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Using Necessary Condition Analysis in Managerial Psychology Research: Introduction, Empirical Demonstration, and Methodological Discussion

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Abstract

Purpose: The authors present a novel methodological tool-Necessary Condition Analysis (NCA) to aid managerial psychology researchers in properly testing necessity statements.

Design/methodology/approach: The authors employ NCA to analyze whether three basic psychological needs for autonomy, competence, and relatedness are necessary for work engagement.

Findings: The authors illustrate the value and application of NCA by revealing that basic psychological needs for autonomy, competence, and relatedness are necessary for work engagement, as proposed by self-determination theory (SDT).

Originality/value: The authors illustrate the importance of the sufficiency-necessity distinction and the relevance of a necessity logic in managerial psychology. They also discuss NCA's methodological implications for managerial psychology research, theory, and practice.

Keywords: Necessary condition analysis (NCA), sufficiency, necessity, self-determination theory (SDT), methodology, causality

Managerial psychology researchers usually adopt a necessity perspective to express that a condition is critical for an outcome of interest. For instance, Parker et al. (2021) claim that "some degree of job complexity or challenge demands are necessary" for fostering mental model development when exploring how work design affects work cognition. Table I displays additional examples of clearly stated necessary condition statements in managerial psychology research.

Necessity thinking has a long tradition in managerial psychology history. For instance, Maslow (1943)'s hierarchy of needs theory posits that human needs are organized in a hierarchical order, with lower-level needs needing to be satisfied before higher-level needs can be pursued. The appearance of a higher need usually rests on the prior satisfaction of lower needs (Healy, 2016; Maslow, 1943). Therefore, we may apply a necessity perspective to explain the association between two adjacent needs: satisfying a lower-level need is necessary for satisfying a higher-level need. When describing the relationships between adjacent needs, Taormina and Gao (2013) also assert that "it is *necessary* [emphasis added] for lower-level needs to be mostly (though not necessarily 100%) satisfied before a person becomes concerned with satisfying higher-level needs" (p. 168).

Another theory that uses a necessity perspective is Herzberg's motivation-hygiene theory (or two-factor theory; Herzberg *et al.*, 1959; Herzberg, 1966). Herzberg distinguished between motivators (i.e., factors intrinsic to work) and hygiene factors (i.e., factors extrinsic to the work itself), arguing that the presence of motivators leads to job satisfaction, while the absence of hygiene factors leads to job dissatisfaction (Hackman and Oldham, 1976). Motivators can be understood as conditions with sufficiency properties for job satisfaction because their presence can lead to job satisfaction. By contrast, Herzberg et al. (1959) used a metaphor to describe the meaning of hygiene factors, saying that "modern garbage disposal, water purification, and air-pollution control do not cure diseases, but without them we should

have many more diseases" (p. 113). Therefore, hygiene factors are *necessary* to job satisfaction: Their absence will lead to job dissatisfaction. However, hygiene factors are not enough (or sufficient): Their presence does not guarantee job satisfaction.

However, we have barely empirical evidence to support these necessity statements and theories because the methodological tools we traditionally rely on do not match a necessity logic. Although sufficiency and necessity logics differ, researchers do not clearly differentiate them in theory, practice, and research (Goertz and Starr, 2003). As we will demonstrate, testing sufficiency and necessity statements require different methodological tools because sufficiency and necessity logics are not interchangeable. The argument-method misfit emerges when researchers adopt a method implying a sufficiency logic to test a necessity hypothesis.

Therefore, the overarching purpose of the present article is to present a novel methodological tool-Necessary Condition Analysis (NCA; Dul, 2016, 2021), to aid managerial psychology researchers in properly testing necessity statements. NCA was recently introduced by Dul (2016) and has become an increasingly popular tool among management scholars to test necessary but not sufficient relationships (Dul *et al.*, 2023). For example, Hauff et al. (2021) recommend human resource management scholars employ more NCA studies because necessity thinking can bring complementary insights into the theory and practice that an additive sufficiency logic cannot obtain. When researchers find significant independent variables using regression techniques, they can also employ NCA to explore whether these conditions are necessary for the outcome. Nevertheless, with some exceptions (e.g., Costa et al., 2022; Korman et al., 2022), most managerial psychology researchers are still unaware of NCA's value, thereby ignoring an opportunity for disciplinary knowledge growth.

To this end, we aim to make four distinct contributions to the literature. First, we provide a broader discussion on necessity and sufficiency logic and describe the history of necessity thinking in managerial psychology. Second, we introduce the methodology of NCA, which lays the foundation for the general acceptance of new theoretical and methodological concepts inspired by this method. Third, to illustrate the value and application of NCA, we revisit self-determination theory (SDT; Deci et al., 2017; Ryan & Deci, 2017) from a necessity perspective and employ NCA to explore whether three basic psychological needs are necessary for work engagement. Fourth and finally, we provide a future research agenda on NCA by discussing its methodological implications for managerial psychology research, theory, and practice.

Comparison Between Sufficiency and Necessity Logics

Sufficiency and necessity are two distinct logics and have different implications. The distinction between them is theoretically and practically meaningful, but scholars are not aware of the importance of their difference (Dul, 2016; Goertz and Starr, 2003; Hauff *et al.*, 2021). The sufficiency-necessity distinction can be well understood by a non-academic example: Oxygen is necessary for human life - without oxygen, humans cannot survive. However, oxygen alone is not sufficient for life as we also need water, food, and many other elements to sustain ourselves. Therefore, oxygen is a necessary but not sufficient condition for life.

Sufficiency logic emphasizes the constant conjunction (i.e., an unvarying or permanent connection) between condition and outcome. This means the presence of a condition will always lead to the outcome's occurrence. A sufficient condition is "something that is always followed by the outcome but is not required for the outcome" (Mahoney and Acosta, 2021, p. 8). Sufficiency logic has two important features. First, a sufficient condition ensures an outcome's occurrence; it can lead to the outcome. Second, a sufficient condition's

absence does not prevent achieving the outcome because other conditions can compensate for its absence. Common expressions implying a sufficiency logic include: “X leads to Y,” “X promotes Y,” and “the more X, the more Y.”

Conversely, necessity logic emphasizes the constraint the condition places on the outcome. A necessary condition always precedes the outcome; however, the outcome does not always follow the necessary condition. Necessity logic also has two important features. First, the absence of a necessary condition ensures the absence of the outcome; the outcome will not occur if the necessary condition is not in place (Bokrantz and Dul, 2023). A necessary condition must be present to allow the outcome to exist; other determinants cannot compensate for the absence of a necessary condition (Dul, 2016). Second, a necessary condition does not automatically guarantee the outcome’s occurrence but makes the outcome possible. Unlike sufficiency logic, which focuses on the outcome’s occurrence, necessity logic focuses on the absence of the outcome. Common expressions implying a necessity logic include: “X is a precondition or prerequisite for Y,” “X restricts Y,” and “Y is impossible without X.”

X-Y scatter plots can help better contrast the differences between sufficiency and necessity logic. Figure 1 (A) suggests X is a sufficient but not necessary condition for Y. X is sufficient for Y because a higher X can guarantee a higher Y. However, X is not necessary for Y because a higher Y can be achieved in other ways than increasing X. Observations in the upper-left area indicates that a high Y is possible when X is low. In other words, a low X does not constrain a high Y. Regression analytical methods (e.g., multiple linear regression) use an additive average effect logic (Dul, 2016, 2021b; Dul *et al.*, 2023), which can be expressed by the model: $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + e$. In regression models, no determinants are assumed to be necessary (Dul, 2021b). Each determinant compensates for the other, and the effects of each determinant are interchangeable. If one determinant is not in

place, the outcome level will decrease accordingly. However, this reduction can be compensated by increasing other determinants' levels. For instance, as Figure 1 (A) shows, when the X level decreases from 0.5 to 0.3, the outcome level Y will decrease from 0.6 to 0.3. However, achieving an outcome score of 0.6 is possible (e.g., increasing other determinants' levels), with X staying at the 0.3 level.

Figure 1 (B) shows that X is a necessary but not sufficient condition for Y. X is necessary for Y because a high Y level can only be achieved when X is high; achieving a high Y level is impossible when X is low. Nevertheless, X is insufficient for Y because a high X level does not automatically guarantee a high Y level. A necessary condition is a precondition for the outcome; other determinants cannot compensate for its absence. For example, when the X level decreases from 0.5 to 0.3, the outcome level Y will decrease from 0.5 to 0.2. However, if X is necessary for Y, as Figure 1(B) indicates, achieving 0.5 is impossible when X stays at the 0.3 level. A decrease in the X level will constrain or prevent a certain level of Y because it cannot be compensated. An additive sufficiency model cannot capture this critical feature of a necessity relationship. Therefore, regression analytical approaches are not suitable for identifying necessary conditions. Goertz (2003) proposes that the necessary relationships may be better expressed as a multiplicative phenomenon: $Y = X_1 \times X_2 \times X_3 \ldots$, where the absence of a necessary condition (e.g., zero value) can dramatically affect or constrain the outcome. However, multiplicative models differ from "necessary but not sufficient logic" because they assume that all levels of independent variables are necessary and jointly sufficient. We refer to the multiplicative model only to illustrate the limiting effect of necessary conditions' absence on the outcome (Dul, 2016).

Revisiting SDT's Three Basic Psychological Needs from A Necessity Perspective

The Necessity Nature of Basic Psychological Needs

SDT is a macro theory of human motivation and has been widely applied in work and organizational psychology (Deci *et al.*, 2017). SDT maintains that humans have three basic needs (i.e., the needs for competence, relatedness, and autonomy), the satisfaction of which promotes autonomous motivation, performance, and well-being (Deci *et al.*, 2017; Van den Broeck *et al.*, 2016). When researchers emphasize the positive outcomes that needs satisfaction can bring, they imply a sufficiency logic. For example, Ryan and Deci (2000, p. 323) claim that "the experience of satisfaction of the three basic needs leads to well-being." Ryan and Deci (2017, p. 16) also assert that "satisfaction of all three psychological needs also facilitates more autonomous functioning, which in turn yields more effective performance and greater wellness." It is justifiable to employ additive average effect models to verify such propositions.

Few researchers realize that SDT also involves a necessity logic, although a necessity logic may help better understand the nature of basic needs. SDT defines basic psychological needs as "nutrients that are *necessary* [emphasis added] for effective, healthy functioning" (Deci *et al.*, 1996, p. 172). Therefore, "each of these three needs plays a *necessary* [emphasis added] part in optimal development so that none can be thwarted or neglected without significant negative consequences" (Deci and Ryan, 2000, p. 229). Deci and Ryan (2000) adopt a necessity logic to illustrate the nature of needs; they assert that "there are not [*sic*] instances of optimal, healthy development in which a need for autonomy, relatedness, or competence was neglected" (p. 229). Thus, it is not surprising to observe that SDT researchers propose necessity statements regarding basic needs. For example, Van den Broeck et al. (2016) argue that "SDT characterizes basic psychological needs as innate factors that are *necessary* [emphasis added] for such outcomes [psychological growth,

internalization, and well-being] to occur" (p. 1197). Similarly, Ryan and Deci (2017) assert that "in spite of the variegation apparent in human cultural forms and economic arrangements, there are basic and universal psychological needs that are *necessary* [emphasis added] for optimal development" (p. 98).

In summary, SDT researchers propose the importance of basic needs from both sufficiency and necessity logic. However, researchers ignore the necessary nature of basic needs because they only use regression tools to test SDT's main arguments, such as testing whether each basic need uniquely predicts indicators of well-being, job attitudes, and motivation (Van den Broeck *et al.*, 2016). Since its first appearance in the literature, only the theory's "sufficiency" part was examined correctly; the "necessity" part has never been appropriately tested.

An Empirical Demonstration of NCA

We reanalyze a cross-sectional dataset from 506 Lithuanian armed forces soldiers from Rybakovaitė et al. (2021)' study to demonstrate the application of NCA. Using the R package *lavaan*, we first conducted a regression analysis, finding that basic needs for autonomy (b = 0.419, SE = 0.035, $p < 0.01$), competence (b = 0.213, SE = 0.037, $p < 0.01$), and relatedness (b = 0.118, SE = 0.039, $p < 0.01$) are positively related to work engagement, supporting a sufficiency logic between these needs and work engagement. Next, we explore whether satisfying basic psychological needs is necessary for work engagement using the free R package *NCA*, which can produce NCA plots and important parameters such as effect size, p-value, and bottleneck table. The data and reproduction materials of results can be accessed on OSF at the following link: https://osf.io/xfjwp/?view_only=1c9a9981e51c4c5a95d6ce5a79c7b12c.

Figure 2 shows NCA plots for the necessity relationships between basic needs and work engagement. NCA generally uses two ceiling techniques to draw a ceiling line on top of

the data: ceiling envelope with free disposal hull (CE-FDH) and ceiling regression with free disposal hull (CR-FDH). The CE technique generates a piecewise linear envelope along the upper left observations, while CR produces a smooth line (Dul, 2016; Hauff *et al.,* 2021). CE is recommended for dichotomous and discrete variables with a small number of variable levels (e.g., below 5) or when data points near the border do not follow a linear pattern; CR is preferred for continuous variables and discrete variables with many levels or when data points near the border approximately follow a linear trend (Dul, 2016; Dul *et al.*, 2023). However, when the choice is difficult, researchers can use both ceiling techniques to test the robustness by comparing the results of the two default techniques (Dul *et al.,* 2023).

The relative importance of a necessary condition relies on the effect size *d* (*d* = the size of the space above the ceiling/the total space where cases are observed). NCA's effect size *d* is unrelated to "Cohen's *d*" for the standardized difference between two means (Dul, 2016). The space in the empty corner relative to the total space with observations reflects the extent of the constraint that X poses on Y; the larger the space, the more X constrains Y (Dul, 2016). General benchmarks for effect size are $0 < d < 0.1$ small effects, $0.1 \leq d < 0.3$ medium effects, $0.3 \leq d < 0.5$ large effects, and $0.5 \leq d < 1$ very large effects. A general guideline is that "an effect size greater than or equal to 0.1 is often considered to be practically relevant" (Dul *et al.*, 2023, p. 21). However, whether an effect size is considered practically important or not depends on the research context (Dul *et al.*, 2020). The general guideline is often adopted if researchers find it difficult to decide the threshold of practically relevant effect size (Dul *et al.,* 2023). Moreover, considering that effect size may result from random chance, Dul (2020) also introduced a permutation test to avoid false positive conclusions about effect sizes. A permutation test generates a *p*-value, showing the statistical significance of the effect size. Therefore, researchers can claim that they find a meaningful necessary condition when the effect size $d \geq 0.1$ and the *p*-value < 0.05.

CR and CE analyses show similar results in effect size and significance level. We report the results of CE because the observations around the ceiling line do not follow a linear pattern. NCA shows that Autonomy ($d = 0.191$, $p < 0.01$), competence ($d = 0.235$, $p < 0.01$), and relatedness ($d = 0.201$, $p < 0.01$) are all necessary conditions for work engagement. Therefore, SDT's necessity assumptions regarding basic needs satisfaction have not been properly tested until we employed NCA to ensure a theory-method fit.

A bottleneck table enables us to make necessity statements in degrees, showing what levels of the condition are necessary or must be met for the outcome's different levels (Vis and Dul, 2018). Table II displays the bottleneck table, showing levels of each basic need that are necessary for specific levels of work engagement. For instance, for a work engagement score of 6 (the maximum level), the minimum values of relatedness, competence, and autonomy are 5, 4.667, and 5. Otherwise, a work engagement score of 6 is impossible. In addition, NCA also allows researchers to conduct a sufficiency analysis. Figure 2 shows a noticeable empty lower-right space in the autonomy-engagement scatter plot, indicating that a certain level of autonomy is sufficient for a certain level of work engagement. We conducted another analysis specifying analyzing the lower-right corner. NCA shows that the effect size is significant, although small (CR: $d = 0.081$, $p < 0.01$; CE: $d = 0.105$, $p < 0.01$). Based on the bottleneck table, we found that autonomy = 7 is sufficient for work engagement = 3.

However, there are several limitations to the conclusion from this illustrative example. For instance, we cannot draw causal necessity conclusions because the study design is cross-sectional instead of experimental. Researchers can design a necessity experiment in NCA studies (Dul, 2021a). A necessity experiment differs from a traditional one designed to estimate X's average effect on Y. In a necessity experiment, researchers manipulate an assumed necessary condition to produce the outcome's absence or decrease. They can observe whether the maximum outcome level decreases after removing or reducing a

hypothesized necessary condition. The methodological design may also affect NCA results in observational studies. It is reasonable to expect that the relationships of necessity might change when we change the time lag between two measures. Therefore, in addition to investigating empirical NCA studies, management researchers should also be concerned about the influence of research design on NCA results. For example, they can investigate whether the relationships of necessity found are stable over time.

Methodological Implications for Managerial Psychology Research

Exploring Different "Directions" of Necessary Conditions

An empty upper-left corner only represents a particular necessity scenario where (high) X is necessary for (high) Y. As Figure 3 shows, combining the low and high of X and Y, NCA allows researchers to test different "directions" of the necessity relationships. Researchers can specify the corner to analyze using the "*corner* =" argument in the *nca_analysis* function of the NCA software (see "4.3.5 Interpretation of the bottleneck table with other corners" in Dul, 2021a for details).

First, an empty upper-right corner indicates that a low X is necessary for a high Y, as shown in Figure 3 (A). We use the challenge-hindrance stress model (CHM; Cavanaugh et al., 2000) to illustrate this necessity scenario. CHM distinguishes between challenge and hindrance stressors by arguing that they affect employees differently (Cavanaugh *et al.*, 2000; Mazzola and Disselhorst, 2019). Although this theoretical framework looks tautological, the challenge-hindrance stressors distinction has been widely accepted in the literature (Horan *et al.*, 2020; Webster *et al.*, 2011). Integrating a necessity perspective into CHM might lead to an interesting extension, providing another perspective for understanding different stressors. We might distinguish challenge and hindrance stressors by examining whether it is possible to have high positive outcomes (e.g., job satisfaction) when a particular stressor is high. For instance, high job satisfaction is impossible when a hindrance stressor is high (i.e., the upper-

right area is empty). In other words, a low hindrance stressor is necessary for high job satisfaction. In contrast, employees might still achieve high job satisfaction when a challenge stressor is high, indicating that a low challenge stressor is not necessary for high job satisfaction (i.e., the upper-right area is not empty).

Second, an empty lower-left corner indicates that a high X is necessary for a low Y, as shown in Figure 3 (B). We use job embeddedness theory to illustrate this necessity scenario (Mitchell et al., 2001). Mitchell et al. (2001) proposed that job embeddedness can explain unique variance in employees' voluntary turnover over and beyond some traditional attitudinal concepts (e.g., job satisfaction and organizational commitment). Job embeddedness describes a situation where people become "stuck" in their jobs (Jiang *et al.*, 2012; Mitchell *et al.*, 2001). NCA allows us to explore whether high job embeddedness is necessary for low turnover (i.e., whether the lower-left area is empty). If this is the case, it indicates that other determinants cannot compensate for the absence of job embeddedness because it is impossible to achieve low turnover intention when job embeddedness is low.

Third, an empty lower-right corner indicates that a low X is necessary for a low Y, as shown in Figure 3 (C). We use the job demands-resources (JD-R; Demerouti et al., 2001) theory to illustrate this necessity scenario. The JD-R theory proposes that job characteristics can be classified into job demands and resources, and job resources can buffer the impact of job demands on strain (Bakker and Demerouti, 2017; Bakker and de Vries, 2021). A critical precondition embedded in this proposition is that the unfavorable influence of job demands on the job strain can be compensated. However, NCA suggests that we need to examine whether low levels of some particular job demands are necessary for low job strain (i.e., whether the lower-right area is empty). If this is the case, then high job demands must be reduced to an adequate level first to allow for low job strain; otherwise, high job demands may constitute bottlenecks that restrict the existence of low job strain, and achieving low job

strain is impossible even through job resources are also high. However, if we find that low job demands are not necessary conditions for low job strain, increasing job resources to compensate for the negative influence of high job demands will become more meaningful, as suggested by the JD-R theory.

Fourth, NCA allows us to explore more complex curvilinear necessity relationships where two corners are empty (Dul, 2021a). For example, there might be an inverted U shape pattern between workload and job satisfaction because a low workload may make employees feel bored, while a high workload may frustrate employees (Pindek *et al.*, 2022). Applying a necessity logic, we can further explore whether a medium workload is necessary for high job satisfaction. If this is the case, the upper-left and upper-right corners will be empty simultaneously, as shown in Figure 3 (D).

Clarifying Sufficiency and Necessity Logic in Theories

Sufficiency logic focuses on the presence of the outcome (when some conditions are fulfilled). In contrast, necessity logic focuses on the absence of the outcome (when some conditions are not fulfilled). The distinction between sufficiency and necessity should be clarified in theory building. First, we suggest scholars specify the logic they use when theorizing a causal relationship. Proposing that "X is important to Y (or X is a cause of Y)" is ambiguous in theory building because we do not know whether this connection implies a sufficiency or necessity relationship. Therefore, researchers should clearly indicate which logic they adopt to explain the link between X and Y. Second, we suggest researchers directly incorporate necessity hypotheses into theory if they think some important determinants are necessary conditions for the outcome of interest. For example, SDT maintains that three basic psychological needs are necessary, the satisfaction of which promotes psychological growth, internalization, and well-being (Van den Broeck *et al.*, 2016). However, SDT scholars have not clearly incorporated a necessity logic in theoretical propositions. Third, researchers

should revisit sufficiency theories with a necessity perspective and see if incorporating a necessity logic can provide complementary or better insights. For example, a necessity logic might provide a new perspective to distinguish between challenge and hindrance stressors in CHM. Another example is the JD-R theory, which involves a necessary precondition (i.e., the detrimental influence of job demands on job strain can be compensated) that allows sufficiency statements (theories) to work. Theory building and appropriate empirical investigation are mutually reinforcing. Clarifying the sufficiency-necessity distinction in theory building guides empirical research on appropriately testing (or falsifying) the theory. Meanwhile, empirical investigations also help to improve the theory.

Empirical Importance of Identifying Necessary Conditions

Identifying necessary conditions also has important implications for managerial psychology practice because it can inform practitioners of critical determinants that must be fulfilled to allow for desirable outcomes. Organizational resources are limited, and NCA enables practitioners to invest resources in critical factors, which could result in optimal resource allocation (Hauff *et al.*, 2021). Conversely, regression analytical approaches usually reveal many factors significantly related to an outcome, making it difficult for practitioners to determine the most critical factors. Investing resources in several determinants with the most considerable net effects might not bring the desired outcome if practitioners fail to satisfy the necessary conditions that make a desirable outcome possible. For example, our study shows that investing in other managerial practices could be useless in increasing employees' work engagement if their needs for autonomy, competence, and relatedness are not well satisfied. Therefore, besides exploring sufficiency relationships, analyzing necessary conditions are also practically important because, without the necessary conditions, all other managerial practices are ineffective.

Opportunities for Mixed-Method Research

Scholars can use NCA as a stand-alone method to explore the phenomenon of interest from a necessity perspective. They can also use NCA in combination with other methods to get complementary insights (Ding, 2022; Dul, 2021a). Combining sufficiency and necessity logic provides a complete perspective on the causal relationship and allows us to understand complex management phenomena comprehensively. NCA can complement regression by providing additional insights into the results drawn from regression analytical methods (Richter *et al.*, 2020). When researchers use additive effect models to reveal significant determinants with sufficiency properties, they can also employ NCA to explore whether they are necessary conditions for the outcome of interest. Some researchers have adopted such a mixed-method approach in empirical studies to get richer information (Costa *et al.*, 2022; Hauff *et al.*, 2021; Klimas *et al.*, 2022; Lee and Jeong, 2021).

Conclusion

Scientists' tools (e.g., research methods) are not neutral; instead, they shape our thinking and theory-building (Gigerenzer, 1991; Woodside, 2013, 2014). Unlike regression analytical approaches, which focus on independent, additive, symmetrical, and mean-based causality (Delbridge and Fiss, 2013), NCA represents an alternative methodological approach that can change our thinking about managerial psychology research, theory, and practice with a necessity perspective. As Goertz (2003) states, "for any research area, one can find important necessary condition hypotheses" (p.66). We hope our discussion and demonstration could lay the foundation for general acceptance of NCA, engage researchers from managerial psychology and its neighboring disciplines in this methodology, and make innovations in theory and practice.

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Table I

Examples of necessary condition statements in managerial psychology research (emphases added)

Source	Necessity statements
Elangovan et al. (2010)	"An urge to find meaning in one's life, attentiveness, willingness to experiment with new paths, and a growing understanding of the self – are *necessary* for an individual to discover a calling but *not sufficient* to guarantee success in doing so" (p. 435).
Korman et al. (2022)	"High sense of power and high self-efficacy are both *necessary* conditions for low levels of burnout" (p. 151).
Lauring et al. (2021)	"Trust is *necessary* to create continuity in relation to social distance in global virtual teams" (p. 8).
Parker et al. (2021)	"Cognition is *necessary* for job performance" (p. 406).
Unsworth et al. (2016)	"High levels of self-concordance appear to be *necessary* to provide the additional autonomous motivation *necessary* for complex and creative tasks" (p. 714).
Vaulont et al. (2021)	"The strategic core approach also assumes the continuous presence of the core to be a *necessary* condition for team performance" (p. 1767).

Table II

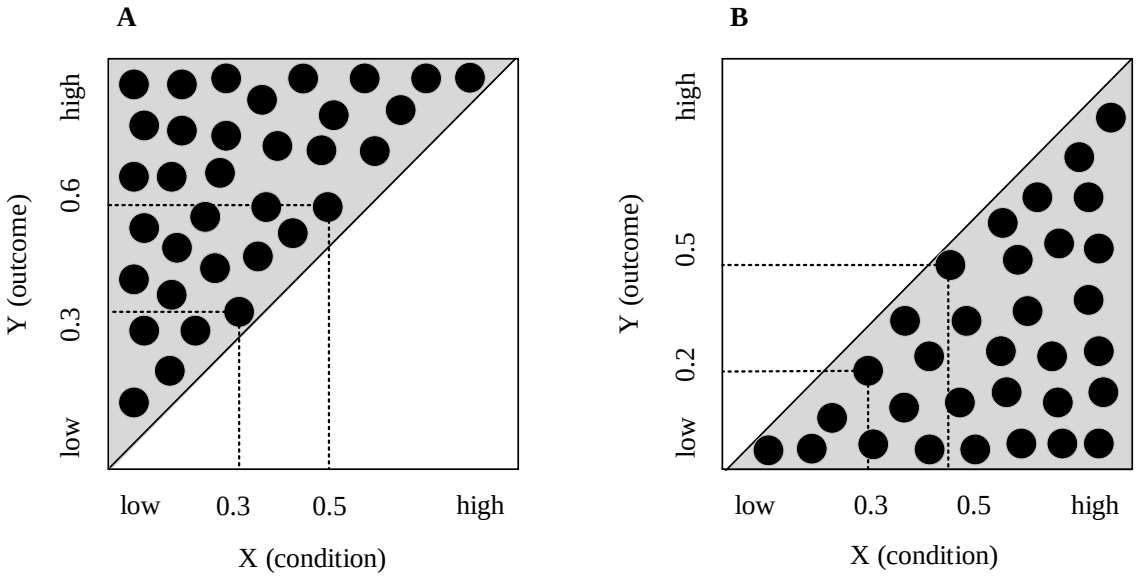
Bottleneck table for the three basic psychological needs

Work engagement	Relatedness	Competence	Autonomy
1	NN	NN	NN
1.5	1.4	1.667	NN
2	1.4	1.667	1.333
2.5	1.6	1.667	1.333
3	1.6	1.667	1.333
3.5	1.6	2.333	1.333
4	2.4	2.667	1.333
4.5	2.4	2.667	3.333
5	2.4	3	3.333
5.5	4.2	4	3.667
6	5	4.667	5

Note. "NN" means "not necessary." Work engagement was measured on a 6-point Likert scale, and three basic needs were measured on a 7-point Likert scale.

Figure 1

Comparison between sufficiency and necessity logic



X is a sufficient but not necessary condition for Y

X is a necessary but not sufficient condition for Y

Figure 2

Necessity relationships between three basic needs and work engagement

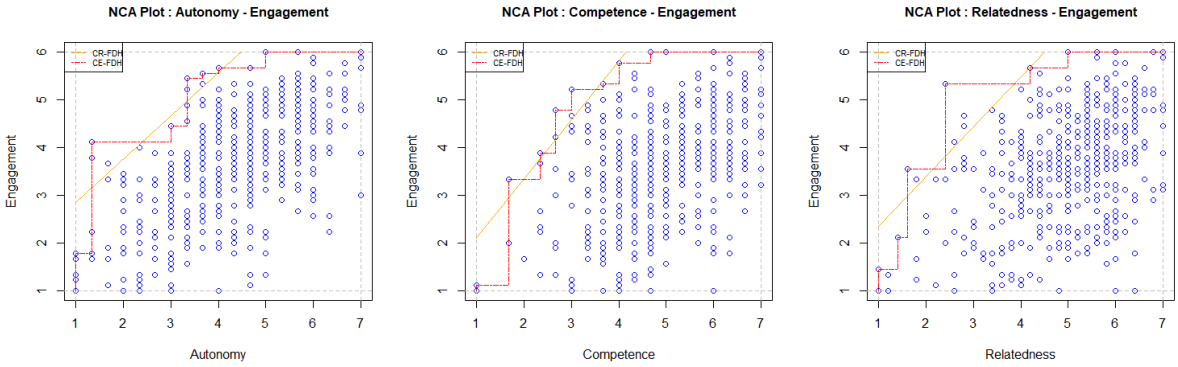
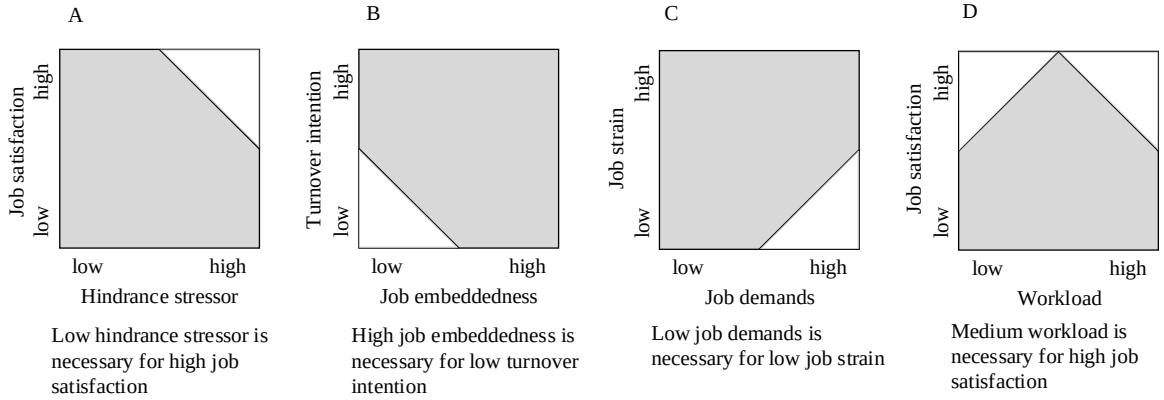


Figure 3

Different directions of necessary conditions



Low hindrance stressor is necessary for high job satisfaction

High job embeddedness is necessary for low turnover intention

Low job demands is necessary for low job strain

Medium workload is necessary for high job satisfaction