances entrepreneurial firms' capability of utilizing the institutions and understanding of institutional environments (...) ' (...) we (...) recognized the potential of deploying political capital to enhance entrepreneurial firms' alignment with their home environments, which is an important mechanism to enhance firms' capability of utilizing and exploiting institutional benefits in emerging markets. This finding means that <u>embedment within well-developed home country institutional environments is necessary but not sufficient in itself for entrepreneurial firms to attain specific</u></p>	

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Appendix 1 (continued)

Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
Lu, Liu, Wright, & Filatotchev, 2014 (E)	Internationalization (FDI entry); experiences and location factors as NCS	The article investigates the relationship between international experience and FDI and how it is moderated by government support. The authors explicitly argue against specific necessary conditions. '(...) we argue that well-developed institutions in host countries reduce the importance of experiential learning as firms face low political risks and uncertainty when operating in such a context. ... under-developed institutions generate hazards of expropriation and transactional uncertainty, and so foreign firms have to rely on their prior experience to understand, interpret, and deal with political and operational risks in foreign locations. This implies that <u>direct experience of a host country is no longer seen as a necessary condition for FDI entry when firms operate in a host country with well-established institutions.</u> ' (p. 432)	'Hypothesis 2: <u>High quality of host country institutions will reduce the importance of a Chinese firm's prior international experience in a host country in facilitating an FDI entry.</u> ' (p. 433)	Regression-based [experience and supportive policy as independent and moderator variables]	'Our study focuses on the interrelationship between (...) No prior international experience (...), FDI promotion policies (...), and the quality of host country institutions (...), and conducts a detailed analysis of how (...) government support and host country institutions interact with prior international experience (...)' 'Our findings indicate that the importance of firms' prior international experience (...) varies, depending on the institutional context (...)' ' <u>Our findings help managers of MNEs understand the conditions necessary to conduct FDI and show that government support is an important contingency factor</u> (...)' (p. 444–445)	<u>advantages for international expansion.</u> ' (p. 850)
Filatotchev et al., 2009 (E)	Internationalization; R&D and network membership as NCS	The article examines the factors that affect the export orientation and export performance of SMEs. '(...) <u>investment in R&D and network membership may represent necessary but not sufficient conditions for internationalization.</u> ' (p. 1007); 'We expect that the internationalization process of SMEs in emerging markets will be driven by their innovation strategy, supported by investment in R&D and their global networks.'; (...) innovation capabilities not only promote the export orientation of firms, they also enhance export performance (...)' (p. 1008)	'Hypothesis 1a: <u>Export orientation of the SME is positively associated with R&D intensity.</u> '; 'Hypothesis 1b: Export performance of the SME is positively associated with R&D intensity.' (p. 1008); 'Hypothesis 2a: <u>Export orientation of the SME is positively associated with the presence of global networks.</u> '; 'Hypothesis 2b: Export performance of the SME is positively associated with the presence of global networks.' (p. 1009)	Regression-based	'The results (...) show that the possession of global networks (...) are significantly associated with export orientation and export performance'; 'R&D intensity receives mixed support with respect to export orientation (...), but is significantly associated with export performance (...)' 'Perhaps high levels of R&D spending enable SMEs to respond quickly to the technological demands of global customers.' (p. 1016–1018) In their interpretation of further findings, the authors highlight: '(...) <u>the result may suggest that innovation is a necessary condition under which firms are able to compete in international markets in high-tech industry,</u> regardless of whether those firms are owned by returnee entrepreneurs or by home-grown entrepreneurs.' (p. 1018)	No
Johanson & Vahlne, 2009 (C)	Internationalization; insidership in networks and short psychic distance as NCS	The article introduces a revised version of the Uppsala internationalization process model and in this context involves key necessity logic arguments: 'Our core argument is based on business network research and has two sides. The first is that markets are networks of relationships in which firms are linked to each other in various, complex and, to a considerable extent, invisible patterns. Hence <u>insidership in relevant network(s) is necessary for successful internationalization,</u> and so by the same token there is a liability of outsidership. <u>Second, relationships offer potential for learning and for building trust and commitment, both of which are preconditions for internationalization.</u> ' (p. 1411–1412)	n.a.	n.a.	n.a.	n.a.

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Appendix 1 (continued)

Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
Qian & Delios, 2008 (E)	Internationalization; internalization benefits as NCs	<p><u>'Insidership in relevant networks is a necessary but insufficient condition for successful internationalization.'</u> (p. 1411, and 1415); <u>'Short psychic distance</u> will facilitate the establishment and development of relationships, which is a <u>necessary but insufficient condition for the identification and exploitation of opportunities.'</u> (p. 1425)</p> <p>The article investigates the foreign activities in the banking sector, more specifically the motivation for foreign expansion and the determinants of foreign market choice. 'The greater the imperfections in the markets for the exchange of [firm specific assets], the more likely it is that a firm that possesses these assets will use FDI to transfer the advantages embodied in these assets across national borders. We call advantages that come from the internalization of those products (...) Type 1 IB (<u>internalization benefits</u>). Type 1 IB constitute a <u>necessary condition for cross-border internalization</u> (...)' (p. 233–234) And then, further on type 1 IB: '(...) multinational banks can secure revenues from its clients by matching its (...) products and (...) specific needs in their international operations. Information concerning a client's financial requirements (...), and other aspects of their operating status is an essential input into the development of the final products and services that a bank offers to its client. This intermediate product involves valuable knowledge (...). To build up client-specific information is a time-consuming process, which requires the bank to make detailed plans to acquire, develop and exploit the information. (...) Because the information is specific to the very relationship between that client and the bank, the external market fails; it is unable to mediate a price for the information, even if a bank wanted to sell that information to allow its clients to be serviced by a bank in its client's foreign markets (...). Consequently, (...) a bank is motivated to build a (...) presence in a host country via FDI, to internalize the exchange of client information.' (p. 234)</p>	'Hypothesis 1: The likelihood of a bank's entering a given host country is <u>positively related to its domestic clients' FDI activities in that host country.</u> ' (p. 234)	Regression-based	'This result is consistent with H1: No the greater the number of entries by a bank's clients in a country, the more likely a bank is to enter that country.' (p. 241) '(...) we observed the expected positive relationship between a bank's clients' foreign entry activities and the likelihood of a bank's entering a foreign country. The motivation for a bank's foreign entry comes from the internalization benefits associated with an internal, cross-border transfer of a bank's information/ knowledge in dealing with its clients, or a bank's expertise in international trade settlement.' (p. 244)	No
Barkema & Drogendijk, 2007 (E)	Internationalization success; experiences as an NC	<p>The article discusses the internationalization process (incremental versus larger steps) of firms, the role of international experience, and the related performance implications.</p> <p><u>'A key assumption of our study is that learning how to handle foreign cultures is a necessary condition for successfully operating abroad.</u> Since the early days of IB, researchers have emphasized the 'liability of foreignness' (...) implying that a lack of knowledge of local cultures and institutions reduces performance and increases the failure rate of foreign expansions (...). In order to <u>enhance the success</u> of their foreign</p>	'Hypothesis 1a: <u>Experience</u> in a cultural bloc <u>improves</u> the performance of later investments (...); 'H1b: Local contractual <u>experience</u> (...) <u>improves</u> the performance of subsequent FDI (...); 'H1c: When doing FDI, companies <u>benefit from</u> previous FDI <u>experience</u> in the same country'; 'H2: Companies that enter a country through immediate FDI <u>benefit more</u>	Regression-based [conditional effects implemented, and subsamples of different levels of experience analyzed]	'Consistent with our theory, we found that companies benefited from their experience when expanding to other countries in the same bloc.'; 'Apparently, sequential expansion paths may still increase local learning and success.' (p. 1143)	No

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Appendix 1 (continued)

Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
		operations, <u>companies need to learn</u> about institutions (...)’ (p. 1134)	<u>from their FDI experience</u> when undertaking subsequent FDI in the same country than do companies whose initial entry was through contractual means (...); ‘H3: <u>International experience improves the performance of FDI in a new cultural bloc.</u> ’ (p. 1137–1138)			
Galan, Gonzalez-Benito, & Zuñiga-Vincente, 2007 (E)	Internationalization success; OLI as NCs	The article analyses the location decisions (FDI) of multinational enterprises. ‘(...) it is (...) important to recognize that, although <u>the possession of such ownership specific and internalization advantages is a necessary condition for achieving a better international competitive position.</u> it is not sufficient for ensuring the potential success of investment decisions in foreign countries (...) <u>similarly, location factors (...) are one of the basic determinants</u> that should be taken into consideration (...) location factors can affect the global competitiveness of firms, and hence determine their chances of future survival.’ (p. 977–978) ‘(...) a detailed list of the main location factors considered by several empirical studies that have examined their positive or negative influence on the location decisions of MNE managers ...’ (p. 980); ‘Ultimately, all these reasons help in understanding <u>why certain market factors frequently show a positive impact on the inflow of FDI.</u> ’ (p. 982)	[The necessity arguments are not key to hypotheses testing; ‘Hypothesis 1: The relative importance of specific location factors for the FDI decision is, to a major extent, dependent on the host country’s stage of economic development within the IDP.’ (p. 982)]	n.a.	n.a.	n.a.
Luo & Tung, 2007 (C)	Internationalization success; dynamic capabilities as NCs	The article presents a springboard perspective to describe the internationalization of emerging market, multinational corporations. Several of the authors’ arguments relate to necessities, although necessity logic does not seem to be the focus of their framework. ‘(...) springboard’ moves allow EM MNEs to alleviate some latecomer or newcomer deficiencies in areas such as consumer base (...)’ (p. 485); ‘(...) EM MNEs use outward investment as a springboard to bypass stringent trade barriers (...). This allows EM MNEs to leverage their massive production capabilities while avoiding their deficiency in reaching and interacting with overseas customers or end users.’ (p. 486) ‘EM MNEs’ motives behind the springboard behaviors can be broadly summarized as (1) asset-seeking or (2) opportunity-seeking. (...) <u>These assets are necessary to meet the needs for (1) bolstering economic and social development at home, and (2) compensating firm-level competitive disadvantages.</u> ’ (p. 487) ‘According to the dynamic capability theory, <u>a firm’s ability to deploy, transfer, and manage geographically dispersed critical resources (...) is a necessary condition for sustained success in global competition.</u>	n.a.	n.a.	n.a.	n.a.

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Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic	
Weerawardena, Mort, Liesch, & Knight, 2007 (C)	Internationalization; market knowledge as an NC for internationalization in born global firms	To overcome post-springboard and post-acquisition challenges, emerging markets MNEs have to plan ahead the global resource-flow and product-flow systems before embarking on expansions ahead.' (p. 495)	The article presents a conceptual model of born global firm internationalization that is embedded in ideas on the role of market knowledge as an NC – yet the conceptual framework itself focuses on the antecedent learning and knowledge building processes. ' <u>(...) market knowledge is a necessary but insufficient condition for the development of leading-edge knowledge evidenced as innovative products (...)</u> which facilitates multiple market entry simultaneously in the firm's early stages of internationalization. (...) Following this analogy, we conjecture that (...) the firm must acquire knowledge from other sources to develop leading edge innovative products and services that will fulfill these needs.' (p. 296–297) 'In sum, our conceptualization draws on a foundation of organizational learning theory in that we argue that for accelerated internationalization <u>the firm must learn from multiple sources, and that knowledge results from this learning.</u> ' (p. 298); ' <u>(...) there are three learning capabilities that are instrumental to early internationalization in born global firms: market-focused learning capability, internally focused learning capability, and networking capability.</u> ' (p. 300)	n.a.	n.a.	n.a.	n.a.
Oviatt & McDougall, 2005 (C)	Internationalization; NC specific to the existence of international new ventures	The article presents a framework to understand the existence of international new ventures. ' <u>(...) a framework that describes four necessary and sufficient elements for the existence of international new ventures: (1) organizational formation through internalization of some transactions, (2) strong reliance on alternative governance structures to access resources, (3) establishment of foreign location advantages, and (4) control over unique resources.</u> ' (p. 29)	'The first three elements define the necessary conditions for the existence of an international new venture (...). However, these are not sufficient conditions for sustainable competitive advantage. Sustainable competitive advantage (...) requires that its resources be unique.' (p. 36)	n.a.	n.a.	n.a.	n.a.
Henisz, 2003 (C)	Internationalization; location advantages as NCs	The article examines whether extant theories can explain the observed flows of FDI. It proposes some extensions that relate to investments in politically salient industries and in capital-scarce countries. ' <u>(...) I extend their discussion of effective cooperation with host governments so that this ability, like the</u>		n.a.	n.a.	n.a.	n.a.

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Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
		ability to innovate and market, <u>may provide multinational firms with an advantage</u> over their domestic counterparts. This advantage will not be present in all markets. Industries characterized by substantial government involvement (...) are more likely to engender such investment. <u>Capital scarcity in the domestic market is another necessary condition</u> . In these cases, which are increasing in relative economic importance, the ability to manage institutional idiosyncrasies should be added to the ability to innovate as a key component of a long-run theory of the multinational enterprise.' (p. 183)				
Topic: Foreign entry mode (success) (total: 4) Zhou & Poppo, 2010 (E)	Foreign entry modes; transaction cost drivers and location factors as NCs	The article examines whether variations in perceptions of legal enforceability in China affect the use of contracts and relational reliability. 'Unknown, however, is how legal enforceability affects this relationship. <u>A prevailing view for doing business in emerging economies is that transacting with known parties is a necessary precondition to more complex, risky exchanges and thus more explicit contracts</u> (...). Based on the institutional logic (...), however, we extend that the effect of relational reliability on contracts may weaken as perceptions of legal enforceability increase: an effective legal system may mitigate the need to rely on relational reliability as a vehicle for governing more complex contractual exchanges.' (p. 862)	'Hypothesis 1a: The <u>relationship between asset specificity and contract explicitness is stronger</u> when perceived legal enforceability is high rather than low.; H1b: The relationship between environmental uncertainty and contract explicitness is stronger when perceived legal enforceability is high rather than low.; H1c: The relationship between behavioral uncertainty and contract explicitness is stronger when perceived legal enforceability is high rather than low.' (p. 866).	Structural equation modeling with interaction terms	'Our results show that legal enforceability affects the governance choices of relational reliability and contracts in a manner consistent with the governance choice logic of TCE.'; 'In particular, when perceptions of legal enforceability are strong, managers are more likely to draft more explicit contracts and less likely to use relational reliability to safeguard their exchanges from transaction risks (...). In contrast, when legal enforceability is low, managers are less likely to use explicit contracts, and more likely to rely on relational reliability to safeguard their exchanges with high asset specificity and environmental uncertainty.' (p. 875–786)	No
Hennart, 2009 (C)	Foreign entry modes; transaction cost theory drivers as NCs	The article proposes a model that explains foreign market entry. '(...) show that <u>transaction cost theory can be used to describe the necessary and sufficient conditions for the choice of equity joint ventures (EJV)</u> as a first-best strategy (...) EJVs will arise when at least two owners hold complementary assets that they want to bundle and the market sale of those assets would incur high information, bargaining and enforcement costs.' (p. 1435). 'MNEs will move from (...) licensing or contractual sale of technology to wholly	n.a.	n.a.	n.a.	n.a.

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Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
Sirmon & Lane, 2004 (C)	Foreign entry modes success; complementary resources as NCs	owned local firm to (...) EJV with local firm and finally to wholly owned subsidiaries (WOS) (...) such an evolution is only one of many that are possible (...) a <u>necessary condition for a move from licensing to EJV is that the complementary assets held by the local firm remain difficult to transact, while those held by the MNE change from easy to transact to difficult to transact.</u> Likewise, for MNEs to transform their EJV into a WOS, the market for the complementary assets held by local firms must become more competitive, while the technological advantages held by the MNE must remain difficult to sell.' (p. 1446)	n.a.	n.a.	n.a.	n.a.
Martin & Salomon, 2003 (C)	Foreign entry modes; LoF and transaction costs as NCs	The article describes the effects of knowledge transfer and knowledge tacitness on entry mode choice. It builds on several theoretical perspectives that involve various necessity arguments and that are part of the baseline thinking used for the conceptual model. 'One of the basic premises of internalization research on multinational firms is that, in order to succeed internationally, a firm must possess some advantageous, intangible knowledge-based assets' (p. 356); 'However, possession of a knowledge-	n.a.	n.a.	n.a.	n.a.

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Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
		<p>based advantage does not by itself guarantee that a firm will be able to exploit the sources of this advantage in foreign operations. Recent work in the 'knowledge based' literature suggests that the tacitness of such knowledge places major constraints on the extent and manner in which it can be used to support corporate expansion.' (p. 357). 'This paper explores the conditions under which tacit knowledge constrains entry mode selection.' (p. 357)</p> <p>In Table 1, the authors present mathematical conditions under which the entry mode is preferable to alternatives, and they comment on this. For instance: '(...) for an alliance to be preferable to licensing and to a WOS, there must exist a range of conditions where the alliance faces a liability of foreignness lower than the foreign partner's share, and/or knowledge dissipation costs lower than the local partner's share.' (p. 359); 'If [knowledge dissipation costs] sufficiently exceeds [the liability of foreignness], or vice versa, then the condition will not by itself allow an alliance to outperform both a WOS and a license. Conversely, the condition is sufficient to ensure that an alliance is the preferred mode in a range where [the liability of foreignness] and [the knowledge dissipation costs] are approximately equal.' (p. 372)</p>				
<p>Topic: Knowledge sharing/ transfer/ creation (total: 11) Minbaeva et al., 2018 (E)</p>	NC for knowledge sharing/ transfer/ creation	<p>The article develops a theoretical model to examine the impact of a foreign parent's disseminative capacity on knowledge transfer to International Joint Ventures (IJVs).</p> <p>'(...) the capacity of the foreign parent to share knowledge with the IJV is an important condition for the effective, speedy transfer of knowledge.'; '(...) we conceptualize disseminative capacity as a combination of the sender's ability to codify and articulate knowledge, the sender's willingness to share knowledge, and the sender's propensity to create and use opportunities for knowledge acquisition by the receiver. Consistent with the previous research, we argue that</p>	<p>'H1. In the context of IJVs, the higher the foreign partner's ability to codify and articulate knowledge, the higher the extent of knowledge acquisition by the local partner.' (p. 715)</p> <p>'H3a. (...) the frequency of interactions between foreign and local IJV partners positively mediates the relationship between the foreign partner's ability to codify and articulate knowledge and the extent of knowledge acquisition by the local partner.' (p. 716)</p>	Structural equation modeling	<p>'H1 proposes that ability, knowledge articulation and codification have a direct positive effect on knowledge acquisition. For the relationship between codification ability and knowledge acquisition, the standardized regression coefficient is not significant and so H1 is not supported.' (p. 719) The authors perform a mediation analysis and conclude that H3a is unsupported. Then they introduce a further thought from a multigroup-analysis: '(...) the most challenging question for future research raised by our results concerns the conditions necessary for the creation of opportunities for knowledge acquisition. Our results indicate that some threshold levels of business relatedness are required to ensure effective creation of interactive opportunities</p>	No

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Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
		<p><u>the sender's ability is a necessary but insufficient condition for successful knowledge acquisition by local partners. Clearly, knowledge senders must have the ability to engage in knowledge sharing if a knowledge transfer is to be successful'</u> (p. 713)</p> <p>'However, <u>knowledge transfer cannot occur without an opportunity to transfer knowledge (...)</u>. This means that organizations must create opportunities for frequent interaction. Therefore, we explicitly consider (...) the opportunities that are created for interaction between the firms.' (p. 714–715)</p>			for knowledge acquisition. (...) partners "must have sufficiently similar knowledge bases and (...) Alternatively, a key barrier may also be the processing of new knowledge and its integration with prior knowledge.' (p. 721)	
Berry, 2017 (E)	Knowledge sharing/ transfer/ creation; absorptive capacity in foreign operations as NCs	<p>The article explores how organizational practices can buffer country-level institutional deficiencies for firm knowledge.</p> <p>'(...) considering higher value parent firm knowledge transfers in particular, <u>higher absorptive capacity in foreign operations may be a necessary precondition for such knowledge transfer.</u> Without local capabilities to use and exploit parent firm knowledge, MNCs may not be willing to put their higher value knowledge assets at risk in these weak IP protection countries. Home country expatriates will be aware of the capabilities of foreign operations because they have interacted with local employees and they can play an active role in either encouraging or discouraging the transfer of more or less valuable parent firm knowledge to these operations.' (p. 793).</p>	'Hypothesis 5: When foreign operations are located in countries where IP protection is weak, <u>the greater the absorptive capacity of those operations, the stronger the positive effect of home country expatriates on the transfer of higher value parent firm knowledge.'</u> (794)	Regression-based (with an analysis of interactions)	The results support H5: 'The positive and No significant coefficients for both of the interaction terms show that these absorptive capacity measures have a significantly larger effect in foreign operations with expatriates than in those without expatriates (...) there is a significant increase in the value of parent firm knowledge that is transferred to operations in weak IP protection countries when home country expatriates are present in operations with higher absorptive capacity, and that this effect is significantly stronger in weak IP protection countries (...). This suggests that the influence of home country expatriates on transfers of higher value parent firm knowledge to operations in weak IP protection countries is contingent on the capabilities of foreign operations, supporting the logic underlying H5.' (p. 802)	No
Michailova & Zhan, 2015 (C)	Knowledge sharing/ transfer/ creation as NCs for innovation; [Likewise: motivation as an NC for innovation]	<p>The article discusses the link between dynamic knowledge capability and subsidiary innovation. 'We use the dynamic capabilities perspective from the strategic management literature to develop a framework that (a) differentiates between generative, sourcing and integrative capabilities in MNC subsidiaries (...)' (p.576); 'We also argue that <u>if any of these three capabilities is missing, innovation will be sub-optimal (...)</u>' (p. 580)</p> <p>For instance, the authors outline: '<u>Generative capabilities are necessary but insufficient for innovation (...)</u>' (p. 577); '(...) to transform knowledge into innovation, <u>it is necessary to</u></p>	n.a.	n.a.	n.a.	n.a.

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Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
Reiche et al., 2015 (E)	Knowledge sharing/ transfer/ creation; (shared) language as NCs	<p><u>reconfigure and recombine inputs</u>' (i.e., to integrate knowledge from multiple sources) (p. 579) 'Prop. 1. Subsidiary generative capabilities are <u>positively related</u> to subsidiary innovation.' (p. 577); 'Prop. 2. Subsidiary internal knowledge sourcing, based on subsidiary sourcing capabilities and internal embeddedness, <u>is positively related</u> to subsidiary innovation.' (p.578); 'Prop. 3. Subsidiary external knowledge sourcing, based on sourcing capabilities and external embeddedness, <u>is positively related</u> to subsidiary innovation.' (p. 579); 'Prop. 4. The subsidiary's capability to integrate knowledge from multiple sources <u>is positively related</u> to subsidiary innovation.' (p. 579); 'Prop. 5. A subsidiary that possesses all three dimensions of DKC types will innovate more than will subsidiaries that possess only one or two dimensions.' (p.580)</p> <p>The article examines how shared language affects subsidiaries' tacit knowledge inflows from HQ.</p> <p>'(...) that <u>shared language among subsidiary and headquarters (HQ) managers is an insufficient condition for subsidiary knowledge receipt.</u> (...) we examine how shared language affects subsidiaries' tacit knowledge inflows from HQ. Specifically, we study (1) whether this relationship is mediated by the extent to which subsidiary managers share HQ goals and vision, and the extent to which human resources decisions are centralized at HQ; and (2) whether subsidiary type (greenfield vs acquisitions) moderates these mediated relationships such that in both cases the mediation will be stronger in foreign acquisitions compared with foreign greenfields.' (p. 528).</p> <p>'While the IB literature has examined a common social identity as an antecedent to knowledge flows (...), social identity scholars have also pointed to <u>common knowledge as a prerequisite for developing a shared identity.</u>' (p. 530) '(...) <u>although a shared language may trigger a process of identity construction, it is not a sufficient condition for developing a common identity.</u>' (p. 531); '(...) the transfer of tacit knowledge requires an articulation process that renders the personally held knowledge accessible to others, which makes <u>language a fundamental prerequisite for knowledge transfer</u> (...)' (p. 533)</p>	<p>'H1: <u>Shared language</u> among subsidiary and HQ managers <u>will be positively related to subsidiary knowledge inflows</u> from HQ.' (p. 533). 'H3: The extent to which HR decisions are centralized will mediate the positive relationship between shared language among subsidiary and HQ managers and subsidiary knowledge inflows from HQ.' (p. 534)</p>	Regression-based (including interaction and mediation)	<p>Building on the regression-based analyses, the authors confirm their hypotheses: '(...) we have theorized why common <u>tacit knowledge</u> also serves as an <u>important prerequisite for developing a shared identity</u> and that knowledge receipt can be conceptualized as an act to construct a common identity <u>because it allows for an understanding of relevant contextual conventions.</u>' (p. 545)</p> <p>'(...) we contribute to research on international HRM. (...) little research has examined the type of <u>HR configurations that are necessary to facilitate MNE knowledge flows</u> (...); 'Our findings suggest an additional rationale for HR centralization because centralized HR decision making may provide subsidiary managers with the motivation to construct a shared HQ identity through tacit knowledge receipt.' (p. 546)</p>	No

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Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
Bojica & Fuentes, 2012 (E)	Knowledge sharing/ transfer/ creation as NCs for entrepreneurship-performance outcomes	The article analyzes how knowledge acquisition from alliances affects the corporate entrepreneurship-performance relationship. '(...) we aver that <u>market and technological knowledge (...) represent a necessary condition for identification and exploitation of opportunities.</u> ' (p. 399) "There is increasing evidence that a firm's value creation derived from relationships with other firms is growing, since these relationships are important vehicles for organizational learning through inter-acquisition and joint creation of new knowledge (...). Because these relationships facilitate <u>knowledge acquisition concerning markets and technologies</u> – which, as we argued before, is a <u>necessary condition for translating entrepreneurial activities into higher performance</u> – they may have important implications for entrepreneurial outcomes.' (p. 400); 'A firm cannot, therefore, continue to be entrepreneurial and to create wealth through its entrepreneurial activities unless it acquires knowledge from its relationship with peers.' (p. 401)	'H1. Knowledge acquisition through an inter-firm relationship <u>positively moderates the relation</u> between corporate entrepreneurship and firm performance.'; 'H2. The <u>positive effect</u> of knowledge acquisition through an inter-firm relationship on the relation between corporate entrepreneurship and firm performance <u>will be stronger</u> in firms that possess large knowledge bases.' (p. 401)	Regression-based (including interaction)	The authors confirm the moderating effect of knowledge acquisition. They moreover discuss: '(...) high potential absorptive capacity does not necessarily lead to better performance, unless it is joined by realized absorptive capacity that incorporates the acquired knowledge into the firm's operations (...). Said differently, <u>high potential absorptive capacity is a necessary but not a sufficient condition for translating corporate entrepreneurship into enhanced performance.</u> ' (p. 405–406)	No
Kotabe, Jiang, & Murray, 2011 (E)	Knowledge sharing/ transfer/ creation as NCs for product market performance	The article explores the effects of managerial ties with government officials and foreign partners on knowledge acquisition, and how this affects firms' new product market performance. ' <u>Knowledge acquisition is considered a necessary but insufficient condition for organizational learning</u> to take place (...). From an organizational learning perspective, <u>firms need to possess a considerable level of realized absorptive capacity</u> to capitalize on knowledge acquisition from external sources to facilitate organizational learning.' (p. 167) '(...) When firms lack indigenous realized absorptive capacity (...), they cannot benefit from knowledge acquisition to improve their new product market performance.	'H4a. A firm's realized absorptive capacity <u>enhances the positive effect of a firm's knowledge acquisition</u> from government officials on its new product market performance.'; H4b. A firm's realized absorptive capacity <u>enhances the positive effect of a firm's knowledge acquisition from foreign MNC partners on its new product market performance.</u> ' (p. 170)	Regression-based (including interaction)	The authors confirm their hypotheses and outline that: 'Our findings confirm that a government's favorable support could only be a necessary, but not a sufficient condition for new product market performance.' (p. 174)	No
Chi & Seth, 2009 (E) [A simulation study]	Knowledge sharing/ transfer/ creation;	The article examines the mode choice of a multinational enterprise and a local firm to exploit their complementary capabilities. In their introduction, the authors more broadly outline: '(...) research has	n.a. [they do not outline specific hypotheses but aim at	Simulation	'In brief, our model under certain conditions makes a different prediction on the optimal choice of mode for exploiting complementary	n.a.

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Appendix 1 (continued)

Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
	complementary capabilities as NCs	revealed that knowledge transfer is a two-way street involving learning by both multinational and indigenous firms (...). <u>A necessary condition for such learning to create value is the possession by the two firms of knowledge-based complementary capabilities. However, this is not a sufficient condition:</u> it does not guarantee that any joint effort to exploit the complementarity will yield a positive joint value for the two firms. Whether the potential value can be realized also depends on the efficiency of the mode that the two parties choose to exploit their complementary capabilities.' (p. 365). In a subsection the authors focus on an analysis of whether market failure is a necessary condition for joint venture formation. In their discussion of this subsection, they outline a set of jointly sufficient conditions for a joint venture, being the optimal mode of organization involving two parties that want to exploit their complementary assets. (p. 377)	answering specific questions using a simulation study]		capabilities than existing theories; the new insight is due to an integration of the real options logic with the model to identify four factors that are expected to influence the choice of mode for exploiting synergy between complementary assets of two parties in the presence of uncertain learning. These are: (1) absorptive capacities of the parties; (2) frictions in knowledge and asset markets and the associated incentive issues for knowledge sharing; (3) bargaining cost; and (4) switching cost.' (p. 382) They conclude that the economic viability of a mode not only depends on the presence of complementarity between the capabilities of the parties but also on the efficiency of the chosen mode for combining the capabilities. (p. 383)	
Reiche, Harzing, & Kraimer, 2009 (C)	Knowledge sharing/ transfer/ creation; structural ties as NCs	In the article the authors develop a cross-level model that explores how assignees' social capital translates into inter-unit intellectual capital. '(...) although social capital is based on a certain structural configuration of actors, its benefits can be realized only through the existence of relational and cognitive social capital. <u>Structural ties are thus a necessary but insufficient condition for social capital effects to occur. Only once the assignee has connected the social networks at the home and host unit, thereby building structural inter-unit social capital, can employees use these cross-unit ties to develop relational and cognitive inter-unit social capital and, in turn, engage in knowledge-sharing.</u> ' (p. 517) 'Proposition 2a: Structural inter-unit social capital <u>will lead to</u> the development of relational and cognitive inter-unit social capital.' (p. 518)	n.a.	n.a.	n.a.	n.a.
Noorderhaven & Harzing, 2009 (E)	Knowledge sharing/ transfer/ creation; social interaction as NCs	The article investigates the role of social interaction between managers for knowledge sharing in MNEs. 'To the extent that knowledge is indeed socially constructed, <u>social interaction</u> should be seen not primarily as a means for transferring existing knowledge, but rather <u>as a necessary condition for the social production of knowledge.</u> ' (p. 725).	'Hypothesis 1: <u>Social interaction</u> between a subsidiary and other parts of the MNE <u>will be positively related to knowledge exchange</u> (inflows as well as outflows).' (p. 725).	Regression-based	'Turning to the main effects of the explanatory variables, intensity of interaction has a consistent positive effect on all four types of knowledge flow. This confirms Hypothesis 1, our baseline hypothesis' (p. 733). 'Our analyses were guided by the ideas developed in two different perspectives on intra-MNE knowledge flows: the sender-receiver model and social learning theory. Based on both perspectives we expected (as our baseline hypothesis) a positive effect of social interaction intensity on all intra-MNE knowledge flows ...' (p. 735).	No
Lazarova & Tarique, 2005 (C)	NC for knowledge sharing/ transfer/ creation	The article proposes a conceptual framework that describes conditions under which personnel transfers result in successful 'reverse' knowledge transfer. ' <u>Accumulating knowledge abroad is necessary but not</u>	n.a.	n.a.	n.a.	n.a.

(continued on next page)

Appendix 1 (continued)

Source	Subtopic	Necessity logic arguments	Hypotheses	Analysis technique (AT)	Interpretation and/ or necessity arguments in the discussion	AT fits logic
		<p><u>sufficient for knowledge transfer to take place</u>. Repatriates must be also willing to share that knowledge with other in the organization. [...] Consistent with such arguments, we suggest that repatriate motivation to share knowledge is the second key component to readiness to share as important as international knowledge itself.' (p. 366)</p> <p>The authors outline that: 'This view is consistent with ... the proposition that <u>successful knowledge transfer is contingent upon the presence of both employees'</u> ability to acquire knowledge and on their motivation to transform and share that knowledge.'</p> <p>'In order to be ready to transfer knowledge, repatriates have to: (a) have valuable knowledge to transfer and (b) be motivated to transfer that knowledge. In order to receive knowledge, organizations need to (a) have the right tools to capture knowledge, and (b) create the right incentives for repatriates to share their knowledge' (p. 369)</p>				
Wang, Tong, & Koh, 2004 (E)	NC for knowledge sharing/ transfer/ creation	<p>The article develops a model that describes the knowledge transfer from MNCs to their subsidiaries in China.</p> <p>'The <u>general education employees receive before employment is necessary but not sufficient conditions for the development of absorptive capacity</u> (...) Since possession of prior related knowledge is <u>necessary</u> for the effective assimilation of new knowledge (...) there is a need to provide adequate training to equip employees with the essential knowledge for their jobs.' (p. 178)</p> <p>'P6: The better the qualifications of employees, the greater the extent of knowledge the China subsidiary acquires from its MNC parent.'; 'P7: <u>The greater the emphasis on training, the greater the extent of knowledge</u> the China subsidiary acquires from its MNC parent' (p.178)</p> <p>'Organizations do not learn; rather, the individuals in organizations learn and share knowledge among themselves. Thus, <u>individual learning is a necessary condition for organizational learning</u>' (...) (p. 178); 'P8: <u>The greater the China subsidiary employees' intent to learn, the more knowledge the subsidiary acquires</u> from its MNC parent.' (p. 179)</p>	n.a.	Qualitative analysis of interviews	n.a.	n.a.
Diverse (total: 10)						
<p>Knowledge of, identification with, and the internalization of more than one societal culture as NCs for multiculturalism, Vora et al., 2019 (C); achieving efficiency as an NC for SMEs to pay higher employee wages, Maksimov, Wang, & Luo, 2017 (E); risk-taking as an NC for organisational improvisation, Hodgkinson, Hughes, & Arshad, 2016 (E); generalized principles of conduct as an NC for a meaningful multilateral order, Kobrin, 2015 (C); a subsidiary's ability to exercise power on at least one of the functional levels as an NC for its strategic power, Mudambi, Pedersen, & Andersson, 2014 (E); talent as an NC for achieving excellence, Nijs, Gallardo-Gallardo, Dries, & Sels, 2014 (C); brand identification as an NC for consumer behavior, Lam, Ahearne, & Schillewaert, 2012 (E); trust as an NC for high quality dyadic relationships, Sue-Chan, Au, & Hackett, 2012 (E); the implementation of an environmental management system as an NC for the ecological sustainability of business activities, Ramus, 2002 (E); diverse: creates a measure of IPR protection for countries with two necessary components, Ostergard, 2000 (E).</p>						

Note: C = conceptual, E = empirical; *We do not present the details of studies that do not theorize on but discuss necessities, adopt a more exploratory approach on necessity logic, or adopt a configurational approach (total: 13), see [Chi, Li, Trigeorgis, & Tsekrekos, 2019](#); [Crilly, 2011](#); [Dastmalchian et al., 2020](#); [Furuya, Stevens, Bird, Oddou, & Mendenhall, 2009](#); [Judge et al., 2014](#); [Kim, 2013](#); [Kotabe, Srinivasan, & Aulakh, 2002](#); [Laursen, Masciarelli, & Prencipe, 2012](#); [Lazarova & Cerdin, 2007](#); [Nadkarni & Perez, 2007](#); [Pajunen, 2008](#); [Schneider et al., 2010](#); [Witt & Jackson, 2016](#).

Appendix 2

NCA parameters per year.

Year	Non corrupt		Favorable taxation		Flexible labor regulations		Political stability		Political rights	
	d	p	d	p	d	p	d	p	d	p
2010	0.694	0.055	0.644	0.119	0.630	0.050	0.779	0.024	0.219	0.820
2011	0.574	0.023	0.610	0.010	0.563	0.006	0.748	0.007	0.256	0.819
2012	0.611	0.032	0.608	0.031	0.650	0.002	0.745	0.020	0.372	0.791
2013	0.639	0.030	0.732	0.001	0.665	0.008	0.737	0.040	0.360	0.852
2014	0.606	0.040	0.500	0.245	0.571	0.021	0.727	0.006	0.706	0.490
2015	0.603	0.054	0.645	0.008	0.715	0.000	0.691	0.009	0.318	0.874
2016	0.645	0.053	0.737	0.001	0.759	0.000	0.661	0.089	0.303	0.885

Note: You will find a few recommendations and illustrations on NCA applied to panel or longitudinal data in Dul (2021).

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