

PRESSURE CAPACITY – A REVOLUTIONARY BENCHMARK FOR PROMOTING HEALTHY WORK ENVIRONMENTS

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ABSTRACT

Elevated levels of pressure underscore the urgency for applying the job demands-resources (JD-R) model to the U.S. construction industry. Pressure capacity is introduced as a novel, nuanced terminology with respect to the JD-R theory. Pressure is defined as *the demands, obligations, and consequences placed on individuals and groups to meet the expectations of a project, market, individual, group, etc.* The word capacity refers to *the total ability to absorb pressure through culture, character, processes, skilled labor, and other methods.* Through this pioneering theoretical paper, the value of pressure capacity is emphasized through key literature surrounding varying JD-R applications, the Yerkes-Dodson theory, and potentiality as a metric.

A series of models is subsequently developed. The Lechtenberg Pressure Flow Model serves as a diagram for mapping the flow of pressure within the traditional OAEC stakeholder model. The Pressure Elasticity Model illustrates individual-level pressure dynamics. Reminiscent of the FICO credit score model, the Pressure Capacity Scale (PCS) model serves the parallel purpose of communicating pressure dynamics, identifying risk, and promoting worker well-being and subsequent performance. Global collaboration is key to unlocking the full potential of pressure capacity for lean and the general construction industry.

KEYWORDS

Pressure capacity, job demands-resources, psychological safety, waste, collaboration.

INTRODUCTION

Current trends in the American construction industry indicate an environment in which rising expectations exceed the limits of individuals and threaten their general well-being. According to the Associated Builders and Contractors (ABC), data from the past two decades shows an alarming, increasing disparity between construction spending and employment. In 2026, the industry will need to attract 499,000 new workers...[and] if it fails to do so, industrywide labour cost escalation will accelerate, exacerbating already high construction costs and reducing the volume of work that is financially feasible (ABC, 2025). The implications of such a market

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scenario should be seriously considered. Since 2019, the productivity index for workers in industrial building construction has spiked by an astonishing 13.3%, while the hours worked have dropped by 0.8% (U.S. BLS, 2025). This abnormality, in contrast to past decades, may reflect how workers are being pushed to compensate for increasing workload expectations with higher productivity and performance. There are additional concerns over a mass exodus of experienced workers leaving the industry, which may further stretch the productivity index (ABC, 2025). Essentially, this setup suggests a context in which workers are unhealthily pushed beyond their means to meet the expectations of either financially feasible or unfeasible projects. This scenario appears not to be restricted to the U.S. alone, but to the global industry when taking into consideration the prevalent rise in suicide rates (Araki & Smith, 2025). Before jumping to conclusions in drawing connections between the nature of the construction industry and its workers, it is critical to understand the fundamental psychological theories that may help explain this seemingly degrading relationship marked by extreme cases of suicide.

THEORETICAL MODELS FOR WORKER WELL-BEING

In psychology academia, the concept of work and its relationship with individual well-being has seen much development over the past couple of decades. One of the earliest theories was the two-factor theory, which clarified the factors behind job satisfaction and dissatisfaction, essentially arguing that satisfaction did not necessarily imply the absence of dissatisfaction (Herzberg, 1966). The job characteristics theory then followed, which argued that work structure largely influenced employee motivation, satisfaction, and performance. (Hackman & Oldham, 1976). Soon thereafter, the job demands-control (DCM) model assumed a more dogmatic position in which worker autonomy or control over their work was the dominant factor in coping with high job demands, leading to less job strain (Karasek, 1979). For nearly 20 years, the DCM model remained the sovereign theoretical construct. In 1996, the effort-reward imbalance (ERI) model introduced the importance of reciprocity, in the sense that increased strain is experienced when high effort is matched with low reward (Siegrist, 1996).

Bakker and Demerouti appeared to completely transform the general understanding of job demands and workers starting in the early 2000s. They exposed weaknesses of the ERI and DCM model for their ‘static character’ and limited practical use, for only being able to produce a ‘laundry list’ of job demands and the lack of resources as predictors for strain, among other issues (Bakker & Demerouti, 2007). Thus, the job demands-resources (JD-R) model was created, which pulled autonomy out of its somewhat arbitrary place as the central resource, and essentially expanded to create a more overarching model that could be applied to various occupations. *Job demands* are defined as “those physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological effort or skills and are therefore associated with certain physiological and/or psychological costs.” On the other hand, *job resources* are “the physical, psychological, social, or organizational aspects of the job that have motivating potential, that are functional in achieving work goals, that regulate the impact of job demands, and that stimulate learning and personal growth” (Bakker et al., 2023). Figure 1 below illustrates the dynamics of job demands and resources and how they contribute to overall job performance. One key idea to note is the evolution of the various terms that are associated with the unchanging names of job demands and job resources. Comparing the 2007 model, ‘work engagement’ replaced motivation, ‘exhaustion’ replaced strain, and ‘job performance’ replaced organizational outcomes (Bakker & Demerouti, 2007). These terms appear to be a more honed-in and accurate depiction of health impairment and motivational processes because of an increased number of validating empirical studies for concepts related to burnout and work engagement (Bakker et al., 2023).

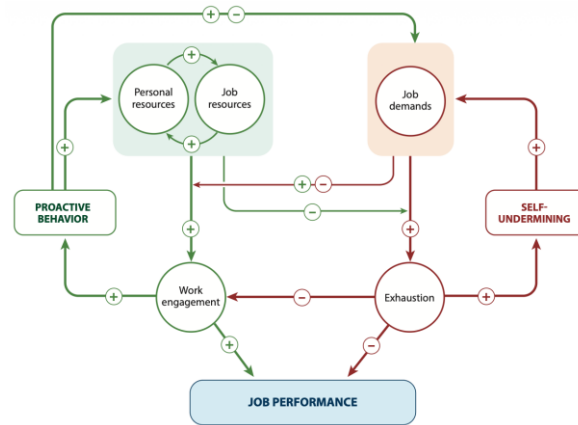


Figure 1: The job demands-resources model (Figure 1 in Bakker et al., 2023)

Since the JD-R model's initial appearance in the early 2000s, much research has been done to evolve its related principles and propositions while maintaining the core idea of job demands and resources. Some of the biggest innovations include 1) the person x situation approach, which incorporates personality, 2) multilevel JD-R theory involving the effect of organizational constructs, 3) new proactive approaches, including job crafting, proactive vitality management, and playful work design, and 4) the work-home resources model, which accounts for the effect of workers' situations away from the workplace (Bakker et al., 2023). Considering the nature of this paper, while there is not nearly enough space to discuss each proposition of the JD-R model, the hope is that this brief overview of various theoretical models may assist in drawing connections to critical psychological research. Once again, it is emphasized that several of the JD-R model propositions are strongly backed by empirical studies. The nine propositions posed by Bakker are embedded in the proposed theoretical models of this paper (Bakker et al., 2023).

THE ROLE OF PRESSURE CAPACITY

Bakker emphasizes the generic nature of the JD-R model and thus encourages the creation of more dogmatic and practical models that more accurately represent specific industries and situations, as with the person x situation approach and multilevel JD-R theory (Bakker et al., 2023). Derived from the concept of job demands and resources, pressure capacity is a formal term tailored to the workplace dynamics of the construction industry. Pressure encapsulates *the demands, obligations, and consequences placed on individuals and groups to meet the expectations of a project, market, individual, group, etc.* The word capacity refers to *the total ability to absorb pressure through culture, character, processes, skilled labor, and other methods.* The purpose of creating *pressure capacity* is inherent in the current situation of the construction industry described in the beginning, which appears to be characterized as a *high job demand* and *low job resources* environment, generating high strain or exhaustion. As such, it seems imperative to create a focus term tailored to the complex situation of construction workers in an effort to urgently facilitate more research and practical application. In acknowledging other project delivery methods, the most prevailing owner, architect, engineer, and contractor (OAEC) stakeholder model will be utilized to employ the value of pressure capacity. This paper strives to take the base definition of pressure capacity one step further by transforming it into a highly valuable metric for all industry stakeholders and workers.

DIRECT VALUE TO LEAN THEORIES AND APPLICATION

Respect for people is a core, if not central, pillar of lean ideology. The concept of pressure capacity is closely linked to this pillar, as it directly addresses the well-being of workers and their subsequent impact on the workplace. Araki & Smith introduced the significance of social waste as "essentially interweaving process wastes and physical wastes in lean. Unhealthy and

unsafe practices at the corporate, group, and individual levels may lead to unanticipated delays, inefficiencies, and unproductivity” (Araki & Smith, 2025). In addition to advancing the value of social waste, many other key lean concepts and practices may benefit from pressure capacity.

Expounding upon the idea of operation and process flow, Kalsaas proposes the idea of workflow using the metaphor of a river, where the river flows with a certain smoothness, intensity, and quality (Kalsaas, 2013). Pressure capacity may assist in gauging the impact on individuals and groups of varying levels of downtime (perhaps a form of capacity), which defines the ‘smoothness’ of workflow. Slack, a comprehensive method for addressing complex projects, is yet another form of capacity that may be utilized to alleviate pressure. It involves evaluating the extent to which processes should be shielded against variability with complex socio-technical systems (CSS) without compromising efficiency, or, in other words, producing waste (Formoso et al., 2021). Pressure capacity facilitates defining the emergent outcomes and hierarchical demands (forms of pressure) of CSSs, which trigger the need for slack.

In addition, pressure capacity supports the more fundamental lean tenets of optimizing value, minimizing waste, and fostering collaboration. The nature of the concept involves being critical of various job demands and their effect on project efficiency, as well as evaluating the value which job resources bring. Christensen et al. (2023) emphasize that the OAEC industry needs to enable a collaborative decision-making process to include different perspectives and thereby find the best solutions. Understanding pressure capacity demands selflessness and mutual understanding within the OAEC stakeholder model. The main premise here is that various lean ideologies may be utilized to either exert or alleviate pressure, as well as provide additional capacity where needed. The presented ideologies are not meant to be an exhaustive list, but rather a starting point from which the concept of pressure capacity can develop.

RESEARCH GAP & OBJECTIVE

The primary purpose of this paper is to demonstrate the urgent need for the novel term pressure capacity in the construction industry, derived from the foundational ideas of the job demands-resources model in psychology. This is an answer to Bakker’s directive to create more dogmatic and practical models that are specifically relevant to a given occupation (Bakker et al., 2023). Currently, there are no construction industry-specific JD-R models, and subsequently, limited models for practical application. As such, this paper will seek to 1) expound upon the theoretical JD-R model within a construction industry context, and 2) provide a practical avenue to employing the value of pressure capacity.

METHODOLOGY

The process of developing this theoretical paper consisted of the following:

1. Preliminary Research Framework Development – A group consisting of both academic personnel (5) and construction industry professionals (4) was organized to identify a research problem, establish a thesis, and brainstorm solutions and models to support the central idea of pressure capacity. The profile of the primary discussion group includes academic professors from the construction and psychology departments, seasoned safety personnel, and experienced construction field and project managers. The group met and communicated weekly for two months to develop the theoretical concepts.
2. Theoretical Refinement Through SLR – This phase entailed a more rigorous development of the theories that evolved from the experiences of the discussion group, as each concept was refined and supported through academic sources to add scholarly relevance and significance to the initiative. A rudimentary systematic literature review process was adopted, as supporting sources were handpicked from academic and public databases according to topic relevance to support each principle.

3. Model Development – Once each theory was established, subsequent models were developed to reflect more concise, polished outcomes of the theoretical experiment.
4. Synthesis & Future R&D – The purpose, function, and benefit of the proposed models are discussed and synthesized to create a stronger theoretical foundation and guide the direction of future studies.

KEY ASSUMPTIONS

The following assumptions were derived from a collective understanding of existing literature, combined with personal industry experience among the researchers. These assumptions help ground the subsequent theoretical models that are proposed.

Assumption 1: Managing job demands and construction-specific resources is key to improving workers' overall well-being. This may be effectively approached through either individual or organizational means, the latter of which we have more control over from an objective standpoint.

One recent empirical study successfully utilized the JD-R model within a construction safety context in Korea. Several key variables were linked to worker well-being, including 1) environmental, physical, and mental job demands, 2) top management safety attitudes, 3) safety cultures and systems, 4) middle managers' safety competency, 5) organizational stress and risk management, and 6) workers' safety behaviour. Their study revealed that hazardous work environments, physically strenuous tasks, and mental stress had a profound hindrance on workers' safety behaviour, while middle managers' safety competencies had a key influence on their behaviours (Seo et al., 2025). Aside from this rare study, which directly connects the JD-R to construction, many other psychological studies support this organizational impact claim, including job design and leadership, such as in the case of the multi-level JDR theory depicted below in Figure 2 (Bakker et al., 2023).

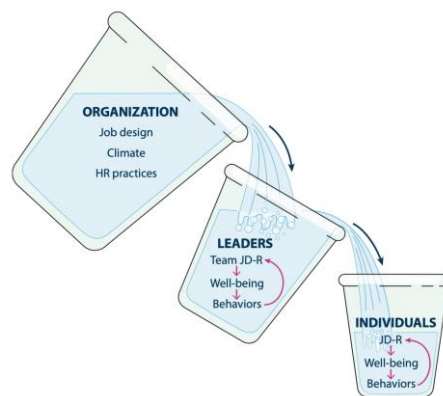


Figure 2: The multi-level JD-R theory (Figure 3 in Bakker et al., 2023)

It is critical not to become hyper-focused on organizational-level approaches, but to also consider an individual-level approach. For one, research suggests that personality plays a key role in perceiving and evaluating job demands and resources, which subsequently affects employee well-being (Borst & Knies, 2021). Essentially, demands and resources may differ within individuals, which may be moderated through personality (Bakker, 2015). Nevertheless, one empirical study emphasizes the value of assessing both objective job characteristics and subjective employee perceptions (Li et al., 2023). Based on this research, the assumption is that while little to no control is held at the individual level, such as in the case of personality, greater control and overall impact on pressure capacity for a group of workers can be found through

more objective, organizational-level approaches, such as in the case of job design and leadership.

Assumption 2: The dynamics of pressure operate differently at the individual and organizational level. It is critical to distinguish between these two ideas to most effectively address pressure in the workplace.

In 1908, a study on mice discovered that learning improved with electric shocks to a certain threshold, after which further increases in shock intensity led to decreases in learning. This became known as the Yerkes-Dodson model, which essentially proposes an inverted U-shaped curve to explain the relationship between pressure and performance (Yerkes & Dodson, 1908). There appears to be controversy over the validity of the Yerkes-Dodson Law (YDL). On one hand, you have empirical research that appears to support the theory, while on the other, critics who warn of the intuitive ‘seductive’ nature of a model having a conflating, empirical basis (Corbett, 2014). Nevertheless, while the anti-YDL extremists argue strongly against the U-shaped curve, there appears to be a consensus that this relationship between pressure and performance is a noteworthy pursuit, and that the outcomes of those supporting studies may ‘window’ different locations along the inverted U-shaped curve (Hancock & Ganey, 2003).

In accordance with Assumption 1, one of the core assumptions is that pressure is a natural and necessary tool that may be used to maintain accountability, quality, timelines, budget constraints, and so forth on construction projects. Healthy pressures may help team members align and focus on a clear vision, without exceeding individuals' and groups' capacity or negatively impacting their well-being. On the other hand, unhealthy pressures are those that compromise their capacity and well-being. One conceptually parallel study that directly links the JD-R model to the YDL differentiates between ‘hindrance demand’ and ‘challenging demand,’ the latter of which had a positive effect on work engagement (Kim et al., 2024). Concerning Assumption 2, organizational managers must be cognizant of the fact that organizational-level averages for pressure capacity may not necessarily account for individual outliers, especially in the case of suicidal ideation, which is an especially complicated and sensitive situation. In other words, while organizations shouldn't feel forced to adapt their general resources for these outliers, they should be aware of both the company-level mean and individual-level pressure capacities of their employees.

Assumption 3: Creating a quantifiable pressure capacity metric may provide a valuable benchmark for all stakeholders in tracking and improving worker engagement and/or performance.

Up until now, the concept of pressure has been kept largely at a conversational level and, in some respects, generalized and left undefined. Defining specific pressures and assigning quantifiable metrics may give stakeholders targets, rather than mere options for exerting and alleviating pressure. For instance, in America, since OSHA's founding in 1970, worker deaths have gone from about 38 per day to 15 in 2023, while worker injuries and illnesses have gone from 10.9 incidents per 100 workers in 1972 to 2.4 per 100 in 2023 (Occupational Safety and Health Administration, n.d.). As rules and guidelines for physical safety were established and thereby enforced, this resulted in clear improvements for physical safety. As expressed by increasing suicide rates and other metrics, there is an increasing concern for psychological, social, and additional organizational aspects of jobs that affect worker well-being. By providing a more holistic pressure capacity scale underpinned by the JD-R model, perhaps there will be a general increase in concern among stakeholders, which may directly contribute to the overall increase in worker well-being. Once again, evidence for the industry suggests that presenting best practices as targets rather than options is more likely to produce desired results.

RESULTS & DISCUSSION

The following section presents the theoretical results derived from the presented assumptions. The presented models are to be regarded as flexible and adaptable to best suit the needs of the construction industry within various cultures and systems. Each component of the model is first defined, followed by a discussion of the implications and value that the models bring in building a fundamental understanding of pressure capacity, advancing lean pursuits, and promoting healthy pressure environments. This section will be followed by the final section of future experimentation, which proposes a holistic agenda for future research and development on pressure capacity.

THE LECHTENBERG PRESSURE FLOW MODEL

Figure 3 is a result of Assumption 1, which discusses the value of an organizational-level approach to job demands and resources. With respect to pressure capacity, the following model is a construction industry-oriented development of the multi-level JD-R theory shown in Figure 2. The rivers represent various roles within the traditional OAEC stakeholder model. They are all set at different elevation starting points on a mountain to help illustrate the flow of pressure within the hierarchical system, where owners hold the greatest autonomy. The water may represent the fundamental components of a construction project, while the flow of the water may represent pressure. Traveling down the mountain, the natural flow of the water is assumed to accelerate, hitting its highest intensity and maximum pressure at the bottom.

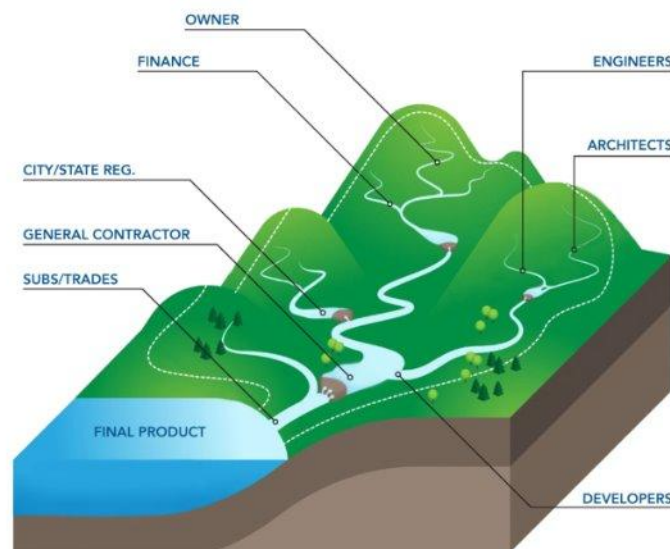


Figure 3: The Lechtenberg Pressure Flow Model

The degree of autonomy assumed in the construction process was a key factor in determining the location of each stakeholder. One of the first key elements to note is the disparity present between the owner and contractors. Subcontractors and trades are illustrated as experiencing the greatest difficulty in combating the natural flow of pressure within the traditional OAEC model, being the final segment of the construction process before the final product. This is harmonious with previous research, which suggests that autonomy is a key resource in coping with job demands (Bakker, 2007). While this may be seen as a rudimentary model, it nonetheless contributes to the development of pressure capacity by providing an organizational context for the traditional OAEC stakeholder structure through a concise visual. Before

adopting an organizational-level approach, it is critical to consider the leverage that each role has with respect to job demands and resources.

THE PRESSURE ELASTICITY MODEL

Figure 4 below is grounded in Assumption 2 and emphasizes the concept of pressure elasticity. Based on existing research for the JD-R and Yerkes-Dodson theories, this figure depicts the dynamics of pressure at the individual level. It expounds upon existing theoretical papers by integrating the concept of elasticity. As with a rubber band, with respect to job demands and resources, an individual may experience (1) a tensionless state of zero pressure, (2) an elastic state in which their well-being remains intact, (3) a deforming state in which their well-being is negatively affected, or (4) a catastrophic state which leads to a breaking point resulting in death by exhaustion, suicide, and so forth. The Yerkes-Dodson inverted U-curve for pressure and performance acts as a basis for the first three states. Catastrophic pressure represents extreme cases such as suicide.

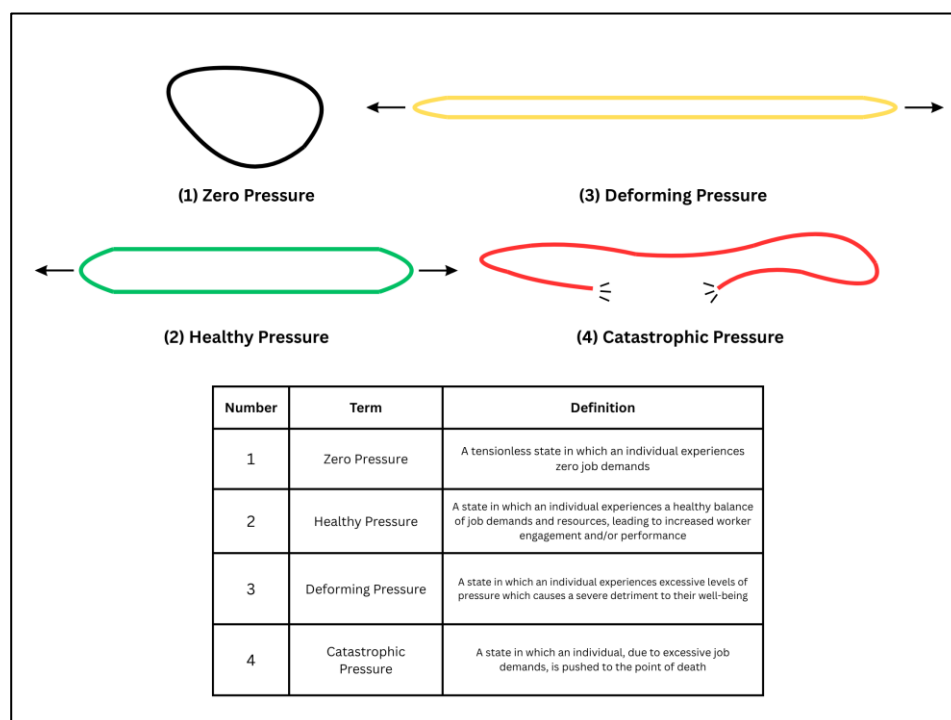


Figure 4: The pressure elasticity model

THE PRESSURE CAPACITY SCALE MODEL

Backed by Assumption 3, the pressure capacity scale (PCS) model is inspired by the FICO credit score model, created by the Fair Isaac Corporation as a critical tool for communicating creditworthiness and financial history between lenders and borrowers. Despite controversial opinions, its universal, continued use is driven by its value for risk management, equitable treatment, and making the credit market more efficient (Boslaugh, 2022). Presented in Figure 5, the PCS serves the parallel purpose of communicating project feasibility and providing risk management, fairer treatment of worker well-being, and worker efficiency concerning job demands and resources through a comprehensive net pressure score. This model does not represent a final, polished system for the tool, but rather addresses the key principles that underpin its utility. Variations may be adopted, such as by scaling ‘Goldilock’ scores to parallel the more universally recognized min-max FICO scoring system. For those unfamiliar, the term ‘Goldilocks’ refers to the optimal part of a range of values or conditions, which typically lies at

the center. In theory, between the extreme spectrums of zero pressure and maximum pressure, it is hypothesized that there exists a Goldilocks zone of compromise that allows for both perspiration and capacity to thrive.

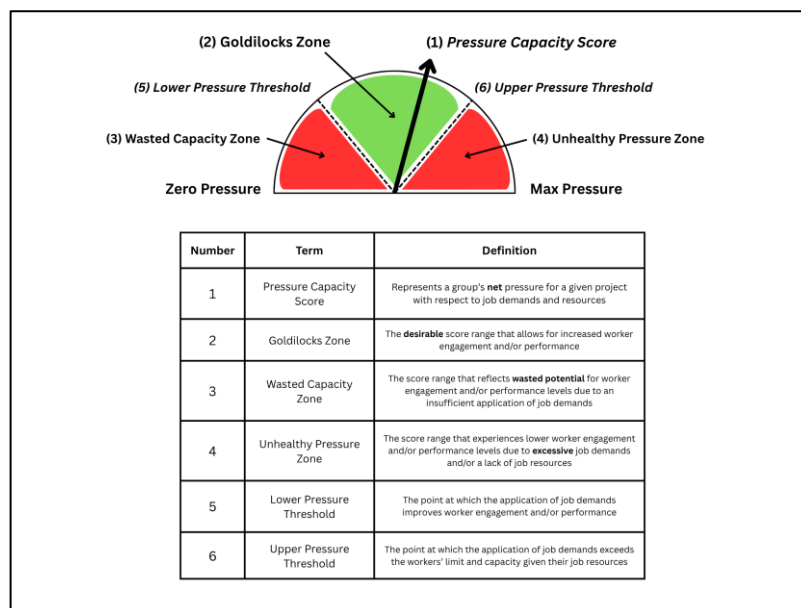


Figure 5: The Pressure Capacity Scale (PCS) model

Just as the FICO score is calculated through five key weighted components consisting of 1) Payment History (35%), 2) Amounts Owed (30%), 3) Length of Credit History (15%), 4) New Credit (10%), and 5) Credit Mix (10%), it is critical to establish categories with subsequent weightings by which pressure dynamics are most significantly reflected in the workplace. The following table represents a series of options for categories that may comprise the pressure capacity score. The weightings for each category may be clarified in future research.

Table 1: Proposed categories for the PCS model

Proposed Category	Description (Demands/Resources)	Supporting Research (Full Citation in References)
(1) Project Pressures	Schedule compression/slack, financial motives (i.e. liquidated damages, incentives), scope complexity, workforce size	Nepal et al., 2006; Mohammadjafari et al., 2024; Baccarini, 1996; Hanna et al., 2005
(2) Organizational Safety	Safety staff presence, pre-task planning, effective middle-management	Hinze et al., 2013; Hallowell & Gambatese, 2009; Seo et al., 2025
(3) Workforce Capacity	Worker experience, shift lengths & timing	Hallowell, 2010; National Institute for Occupational Safety and Health (NIOSH), 2004
(4) Task Hazard & Complexity	High-risk task density, work overlap/role conflict, hazard exposure	Hinze et al., 1998; Karasek, 1979
(5) Contractual Risks	Allocation of risk, subcontractor prequalification, safety enforcement, degree of autonomy, regulatory complexity	Love et al., 2005; Hallowell, 2010; Karasek, 1979
(6) Environmental & Emergency Stressors	Climate extremes, site congestion, medical capabilities and access	Smith & Hosking, 2013; Hinze et al., 1998; Hale, 2000

One key matter to discuss is how to go about associating the PCS model. Should it, in some form, be connected to projects, contractors, owners, or perhaps institutionalized and pinned to a particular party? Research indicates that the general contractor may be the key stakeholder as the ‘middle manager’ (Seo et al., 2025). In any case, the PCS needs to be as holistic a structure as possible. Establishing such a benchmark has the potential to influence pressure capacity-building incentives, insurance premium rates, prequalification requirements, and more. Ideally,

all parties mutually benefit from the setup of the categories and subdivisions, which then creates shared value and incentivizes the instrument's utility. Furthermore, the PCS model may be used as a key metric in validating and expounding upon the Yerkes-Dodson pressure and performance relationship.

FUTURE EXPERIMENTATION

Figure 6 outlines the abundant opportunities for future research and development of pressure capacity. The primary four categories include theoretical critique and development, pressure flow models, establishing the PCS model, and integrating other lean ideologies. The agenda of theoretical critique and development involves building upon the preliminary stage of the pressure capacity theory by refining the definitions, assumptions, and hypotheses presented in this paper. A second key agenda involves creating pressure flow models, which may assist in enhancing our understanding of workplace pressure dynamics and how to use pressure as a leverage in harmony with capacity. The PCS model is the main spotlight, as this is a medium through which the lean academia may transpose ideologies into practicality and clearer relevance for addressing the industry's common dynamics of pressure. Figure 5 above represents the basic principles of the PCS and serves as the launch point from which effective models can be developed across various cultures, models, and systems. One final hope to be noted is that the development of pressure capacity will serve as a method for observing how the value of lean ideologies compares in terms of their impact on pressure capacity. Ultimately, we are confident that Figure 6 will serve as a holistic, kaizen-focused agenda for unlocking the greatest values of pressure capacity, which is worthwhile for both academia and the global construction industry.

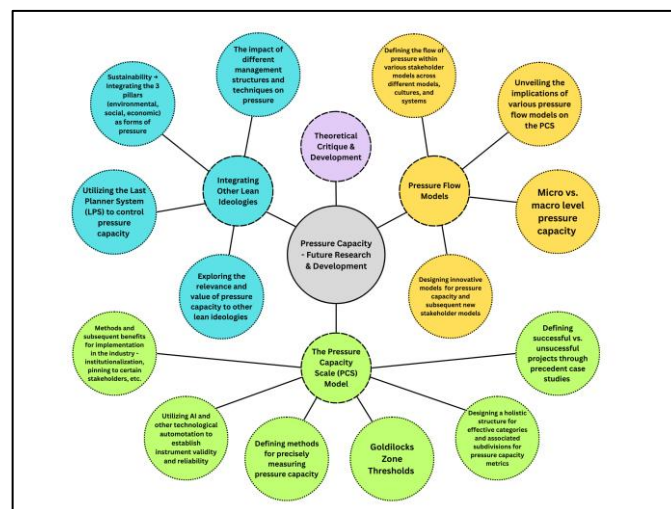


Figure 6: Future Research and Development for Pressure Capacity

CONCLUSION

Elevated levels of pressure underscore the urgency for applying the job demands-resources model to the U.S. construction industry. Pressure is defined as *the demands, obligations, and consequences placed on individuals and groups to meet the expectations of a project, market, individual, group, etc.* The word capacity refers to *the total ability to absorb pressure through culture, character, processes, skilled labor, and other methods.* Assumptions based on existing literature addressed organizational and individual applications for the JD-R theory, the Yerkes-Dodson theory, and the need for establishing pressure capacity as a metric. These assumptions ground the Lechtenberg Model (Figure 3), which illustrates the flow of pressure within the

traditional OAEC stakeholder system, the Pressure Elasticity Model (Figure 4), which illustrates individual-level pressure dynamics, and the Pressure Capacity Scale (PCS) Model (Figure 5), which establishes pressure capacity as a valuable benchmark. Lastly, a holistic agenda (Figure 6) was put forth as a framework for fostering international collaboration on the worthwhile development of the novel pressure capacity concept.

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