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Investigation of PESTEL factors driving change in capital project organizations

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In a volatile, uncertain, complex, and ambiguous environment, organizational change has been a central concern for capital project organizations, that continue to suffer from poor project performance in a growing industry. As such, capital project organizations must understand the changing environment and the factors driving change within their organizations to remain successful in a changing environment and adapt to change. To help the capital projects industry achieve successful organizational change efforts, this paper aims to 1) identify the external factors that are pushing capital project organizations to change and 2) investigate whether these factors impact organizations differently. To achieve the desired objective, a total of 22 PESTEL (political, economic, social, technological, environmental, and legal) factors were identified and validated with a group of 14 subject matter experts and defined via the context of literature. Then, the factors were evaluated via an online survey to understand whether they impact organizations differently based on their age maturity (including contemporary, transitional, and legacy organizations) and type of work (including owners, contractors, and service providers). Findings from this study can provide capital project practitioners and researchers with valuable insights needed to understand the external factors shaping change within the industry.

KEYWORDS

capital projects, change management, construction industry, external change factors, organizational change, PESTEL

1 Introduction

Capital projects organizations can be defined as project-based organizations that "involve the creation of temporary systems for the performance of projects tasks" and carrying out their projects (Thiry, 2007). These organizations are spread across different industries including construction, energy, and manufacturing, where they handle complex, high-value projects such as airports, data centers, refineries, and powerplants (traditional or renewables) to either improve operating-level capabilities or create new products, services, and assets for an expected profit (Scott-Young and Samson, 2008; Caldas et al., 2015; Barone, 2022).

In recent years, capital projects have suffered from poor performance (Forrest et al., 2017). On average, projects require a 38% extension in schedule, cost 40% more than their original budget, and undershot target quality and repeatability by 25% (Chandrasekaran et al., 2021). This poor performance stems from various industry-wide issues including challenges with the workforce, productivity, stakeholder collaborations, material costs,

business models, government spending, technology adoption, and traditional project delivery systems (Caldas et al., 2015; Forrest et al., 2017; CII RT-360, 2019; Chandrasekaran et al., 2021). More recently, the COVID-19 pandemic caused further disruptions in capital projects as it accelerated the capital project industry's push toward digitization and sustainability (Orzeł and Wolniak, 2022).

Consequently, the poor performance of capital projects, the industry-wide challenges, and the coronavirus impact have placed greater emphasis on organizational change within the capital projects industry and the need for construction organizations to successfully navigate the changing environment (CII RT-381, 2022). Organizational change can be defined as an alternation of a core aspect of an organization's operation, structure, or culture, which transforms the organization from a current state to a desired future state (Quattrone and Hopper, 2001; Stobierski, 2020). The need for change is well recognized by capital project organizations with around 75% of senior executives and top decision-makers acknowledging a fundamental necessity to rethink the *status quo* (Chandrasekaran et al., 2021).

As such, studying organizational change for capital project organizations becomes crucial, as it provides leaders with the insights needed to learn, grow, and survive changing environments (Stobierski, 2020). This is especially important as global capital spending is expected to reach $130 trillion by 2027 notably to decarbonize and renew critical infrastructure (Fuchs et al., 2022). Researchers argue that only organizations with proper change strategies, structures, processes, and technologies can undergo a smooth and efficient change effort, and as a result, reduce resource utilization, adapt to shifting market trends, and maintain their competitiveness (Burnes and Jackson, 2011; Burke, 2018; Errida and Lotfi, 2021). In fact, it is commonly known that change efforts have a 30% success rate, a percentage that has both been ascertained and debunked over the years (Hughes, 2011; Tobias, 2015; Heracleous and Bartunek, 2021). Whether this percentage overestimates or underestimates the reality of change efforts for the capital projects industry, the success rate will increase when the organization properly understands the factors that affect the changing environment and drive its change efforts (Isaksson et al., 2011).

1.1 Point of departure

Factors that drive organizational change can be "internal" and stem from within the organization, or "external" and are driven by outside forces that affect an organization's operations (Hartzell, 2021). Several studies on organizational change in the capital projects industry discussed change types and presented case studies such as alternative project delivery methods, new workflow implementations, the application of various technological tools, new safety programs, or knowledge transfer (Gerdin et al., 2010; Caldas et al., 2015; VardiReddy, 2017). However, studies did not explore the internal and external factors that may lead capital project organizations into undergoing such change efforts (El Jazzar, 2022). While internal factors can be unique to every organization depending on its structure and function, external factors are more global and common across most organizations within the industry. As such, this paper will address the gap by identifying and investigating the external factors that are driving change in the capital projects industry. Understanding such factors can allow organizations to anticipate and adapt to change in their industry and marketplace, identify opportunities and threats that can impact operations, make informed decisions and take proactive measures to stay ahead of competitors, and maintain a solid reputation and strong relationships with stakeholders (Tripathi and Jha, 2018; Maali et al., 2020; Pfnür and Wagner, 2020).

1.2 Research objectives

To address the gaps in the literature, this paper answers two major research questions.

- What are the external factors that drive change for capital project organizations?
- Are capital projects with different age maturity and type of work impacted differently by the identified factors?

As such, the main objectives of this paper are to.

- Identify the external factors driving organizational change in the capital projects industry.
- Investigate if capital project organizations with different age maturity (i.e., years of experience) and type of work (i.e., type of experience) are impacted by the same external factors.

To achieve the desired objectives, the study utilized the political, economic, social, technological, environmental, and legal (PESTEL) framework. The PESTEL framework is commonly used in studies that investigate the external factors that drive or pressure organizations to implement changes (Tijani et al., 2022). The framework has proven successful in analyzing the macro-business environment that is external to the firm, as it allows organizations to understand the underlying characteristics that are not within their control (Lamas Leite et al., 2017; Wei et al., 2019).

2 Research methodology

A mixed four-step research methodology was adopted in this study. First, a comprehensive literature review was performed to identify the PESTEL factors that drive change for capital project organizations. The review included academic publications like journal articles, conference proceedings, and book chapters, as well as annual reports and industry findings published by capital project organizations, consultants, and government entities (Table 1). Such a comprehensive review is a common approach for PESTEL related-studies in the industry (Lau et al., 2019; Turkyilmaz et al., 2019; Dalirazar and Sabzi, 2023). A total of 25 factors were identified and shared with a group of 14 subject matter experts for validation. The validation process resulted in 22 factors (Table 3), where some original factors were joined together, edited, or dropped. Every factor was redefined and explained in the context of literature and then shared in an online survey with capital project organizations. A survey was

TABLE 1 Identified references for the PESTEL factors.

PESTEL	References
Political	Petrovic-Lazarevic (2008); Oparin et al. (2016); Loosemore and Lim (2017); UNEP (2017); Loosemore and Lim (2018); Walsh (2018); Xia et al. (2018); Regan (2019); Bou Hatoum, Faisal, et al. (2021a); Lim et al. (2021); Phillips (2021); Regan (2021); Smith Schafer (2021); Bou Hatoum, Nassereddine, et al. (2021b); Pamidimukkala and Kermanshachi (2022); Phillips (2022)
Economic	Gunhan and Arditi (2005); Lewis (2007); Darwish et al. (2012); Winters (2014); De Groote and Lefever (2016); Aramburu (2019); Auberger et al. (2020); Mew (2020); Ribeirinho et al. (2020); Tetteh et al. (2020); The Economist Intelligence Unit (2020); Deloitte (2021b); Huthwaite and Ward (2022); Yoon and Pishdad-Bozorgi (2022)
Social	Cooper et al. (2002); Winston (2002); Moodley et al. (2008); Vennström (2008); Chong and Chen (2010); Spence (2011); Schwatka et al. (2012); Mohd Nawi, Mohd Nasrun et al. (2014); Merriman and Valerio (2016); SHRM (2016); Tortajada (2016); Ainsworth (2017); Quint (2017); Haupt and Harinarain (2017); Dworak and De Villiers (2018); Yang and Manoosingh (2018); Yang and Manoosingh (2018); Chengjie (2019); Hamid and Tutt (2019); Sokas et al. (2019); Caminiti (2020); Ceesay (2020); Dickey et al. (2020); Ernst and Young (2020); Gallagher (2020); BLS (2021); Gabrielova and Buchko (2021); Peng and Chan (2021); Sethi and Goodman (2021); Skanska (2021); AGC (2022); Bechtel (2022); Hatoum et al. (2022)
Technological	Rose and Manley (2012); Nagy et al. (2014); Bilal et al. (2016); Vazquez et al. (2016); Breugel (2017); Zou et al. (2017); Fuchs et al. (2018); Bertram et al. (2019); Boomen et al. (2019); Markets and Markets (2019); Kusimo et al. (2019); Darko et al. (2020); Hall et al. (2020); Hao et al. (2020); Hossain et al. (2020a); Jansen van Vuuren and Middleton (2020); El-Sayegh et al. (2020); Bou Hatoum et al. (2020); Arabshahi (2021); ASCE and EBP (2021); Carson (2021); Yousif et al. (2021); Ammar et al. (2022); Assaad et al. (2022); Hatoum and Nassereddine (2022b); Lawrence (2022); Hatoum and Nassereddine (2022a); Ammar et al. (2023); Atuahene et al. (2023); Hatoum, Ammar, et al. (2023a); Umar (2021)
Environmental	Hong et al. (2011); Dadhich et al. (2015); Murtagh et al. (2016); Agung Wibowo et al. (2018); Anupoju (2020); Benachio et al. (2020); European Commission (2020); Hossain et al. (2020b); Lebling et al. (2020); CDP (2021); Guettler (2021); Abdelshafy and Walther (2022); Andersson and Buser (2022); Climate Action 100+ (2022); Fuchs et al. (2022); Jensen et al. (2022); Jowkar et al. (2022); Pourmokhtarian et al. (2022); Chen et al. (2023)
Legal	Matthews and Howell (2005); Asmar et al. (2013); McKay (2015); Franz and Leicht (2016); Mesa et al. (2016); Prabhu (2017); Nyquist (2018); CII RT-341 (2019); Dargham et al. (2019); FHWA (2022)

TABLE 2 Distribution of survey responses.

Demographic variable	Categories	Frequency	Frequency (%)
Years of Experience	Contemporary (11–25 years)	7	11.48
	Transitional (25–50 years)	12	19.67
	Legacy (50+ years)	38	62.29
	Unspecified	4	6.56
Types of Experience	Owner	30	49.18
	Contractor	18	29.51
	Service Provider	9	14.75
	Unspecified	4	6.56

then designed to investigate the driving factors, where respondents were asked to select the factors that drive their organizational change initiatives. Two demographic variables were collected as well to describe the organization's experience (Table 2): the organization's total years of experience (contemporary–transitional–legacy), as well as the type of work that they perform (owner–contractor–service provider). Finally, statistical analysis was employed to analyze the collected data and address the two objectives.

2.1 Selection of expert panel

The Construction Industry Institute (CII) commissioned a research team to investigate organizational change management within the capital project industry and appointed a task force of 14 subject matter experts (SMEs) to support the research team. The subject matter experts (SMEs) represented owners (5 SMEs), contractors (2 SMEs), service providers (5 SMEs), and academics (2 SMEs). The group had on average 15.5 years of experience in the construction industry and each expert has been through at least one organizational change at their organization in the last 5 years and had great visibility into the process. In general, the number of participants in expert panels varies between 3 and 15, making 10 an acceptable representation (Ogbeifun et al., 2016; Mansour et al., 2022).

2.2 Survey sample

The online survey was first pilot tested with the subject matter experts and then distributed via Qualtrics using the snowball

sampling technique. The technique depends on referrals, and it is a common approach to gathering data from a targeted population (Naderifar et al., 2017). The snowball technique was used in various change-related construction studies because it is a time-saving, efficient, and suitable method to reach targeted participants that are difficult to access (Eze et al., 2021; Gerlak et al., 2021; Justina et al., 2022; Mansour et al., 2022; Omar et al., 2022).

In this study, the targeted population was individuals involved in organizational change initiatives within capital project organizations. The survey was distributed through CII to their members. Additionally, the panel of subject matter experts was asked to promote the survey and share it on their social media accounts to reach a broader audience. The survey asked respondents to verify that their organization has undergone change efforts in the past 5 years, the change affected the capital projects division of their organization, and that the respondents had great visibility into its process (e.g., how it was conceived and how it was executed). A total of 159 responses were received, out of which 61 responses were complete for analysis (around 38%). The distribution of responses (Table 2) shows that a range of organizations was represented in the data sample. The "unspecified" data points were excluded from the analysis.

2.3 Methods of analysis

To investigate the PESTEL factors and understand how they vary between organizations, survey results were used to compute six matrices: a matrix for contemporary organizations, a matrix for transitional organizations, a matrix for legacy organizations, a matrix for owners, a matrix for contractors, and a matrix for service providers. The matrices were then used to compute a normalized score for every factor. The normalized scores can standardize and streamline comparisons across demographic groups, and to that end provide valuable insights regarding the analyzed factors (Assaad and El-adaway, 2020).

2.3.1 Computing the matrices

Each matrix was computed in three steps as shown in Figure 1. The first step involved forming an "Applicable/Not Applicable" matrix where every column represented a factor f), and every row represented a response r). The maximum number of factors F) was F = 22, and the maximum number of responses R) was R = 61. The response for every factor was "Applicable" if the survey respondent selected the factor, or "Not Applicable" if the survey respondent did not select the factor. For example, Response 3) shows "Applicable" for Factor 2), Factor 3), and the very last Factor (22) (i.e., Factor F)), while it shows "Not Applicable" for Factor 1). This indicates that the survey respondent who answered Response 3) selected Factors 2, 3, and 22 as factors that are driving the change efforts in their organization but did not select Factor 1. The next step involved forming an (FxR) matrix where "Applicable" values were changed to 1, and "Not Applicable" values were changed to 0. The matrix was then transposed to an (RxF) matrix where the columns reference responses and the rows reference factors.

2.3.2 Calculating the scores

After forming the (RxF) matrix, every factor received a score by adding all the cells for every row using Eq 1. Then a normalized score was calculated for every factor by dividing the score of the factor by the maximum score among all factors inside the matrix using Eq 2. The normalized score was calculated to standardize the comparisons between factors and ensure accurate comparisons and reliable conclusions when comparing the three matrices for the years of experience matrices (Contemporary–transitional–legacy) and comparing between the three matrices for the types of experience (owner–contractor–service provider). The calculation process is illustrated in Figure 2.

$$Score_f = \sum_{r=1}^{R\ (i.e.\ last\ column)} t_{f,r} \quad (i.e.\ first\ column) \tag{1}$$

$$Normalized\ Score_f = \frac{Score_f}{Maximum\ Score_f\ in\ the\ Matrix} \tag{2}$$

3 Identification of the external factors driving change

As discussed in the research methodology, the total number of external drivers resulting from the panel validation process was 22 PESTEL factors as presented in Table 3. Each of the factors is explained below.

3.1 Political factors

The political factors are mostly associated with government rules and laws that regulate organizations and the way they conduct their business (Issa et al., 2010). Examples of political factors include government arrangements, labor law, natural laws, and policies for corporate taxation (Turk, 2021; Peterdy, 2022). This study identified three political drivers related to union activities, taxation and trading, and human rights.

3.1.1 Streamlined tax and trade policies from the government

Changes in domestic and international trade policies, such as the wave of tariffs that recent US administrations imposed on importing materials like steel, aluminum, and lumber, can have indirect and unintended consequences on industries including construction (Regan, 2019; 2021). Examples of such consequences include an increase in material costs that the buyer of imported material needs to pay, volatility in pricing which negatively impacts project contracts and budgets, delays in receiving material as processing time at ports of entry become longer and thus delaying project schedules, and disruption of the supply chain when looking to new vendors for lower prices and changing projects' types of material to lower costs (SmithSchafer, 2021). Such consequences worsen project cost estimation for an industry that already struggles with cost estimation, budgeting, and overruns (Oparin et al., 2016; Bou Hatoum et al., 2021b).

3.1.2 Greater awareness and support for human rights

Workers in capital projects notably those in construction are highly susceptible to fatal hazards, excessive work hours, heavy

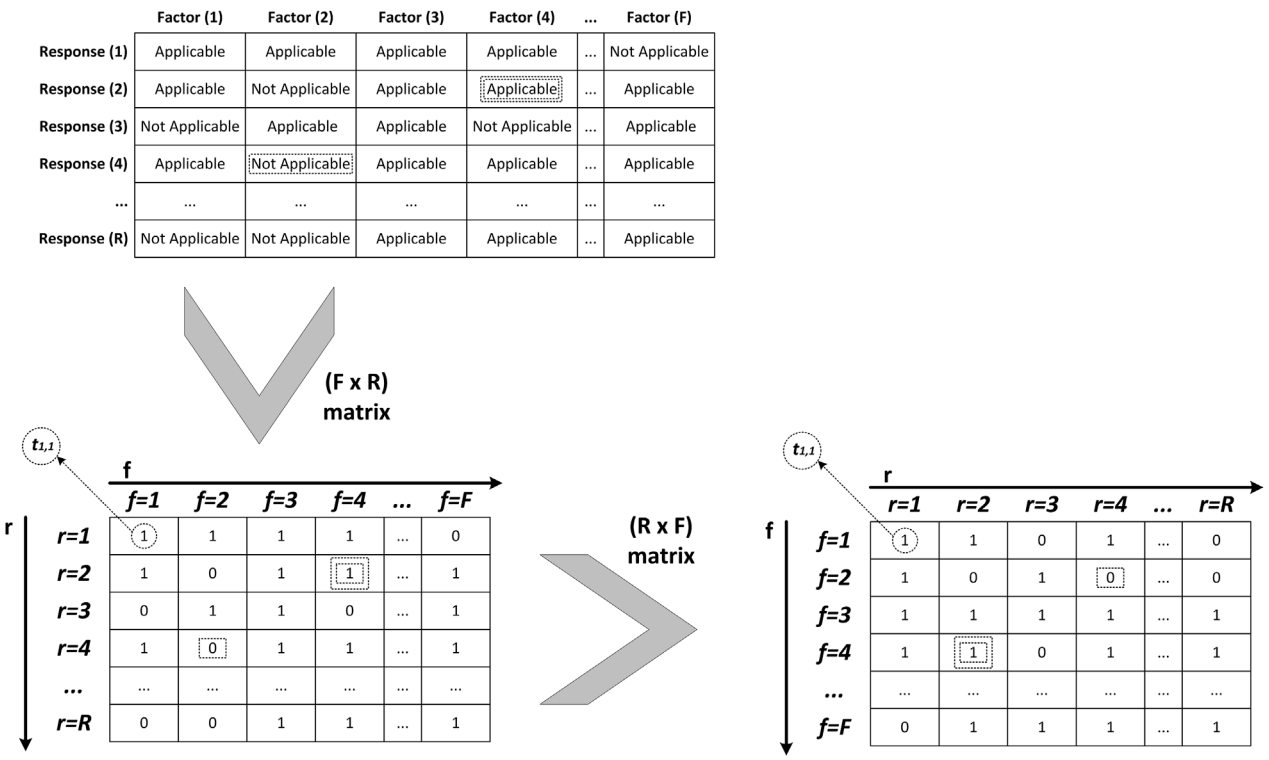

FIGURE 1
Computation of the matrices.

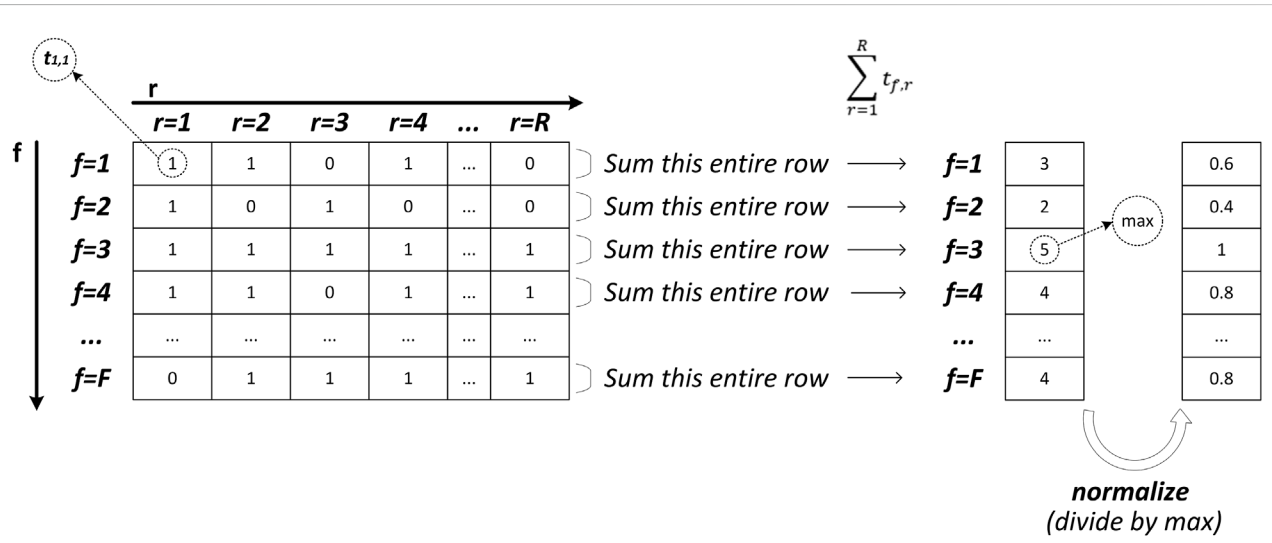

FIGURE 2
Calculation of scores.

workloads, and mental health problems like depression and anxiety (Bou Hatoum et al., 2021a; Pamidimukkala and Kermanshachi, 2022). Moreover, various human rights violations are being documented in major capital projects such as mistreatment and discrimination against migrant workers, forced resettlement of communities, and negative environmental impacts including noise emissions, waste, and pollution (UNEP, 2017). Such ongoing problems have enhanced government efforts to structure corporate governance and created political establishments that are pushing organizations for accountability, transparency, and development of corporate social responsibility (CSR) (Petrovic-Lazarevic, 2008; Xia et al., 2018; Lim et al., 2021). Through CSR

TABLE 3 Identified PESTEL factors.

Code	PESTEL	Driver
PL1	Political	Streamlined tax and trade policies from the government
PL2	Political	Greater awareness and support for human rights
PL3	Political	Strengthened union activities for worker representation
EC1	Economic	Globalization of markets and heightened competition driving growth
EC2	Economic	Increased regionalization and more localized opportunities
EC3	Economic	Diversified construction value chain with participation from non-construction actors
SC1	Social	Aging workforce and the rising threat of knowledge loss
SC2	Social	Inclusive workplace policies promoting equity, diversity, and inclusion
SC3	Social	Evolving customer needs and preferences shaping industry trends
SC4	Social	Pressure from non-governmental organizations driving social responsibility
SC5	Social	Reduced flow of younger workers in the workforce
TN1	Technological	Opportunity for modernizing and revitalizing aging infrastructure
TN2	Technological	Powerful data analytics tools for informed decision-making
TN3	Technological	Increase in off-site construction for faster and more efficient project completion
TN4	Technological	Cutting-edge new and first-of-a-kind technologies enhancing project and industry outcomes
TN5	Technological	3D Printing enabling intricate and customized designs
EV1	Environmental	Pressure from environmentally conscious owners and investors
EV2	Environmental	Increasing legislation for resource efficiency and waste reduction
EV3	Environmental	Progressive regulations for reducing greenhouse gas emissions
EV4	Environmental	Trend toward renovation projects
LG1	Legal	New collaborative delivery systems for efficient project management
LG2	Legal	Innovative project development models for improved business outcomes

organizations can develop multiple strategies with a notable focus on critical issues such as safety, health, welfare, ethics, discrimination, harassment, bullying, racism, sexism, ageism, and corruption (Loosemore and Lim, 2017; 2018).

3.1.3 Strengthened union activities for worker representation

Labor unions play a critical role in providing workers with job security, proper compensation and benefits, appropriate training, and fair treatment in the workplace (Walsh, 2018). The labor-intensive nature of the capital projects industry provides unique labor forces for union representations such as laborers, electricians, and steel workers (Walsh, 2018). Recently, the general public's approval of labor unions is at its highest since the 1960s, notably after the COVID-19 pandemic were more non-union workers lost their jobs compared to union workers (Phillips, 2022). This is accompanied by reintroducing legislation such as the "Protecting the Right to Organize Act" (PRO Act) that redefines the terms "employers" and "employees", protects workers who are seeking to form a union from firing, and increases the government's legislative power to penalize employers who violate workers' rights (Phillips, 2021). One of the effects of the PRO Act on capital projects is that independent contractors would qualify for union representation and their unique status while working on construction projects would make contractors more liable and responsible for them (Phillips, 2021).

3.2 Economic factors

The economic factors relate to the broader economy and impact organizations' profitability and the overall attractiveness of a market or an industry (Sammut-Bonnici and Galea, 2014; Peterdy, 2022). Such factors can have a financial nature and are easily quantifiable for modeling and analysis, while others are more economic with a qualitative nature (Peterdy, 2022). This study identified three economic factors including globalization, regionalization, and new actors entering the supply chain.

3.2.1 Globalization of markets and heightened competition driving growth

Globalization is one of the most important dimensions of the economy in the 21st century, where most industries experience high capital mobility with trillions of dollars moving around the world each day (Winters, 2014). The capital projects industry is no stranger to globalization, as capital projects can be considered an

"engine of growth" in many countries due to their size, contribution to economies, strong industrial linkages, and service-oriented nature (Lewis, 2007; Tetteh et al., 2020). Capital projects organizations can take advantage of the opportunities offered by the global economy and expand their business into international markets for several reasons including stagnant domestic markets, spreading risk through diversification into new markets, competitive use of resources, and finding opportunities in emerging countries with population growth and greater urbanization and concentration in megacities (Gunhan and Arditi, 2005; Deloitte, 2021b). While globalization increases access to other markets, it also increases direct competition with multi-billion dollar companies (Darwish et al., 2012). To face competition, organizations need to be proactive by using reliable project management capabilities and committed resources, building strong networks to improve their supply chain, investing in the latest innovative technologies and start-ups, ensuring compliance with regulations, and promoting sustainability practices (Gunhan and Arditi, 2005; Deloitte, 2021b).

3.2.2 Increased regionalization and more localized opportunities

The world's supply chain is unpredictable as it can always be subjected to major disruptions, especially with recent major events such as the COVID-19 pandemic, the US-China trade war, Brexit, and armed or military conflicts (Auberger et al., 2020; Huthwaite and Ward, 2022). Such disruptions have had a major effect on the sourcing of materials including for capital projects, where organizations are rethinking their dependencies on certain international markets and searching for regionalized supply chains that allow them to keep inventories close to their areas of operations (Huthwaite and Ward, 2022). For example, the US construction industry procures around 30% of its construction materials from China, and this percentage can go up to 80% for some US firms (Mew, 2020). Because of the COVID-19 pandemic, and in light of the reduced workforce, backup orders from suppliers, elongated lead times, and delays in shipping ports, the construction material availability wildly reduced resulting in aggressive purchasing patterns and spikes in national prices for materials like copper, aluminum, and casework (Mew, 2020). Given such major disruptions that could result from an event like the global pandemic, industries are considering regionalization as an alternative to the current model (The Economist Intelligence Unit, 2020). Successful regionalization efforts require capital project organizations to become more customer-centric, optimize the sourcing/distribution footprint, understand the multimodal models of transit, digitize business models, and strengthen risk mitigation (Auberger et al., 2020; The Economist Intelligence Unit, 2020).

3.2.3 Diversified construction value chain with participation from non-construction actors

The technological innovations and the market shifts towards green practices and analytics have introduced non-construction players into the construction industry's supply chain (Ribeirinho et al., 2020; Yoon and Pishdad-Bozorgi, 2022). Examples of such players include suppliers that mass produce standardized and customized modular components, software vendors, IT service providers, data aggregators, energy and Information and Communications Technologies (IVT), and utility companies (De Groote and Lefever, 2016; Aramburu, 2019; Tetteh et al., 2020).

3.3 Social factors

The social factors can refer to the factors that represent the "human and social characteristics, norms, customs, and values" of the people that concern the organization's business such as the staff, partners, and customers (Turk, 2021). Social factors can have an outsized impact on organizations and industries, especially when shaping project performance, influencing the workforce attitude, collaborating with local communities, and targeting customers or constituents (Peterdy, 2022; Tijani et al., 2022). This study identified five social factors including an aging workforce, changes in customer needs, Equity-Diversity-Inclusion efforts, pressure from non-governmental organizations, and reduced flow of young workers.

3.3.1 Aging workforce and the rising threat of knowledge loss

The aging workforce is a critical demographic factor that is adding pressure to the capital projects industry. For example, according to the latest statistics of the Bureau of Labor Statistics (BLS), nearly 43% of the total workforce in the construction industry in the U.S. are above 44 years old, and the median age of the construction workforce is 42.3 (BLS, 2021). The delayed retirement of the aging workforce is mostly attributed to economic needs (Sokas et al., 2019). While research has shown that the aging workforce has caused a decrease in productivity in manufacturing and Information and Communications Technology (ICT) businesses, a different trend is observed for the capital project industry (Chengjie, 2019). For capital projects, older construction workers are a valuable source of knowledge and expertise which are a necessity in a complex industry, and retaining skilled workers is crucial for the success of capital projects as well as ensuring knowledge transfer to younger inexperienced workers (Yang and Manoosingh, 2018). However, the aging workforce poses two major challenges to the capital projects industry. The first challenge is a health concern where the older workforce is likely to get severely ill/injured causing frequent disruptions to operations, and the second challenge is the risk of talent deficit caused by the increasing number of older construction workers exiting the workforce for various reasons including retirement, stringent work requirements, age discrimination, lack of clear lifting limits, and the digital transformation (Schwatka et al., 2012; Yang and Manoosingh, 2018; Sokas et al., 2019; Peng and Chan, 2021). Capital project organizations have taken steps to retain the older workforce and fill the skills gap, but the approaches have been variable and fragmented across capital project organizations (Dickey et al., 2020). Examples of such approaches include offering flexible work hours, providing proper subsidized lodging, providing financial education and health support, creating a new strategy for recruiting older workers by revising recruitment plans, publicizing an age-diverse workforce at the organization to attract older ones, and providing better leave policies and attractive retirement plans (SHRM, 2016; Dickey et al., 2020; Skanska, 2021).

3.3.2 Inclusive workplace policies promoting equity, diversity, and inclusion (EDI)

Recent EDI surveys on capital project organizations show that the majority of organizations (around 75%) consider EDI a priority area, and several organizations (around 30%) agree that not having EDI poses a barrier to organizational growth (Sethi and Goodman, 2021). It is expected that by 2025, approximately three-quarters of the global workforce will be millennials, and by 2030, almost every entry-level role will be filled by Generation Z, both of which will cause a demographic change in the workforce and give rise to a new customer base (Merriman and Valerio, 2016; Gabrielova and Buchko, 2021). This younger workforce is the most diverse workforce among any generation, and it distances itself from organizations that do not promote EDI values (Hatoum et al., 2022). Additionally, clients are also participating in the diversity and inclusion dialogue and embracing these values as they believe they are essential for growth (Merriman and Valerio, 2016). In efforts to combat discrimination and improve their reputation, capital project organizations are taking steps to promote EDI by offering mandatory training courses for their employees, supporting minorities and women in STEM education by offering student scholarships, providing platforms for employees to voice opinions within the organizations, closely monitoring their employment demographics, and advising new strategies to diversify the workforce annually (Skanska, 2021; Bechtel, 2022).

3.3.3 Evolving customer needs and preferences shaping industry trends

Most change is driven by changes in customer behavior and demand which can have a significant impact on how organizations operate (Gallagher, 2020). This is especially true for the construction industry and capital projects due to the fragmented nature of the industry as well as the length of such projects that can span for years between conceptualization and commission (Mohd Nawi, Mohd Nasrun et al., 2014). In fact, studies showed that the variation of customer needs over the project's lifecycle, which can be referred to as "dynamic customer requirement", contributes to uncertainty in the project's success, and makes changing customer requirements a global factor that should be considered cross-functionally across all stakeholders (Chong and Chen, 2010). Thus, customer demand and needs to play an essential role in shaping change initiatives and driving the portfolio of service providers, and failure to understand or meet the change in needs can cause loss of business opportunities, financial consequences, and damaged reputation (Vennström, 2008). Organizations should thus invest in technologies that strengthen customer engagement communication, improve processes and touch points through "customer-centricity" groundwork, and proactively analyze customer needs and preferences via comprehensive research (Dworak and De Villiers, 2018).

3.3.4 Pressure from non-governmental organizations driving social responsibility

Non-Governmental Organizations' (NGOs) power relies upon small bureaucratic apparatus that makes their decision-making processes efficient and allows them to quickly adapt to changing situations through strategic alliances, therefore "becoming catalysts with triggering effects and mobilizers and opinion makers in society" (Cooper et al., 2002; Tortajada, 2016). NGOs have the potential to engage corporations in change efforts through effective nonmanagerial stakeholder engagement that extends to a complex network of organizations including global suppliers, NGOs, distributors, and public servants (Ceesay, 2020). Such change efforts can be related to different critical aspects including accountability, conducts, labor and human rights, health and safety, environment and sustainability, communities, products and projects, and the supply chain (Moodley et al., 2008; Hamid and Tutt, 2019). NGOs can force organizations to change their practices in two ways: either *confrontational practices* like name shaming, protesting, and calling for boycotts, or *collaborative practices* like negotiations, sharing expertise, and funding research (Winston, 2002; Ceesay, 2020). Thus, with the threat of NGOs slowing or halting the construction of critical capital projects that can raise environmental or social impacts, capital project organizations have been developing transparent corporate social responsibility (CSR) programs and establishing partnership initiatives to manage social risks and enhance project delivery (Spence, 2011).

3.3.5 Reduced flow of younger workers in the workforce

According to the latest statistics of the Bureau of Labor Statistics, the younger construction workforce (age 16–25) composes around 10% of the total construction workforce (BLS, 2022). According to a survey conducted by the National Association of Home Builders (NAHB), more than half of young adults (63%) said that there is no or little chance they would consider a career in construction trades mainly due to wanting less physically-demanding jobs or believing that construction work is difficult (Quint, 2017). Moreover, despite raising wages and expanding benefits, the majority of construction organizations are considering filling open positions a "major challenge" (AGC, 2022). This is attributed to the change in the needs of the young workforce who care about respect, honesty, safety, growth, and professional development when looking for employers, while the industry suffers from a poor reputation in different aspects including unclear career advancement opportunities, poor health and safety records, corruption, and high sensitivity to economic conditions (Haupt and Harinarain, 2017; Hatoum et al., 2022). As such, organizations need to undergo changes that can allow them to attract and hire the younger workforce and find the right skills to enhance the construction of capital projects. Examples of change efforts include collaborations and partnerships with educational institutions to support STEM education, expanding internships programs, offering various professional development camps, building campus-like environments similar to those offered by Google and Facebook, adopting and promoting new technologies, and re-skilling their workforce in critical and emerging technologies for future visions such as Artificial Intelligence (AI) for green energy (Ainsworth, 2017; Caminiti, 2020; Ernst and Young, 2020).

3.4 Technological factors

The technological factors reflect the technological innovations that can disrupt the business environment and the organizations'

operations (Peterdy, 2022). In fact, the awareness of the industry's trending and upcoming technology matters is very critical to the long-term strategic decisions of any business (Turk, 2021). This study identified five technology factors related to aging infrastructure, data analytics, increase in off-site construction, new/first-of0akind technology, and 3D printing.

3.4.1 Opportunity for modernizing and revitalizing aging infrastructure

Infrastructure projects are the backbone of a country's economic stability and growth, and with most infrastructure projects currently operating beyond their presumed lifetime, governments will be investing trillions of dollars in replacing and repairing these projects (Breugel, 2017). For example, in the USA, failing to act on the aging infrastructure will cost every American household approximately $3,300 in annual disposable income and $10.3 trillion in GDP losses by 2039 (ASCE and EBP, 2021). Thus, governments will have to make optimized replacement decisions and increase infrastructure investments (Boomen et al., 2019). In turn, the demand for capital projects and capital organization services is expected to significantly increase (Carson, 2021). To keep up with the investments, traditional business-as-usual methods will not work, and capital project organizations will have to integrate technologies in their projects and invest in sustainable material research (Breugel, 2017; Lawrence, 2022). Examples of major technologies for smart infrastructure projects include artificial intelligence (Darko et al., 2020), cloud computing (Zou et al., 2017), drones (Hatoum and Nassereddine, 2022b), digital twins (Ammar et al., 2022; 2023), and wireless and sensing technologies (Hatoum et al., 2023c).

3.4.2 Powerful data analytics tools for informed decision-making

A construction capital project is built on reams of data generated from various sources throughout the project lifecycle, making data a critical element as the capital projects industry progresses into the future (Bou Hatoum et al., 2020). With the rapid advances in computing and data science, data analytics can have major use cases such as designing projects, selecting materials and resources, streamlining construction processes, optimizing resource management, scheduling and applying predictive maintenance, mitigating risks, simulating activities and performance, balancing emissions and monitoring the performance of projects in real-time (Nagy et al., 2014; Bilal et al., 2016; Kusimo et al., 2019). Such use cases can translate into major benefits in terms of productivity, safety, cost, sustainability, and quality (Yousif et al., 2021). Capital project organizations can adopt a combination strategy to leverage big data for transformation that involves developing an in-house data management policy, collaborating with external firms for resource development, and outsourcing big data services to address any capability gaps that may hinder digital transformation (Atuahene et al., 2023).

3.4.3 Increase in off-site construction for faster and more efficient project completion

Offsite construction can significantly impact projects, stakeholders, and the environment by improving project metrics like cost and time, enhancing sustainable approaches through reducing waste and establishing end-of-life recycling potential, and boosting societal impacts like workforce quality of life and stakeholder collaboration (Hao et al., 2020; Jansen van Vuuren and Middleton, 2020). Studies showed that offsite construction could claim $130 billion in the U.S. and Europe markets by 2030 delivering cost savings that exceed $22 billion annually (Bertram et al., 2019). Moreover, future off-site construction operations in industrial, residential, commercial, and infrastructure projects are expected by 2030 to move from single-trade fabrication to modularization, transition from customized offsite construction components to standardized ones, shift from permanent offsite construction structures to portable or relocatable ones, and rely on multi-skilled labor instead of single-skilled labor (Assaad et al., 2022). To achieve the shift toward industrialization and digital manufacturing in construction, several capital project organizations have used "different forms of mirror-breaking" to deviate from the traditional project-based nature of the industry such as vertical integration to enable a streamlined process of acquisition, design, engineering, offsite fabrication, and assembly, and use of relational contracts like IPD to break the supply chain liability fears and costs of innovation and co-create a knowledge transfer for fabrication (Hall et al., 2020).

3.4.4 Cutting-edge new and first-of-a-kind technologies enhancing project and industry outcomes

The large scale and complexity of capital projects and the misalignment of project goals can make it difficult to incorporate new technologies without significant planning and coordination among organizations and project partners (Rose and Manley, 2012). With new technologies flooding the construction market, capital organizations need to develop digital teams to test and deploy technologies such as data professionals for analytics and data management, technology engineers to identify and deploy solutions, and process developers to develop work processes and bridge the gap between the digital team and the field (Fuchs et al., 2018). Organizations should also partner with start-ups to explore new business models, foster research innovations, and collaborate with vendors to provide technology solutions, get licenses and partnering arrangements, and track the value of the adopted technologies (Arabshahi, 2021; Hatoum and Nassereddine, 2022a).

3.4.5 3D printing enabling intricate and customized designs

Advances in 3D printing have been changing the landscape of the capital projects industry and setting the stage for a major shift as the global size of the 3D printing market is expected to increase to $1.5 billion by 2024 (Markets and Markets, 2019). The growth is considered a promising investment even though it has not been fully commercialized on a large scale, where responding to the lack of skilled labor shortage, attracting the younger workforce, and the need to overcome supply chain variability are mainly driving capital project organizations to invest in 3D printing solutions (Vazquez et al., 2016). By properly considering the technological, organizational, environmental, and cost-associated factors related to adopting and implementing 3D printing, the use of 3D printing can enable faster construction, allow for geometrics and design freedom, shrink supply chain and material demand, enhance

construction productivity, reduce safety hazards, and embrace sustainable practices (El-Sayegh et al., 2020; Umar, 2021). 3D printing is also expected to eliminate the cost of formwork which accounts for 25%–35% of the total building cost, reduce construction waste by 30%–60%, labor cost by 50%–80%, and construction time by 50%–70% (Markets and Markets, 2019; Hossain Md. A. et al., 2020).

3.5 Environmental factors

The environmental factors emerged as the most recent addition to the PESTEL framework as a result of the growing popularity of movements such as ESG (Environmental, Social, and Governance) and CSR (Corporate Social Responsibility) across industries (Peterdy, 2022). The increased attention to climate change, scarcity of raw materials, pollution, and limits on carbon emissions is pressuring stakeholders to embrace environmentally friendly operations and pushing projects to embrace sustainable practices (Turk, 2021). This study identified four environmental factors including pressure from environmentally conscious owners and investors, the rising trend in renovation projects, and the increase in legislation on greenhouse emissions and resource efficiencies.

3.5.1 Pressure from environmentally conscious owners and investors

Environmentally aware clients and owners play a significant role in promoting sustainable and environmentally conscious design and construction in their capital projects (Murtagh et al., 2016). Throughout the lifecycle of the project, owners can have decisive roles such as choosing sustainable designs and concepts, prioritizing low-carbon building materials, and utilizing renewable energy (Agung Wibowo et al., 2018). Such decisive roles can impose pressure on project parties to adopt environmentally conscious practices or rethink existing ones. This is also accompanied by different investor-led initiatives such as Climate Action 100+ and the Carbon Disclosure Project (CDP) where hundreds of major investors pressure major companies to disclose environmental information including climate change, water security, and deforestation, and take the necessary actions to meet carbon neutral goals (CDP, 2021; Climate Action 100+, 2022).

3.5.2 Increasing legislation for resource efficiency and waste reduction

The commitment to limiting carbon emissions and increasing circular economy practices has increased the attention to resource efficiency and utilization, notably with the increasing demand for construction materials and the scarcity of raw materials supply (Hossain M. U. et al., 2020). This is leading the industry to investigate and invest in utilizing sustainable materials that can be re-used at the end of the project lifecycle, developing material stocks models that can profile and estimate the quantity and quality of reusable materials across projects and regions, advancing lifecycle assessments and carbon footprints, and developing "building material passports" that can store data on material components across the project lifecycle (Benachio et al., 2020). With the increasing goals to reduce resource usage and waste generation, capital project organizations will need to strengthen resource efficiency efforts and thrive for waste reduction during the design, construction, and operation of capital projects (Hong et al., 2011; Andersson and Buser, 2022).

3.5.3 Progressive regulations for reducing greenhouse gas emissions

As climate change constitutes a threat to the planet and the prosperity of nations, governments continue to lead efforts that decrease carbon emissions and pledge zero-emission visions (Lebling et al., 2020). Capital projects are at the forefront of this pledge, especially as global capital spending is expected to reach $130 trillion by 2027 to decarbonize and renew critical infrastructure (Fuchs et al., 2022). With the built environment generating almost 40% of the annual global carbon dioxide (CO2) emissions, projects need to be developed using green construction methods that limit carbon emissions and support global sustainability objectives (Chen et al., 2023). Capital project organizations should also initiate efforts that allow them to use green and sustainable materials (Anupoju, 2020), invest in green technologies and methods like carbon capture and utilization (Abdelshafy and Walther, 2022), and operate renewable energy generations like wind energy solutions (Dadhich et al., 2015).

3.5.4 The trend toward renovation projects

The gaining building stock and the urgent need to reduce energy consumption and greenhouse gas emissions in buildings and assets have increased the attention on sustainable renovation (Jensen et al., 2022). Renovation efforts aim to optimize energy performance, upgrade the quality of life, and achieve carbon neutrality and recovery (European Commission, 2020; Jensen et al., 2022). Examples of common construction practices include replacing equipment with fossil-fuel equipment with electric ones to cut emissions, utilizing green materials like low-carbon concrete, applying better insulation, renovating heating systems, installing better-glazed windows, using renewable energy sources, and controlling ventilation (Jowkar et al., 2022; Pourmokhtarian et al., 2022). The trends toward renovation projects bring new opportunities to the industry through the millions of projects that need renovation and the hundreds of thousands of green jobs that will be created (European Commission, 2020; Guettler, 2021).

3.6 Legal factors

The legal factors extend to political factors to include regulations that regulate the business environment but are not necessarily government rules or laws (Turk, 2021; Peterdy, 2022). Examples of legal factors include common industry standards, operation permits, and the protection of data and intellectual property (Issa et al., 2010; Peterdy, 2022). The study identified two legal factors related to new delivery systems and project development models.

3.6.1 New collaborative delivery systems for efficient project management

Traditional project delivery systems have had negative consequences such as inhibiting coordination, hindering

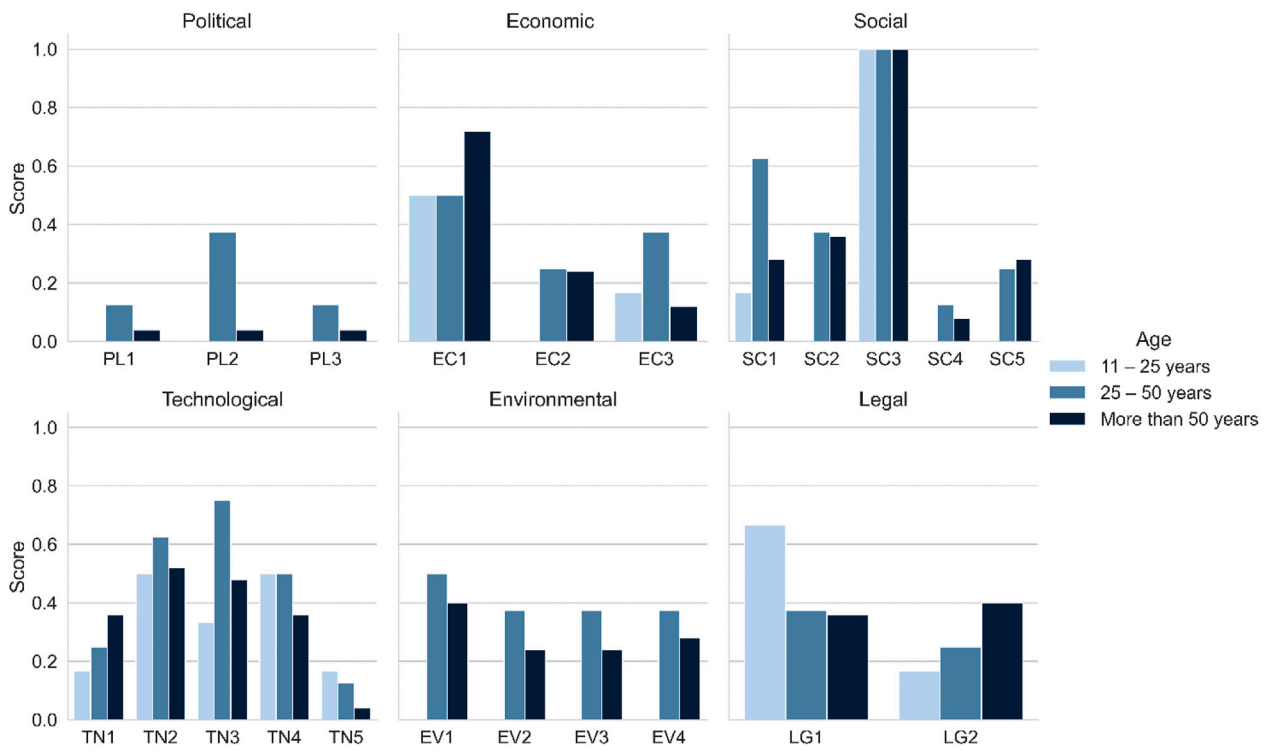

FIGURE 3
Years of experience and change factors.

cooperation, limiting innovation, and promoting the rewards of one stakeholder at the expense of the other (Asmar et al., 2013). By contrast, new delivery systems such as Integrated Project Delivery (IPD) and most recently Integrated Project Delivery for Industrial Projects (I2PD) have emerged (Matthews and Howell, 2005; Franz and Leicht, 2016; CII RT-341, 2019). IPD gained popularity notably with complex healthcare projects achieving major benefits in terms of cost, safety, and quality through promoting trust, communication, information-sharing, confidence, conflict resolution, and no-blame culture (Mesa et al., 2016; Dargham et al., 2019). Moreover, building on IPD, I2PD aims to achieve the objectives of industrial construction projects by implementing collaboration and integration principles such as continuous communication, jointly developed targets, early stakeholder involvement, collaborative decision-making, financial transparency, shares of risk and rewards, relational contracting, and negotiated risk distribution (CII RT-341, 2019).

3.6.2 Innovative project development models for improved business outcomes

New project development models such as Design-Build-Own-Operate-Maintain (DBOOM) and Design-Build-Operate-Maintain (DBOM) have been gaining popularity notably in energy, infrastructure, and utility construction projects (Prabhu, 2017; FHWA, 2022). These models offer integrated project delivery, external capital, and operational efficiencies whereby the owner organization assigns expertise, ownership, and performance incentives to the project party that is best suited to address them (McKay, 2015). These models also combine the responsibility for different functions that are usually disparate under a single entity that takes full responsibility for defining scope, detailed design, construction, asset ownership, operation, and maintenance (Nyquist, 2018; FHWA, 2022).

4 Investigation of the external factors driving organizational change

4.1 Results by years of experience

The breakdown of the different ages and the change factors is shown in Figure 3.

Political factors have the lowest impact on driving organizational change efforts among PESTEL. None of the contemporary organizations selected any of the political factors, and PL2 (human rights awareness) predominately drives transitional organizations. This may be attributed to the ability of an organization to engage with and/or affect change in legislation. Notionally, the focus remains on PESTEL factors having a more intrinsic outcome on survivability.

As for economic factors, EC1 (globalization and increased competition) is the factor that drives change for all three organizations, most notably legacy. Moreover, legacy organizations would more likely have sensitivities to EC1 associated with entrenched, low-cost, supply chains. Although EC2 (regionalization) does not drive change for contemporary organizations as the typical footprint of these organizations is principally regionalized, EC3 (non-construction

actors entering the chain) impacts transitional organizations more as the propensity of seeking to maintain the *status quo* is likely to be higher than contemporary and legacy ones associated with recent successes leading to inherent blind spots.

A nearly universal alignment was found between transitional and legacy organizations when evaluating social factors. The only disparity found between transitional and legacy was for SC1 (aging workforce). Additionally, factor SC3 (changing needs and preferences of customers), was selected as the factor that mostly drives change for organizations between all PESTEL factors. SC1 (aging workforce) is another factor that also impacts organizations regardless of age notably transitional organizations, while SC2 (EDI), SC4 (non-government organizations), and SC5 (reduced flow of young workers) do not drive change for contemporary organizations.

The technological category was the only category among PESTEL where all factors drive every organization regardless of years of experience. TN5 (3D printing) drives change mostly for contemporary organizations, and TN3 (offsite construction) drives change mostly for transitional companies where contemporary organizations diverged from the norm. Conversely, TN1 (aging infrastructure) mostly drives legacy organizations.

Although an influential difference can be observed within the environmental factors, transitional and legacy organizations demonstrated a significant corollary for these factors. However, environmental factors, like political and, for the most part, societal factors, do not drive change efforts for contemporary organizations, but they have a bigger impact on transitional organizations compared to political ones.

As for legal factors, LG1 (new delivery system) is a major factor driving change for contemporary organizations, as it is the only factor alongside TN5 (3D printing) where contemporary organizations lead transitional and legacy. The same cannot be said for LG2 (new project delivery models) which principally impacts legacy organizations when compared to contemporary and transitional organizations. This corollary could be related directly to the fact that contemporary and Transitional organizations are established with newer tools, models, and approaches that inherently alter an industry's approach to solving the same problem.

4.2 Results by type of experience

The breakdown of the different types and the change factors is shown in Figure 4.

Political factors have the lowest impact on driving organizational change efforts among PESTEL. The only type of organization that is slightly driven by political factors is owners, and none of the surveyed service providers selected any of the political factors. Whereas the only political factor considered impactful was PL2 (human rights awareness).

As for economic factors, EC1 (globalization and increased competition) is the primary economic factor that drives change for all types of organizations, markedly contractors. EC2 (regionalization) does not affect service providers, while EC3 (non-construction actors entering the chain) mostly drives contractors. Further, owners and contractors trend nominally with the same focus (es).

Social factors include factor SC3 (changing needs and preferences of customers), which was unanimously selected as the factor that mostly drives change for organizations between all PESTEL factors. All social factors also seem to drive change for owners more than any other type. In contrast, service providers are not affected by SC1 (aging workforce), SC4 (non-government organizations), and SC5 (reduced flow of young workers). Additionally, owners and contractors trend nearly identically when comparing across the social factors.

The technological category was the only category among PESTEL where each of its factor factors drives every type of organization. TN1 (aging infrastructure) and TN2 (data analytics) mostly affect owners. TN3 (Increase in off-site construction) and TN4 (new technology) mostly affect contractors whereas TN5 (3D printing) mostly affects service providers. TN5 is the only factor among all PESTEL factors that drives change for service providers more than owners or contractors.

For environmental factors, similar to political factors, none were selected by service providers. However, unlike politics, they have a bigger impact on change notably with EV1 (environmentally cautious owners) for owners and EV4 (trend toward renovation) for contractors. EV3 (Increasing legislation to reduce greenhouse gas emissions) identified this factor equally as a driver.

As for legal factors, LG1 (new delivery systems) and LG2 (new project delivery models) have an impact on driving all three types of project organizations. While LG1 impacts almost three types equally, LG2 has a bigger impact on owners. Owners also identified both legal factors as equally significant drivers for change.

4.3 Discussion of results

4.3.1 Political factors

Political factors do not drive organizational change for contemporary organizations. This could be explained by contemporary organizations' focus on surviving the market by executing the work and basing any decisions on political implications on their known knowns. Contemporary organizations do not have the same maturity level as transitional and legacy organizations to base their decision on the long game of political situations. In fact, the political environment regulating contemporary organizations should provide such organizations with enough flexibility to encourage innovation and improvisation in products services, and processes (Zahra, 2014).

Moreover, the organizations that are mostly driven by the political environment are the organizations that own projects–i.e., owners, and want to set the tools and processes for their projects (owners are mostly transitional and legacy organizations). Owners also own the capital, which subjects them more to government policies such as taxation and trading (Bastani and Waldenström, 2020). Service providers, on the other hand, provide specific valuable and professional services that are needed for capital projects (Chih et al., 2019). In other words, such organizations "sell a widget", and political factors would not have an impact on their operations. An exception can be where a service

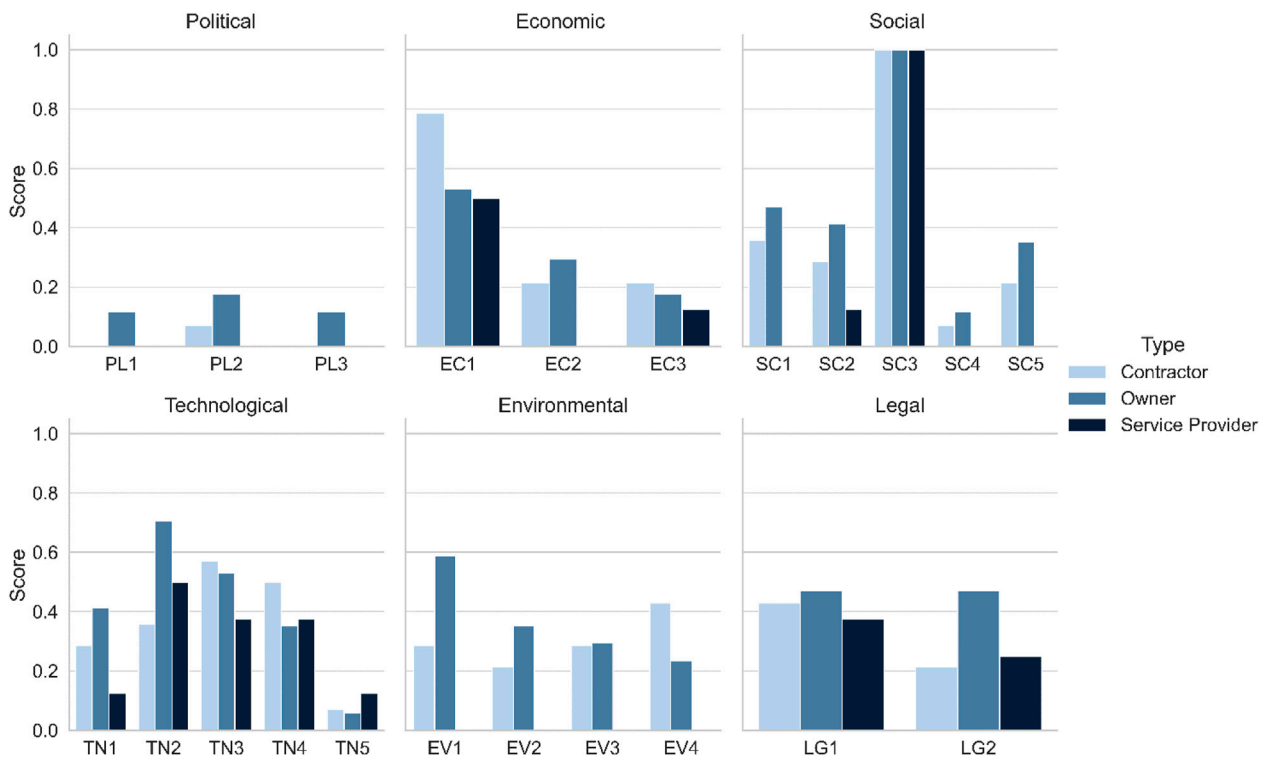

FIGURE 4
Type of experience and change factors.

provider's headquarter is located, as this location can shape taxation, debt, and market operations (Arena and Roper, 2010).

4.3.2 Economic factors

Economic factors and economic components such as globalization of the market, increasing competition, and increasing regionalization are important drivers for non-contemporary organizations to expand their business (El Jazzar, 2022). Furthermore, legacy organizations are not as susceptible to the direct implications of non-construction factors entering the construction value chain as legacy organizations are well-formed within the market and with their established network of collaborators (Suddaby et al., 2010).

Different economic factors drive organizations differently based on the markets in which the organizations operate. First, global expansion is essential to all organizations as they look for opportunities in different markets (Sun et al., 2023). Contractors, for example, need to expand globally, as the capital projects that they can develop in a certain area are very limited. The same applies to owners who want to spread their portfolio and service providers who want to expand their business. Contractors also need regionalization, especially for supply chains, as they need to secure materials and services for their projects, and keep inventories close to their areas of operations (Huthwaite and Ward, 2022). While owners can have the power to push new technology, contractors are more hands-on with non-construction actors entering the supply chain such as technology vendors. Contractors look for technologies that can help them develop projects faster, and vendors need construction sites to test their products (Hatoum and Nassereddine, 2022a; Dadi et al., 2022). This allows for a strong relationship between the two parties that can drive change for contractors more than other project stakeholders.

4.3.3 Social factors

Customers and clients usually drive the business of capital organizations. Thus, the strong effect of customer needs and preferences on change in all organizations is not surprising, and organizations should integrate customer portfolios into their project portfolio management (Voss, 2012). In other social aspects, talent availability and management can contribute to organizational success (Collings, 2014; Ramadan et al., 2022). Legacy organizations have working systems and embedded processes in place that allow them to decrease their dependency on company players and actors. In contrast, contemporary organizations are not able to withstand a loss of talent, as they are predominately reliant on key players to track information, save knowledge to develop strong systems and embed them into their scope of work. Additionally, the reliance on 'tribal knowledge' is prevalent and visible when considering transitional organizations when accounting for the focus on an aging workforce as the results show this factor as a significant factor. Moreover, when people join contemporary organizations, they know that their decision could come with extra pressure and risks that they are willing to take (Specht, 2022). This can in turn decreases the impact of social factors like EDI and the pressure of non-government organizations on the business of contemporary organizations.

Each company has a customer or works for a capital project owner, and once that owner or customer demands a particular change, every within the value chain falls in line with this change (Gallagher, 2020). The same applies to industry problems such as an aging workforce or reduced flow of young workers, as this affects projects and in turn, affects how owners and contractors–i.e., the two major players, can develop the capital projects, invest in future developments, and innovate dynamic solutions to new opportunities (Hatoum et al., 2023b).

4.3.4 Technological factors

Technological factors like off-site construction and data analytics play a crucial part for transitional organizations, especially as they want to remove existing barriers and transition to strong legacy organizations (Kopalle et al., 2020). For example, tracking and analyzing data would be an integral part of this transition, as it can detect old trends and predict future trends to allow the organization to make sound decisions using new technologies such as cognitive computing. As for contemporary organizations, they will tend to take more risky decisions such as investing in disruptive or innovative technologies, especially since being innovative can help them survive new markets, gain shares, and compete with incumbents (Pellegrino and Piva, 2020). Compared to transitional and legacy organizations, contemporary organizations have more flexibility in adopting new technologies because of the absence of historical, traditional, or heritage processes, technology, and tribal knowledge which may prevent technology adoption when present. Such organizations are relatively new to the business, and taking a risk with technology can bring much-needed long-term benefits as well as unique services to grow their business.

Technological factors are important for organizations regardless of their type, notably due to the disruption potential that technology can create (Adekunle et al., 2021). For example, data analytics is more organization-oriented as it can allow organizations to understand where they are and where they are headed, while off-site construction is more industry-oriented, as it is a trend that the entire industry is implementing. Moreover, owners play an important role in pushing technologies as contractors and suppliers are seeking their business. If they demand a technology or force it into their projects, child organizations will typically follow, unless they have a disruptive solution.

Aging infrastructure is another factor that will mostly drive owners to change, as they would require more technology to help them monitor, assess, and repair the status of existing infrastructure projects (Tripathi et al., 2023). However, when legacy organizations straddle this paradigm and integrate new technologies, they have the propensity to navigate and become an agile solution-oriented, and extremely dynamic leader toward the next evolution.

4.3.5 Environmental factors

Similar to political factors, contemporary organizations are new to the business, and they will already implement or at least understand the nature of the business and the best practices needed to improve their services (Freeman and Engel, 2007). Moreover, factors such as gas emissions and resource efficiency have gained momentum and made consumers environmentally conscious and aware, which will therefore have an impact on legacy and transitional organizations to change their existing practices and adhere to the relatively new events (Furlow, 2010). Contemporary organizations, on the other hand, will have such factors "built-in", as they were formed after climate change discussions gained momentum. Further, the adoption of new technologies is more readily available as the framework being implemented is relatively new in origin to the organization.

Environmental factors and regulations regarding capital projects will no doubt affect owners and contractors (Chowdhury et al., 2020). For example, the renovation trend can generate major profits for contractors, and would, in turn, affect their business. On the other hand, owners will be affected by the climate policies to be environmentally cautious in the projects that they own or want to develop. Both parties, however, will be affected by legislation related to resource efficiencies and greenhouse emissions, as contractors are developing the projects and owners are paying for this development.

4.3.6 Legal factors

While contemporary organizations are driven by new delivery systems that promote collaboration, legacy organizations will seek new business models that will maintain their market share in the industry. Contemporary organizations would benefit from collaborative delivery systems such as IPD, Advanced Work Packaging (AWP), and Project Definition Rating Index (PDRI), as collaborating on such trending delivery systems would provide them with the opportunity to gain experience and get exposure to more complex heritage knowledge. On the other hand, legacy organizations would prioritize finding or developing new project business models that would allow them to reinvent their *status quo*, especially when they understand the need for change and recognize its importance for maintaining their business utilizing technologies with a wealth of historical data (Nassereddine et al., 2022).

Capital project organizations understand the need for change, which empowers drivers such as new delivery systems and new project development models for project stakeholders (Chandrasekaran et al., 2021). Traditional models and delivery systems have a long history of causing losses and poor performance, which cause legal factors to drive organizations regardless of type. This is especially true for owners, who look for capital projects that can be completed with faster schedules and lower budgets while maintaining quality and generating profits.

5 Conclusion, limitations, and further studies

The objectives of this paper were to identify the external factors affecting change within capital project organizations and investigate whether the factors affect these organizations differently. With capital projects suffering from poor project performance, and with the exponential rise in capital spending, understanding external factors can allow organizations to properly plan and adapt to change and identify possible opportunities and threats that can impact their business. Using the PESTEL framework, the following can be inferred.

- The study identified three political drivers related to union activities, taxation and trading, and human rights. Political factors do not drive change for contemporary organizations as their focus is mostly on surviving the market and they do not

have the long game and same maturity level of transitional and legacy organizations. Owners however are mostly driven by political factors since their role as project owners makes them subjected to government policies like taxation and trading.

- The study identified three economic factors including globalization, regionalization, and new actors entering the supply chain. Economic factors drive change in organizations differently based on the markets in which these organizations operate. For example, globalization mostly drives legacy organizations as these organizations have well-established networks and geographic spread of operations. Another example is contractors who are mostly involved with non-construction actors entering the supply chain as they work hands-on with them on testing and deploying innovations.
- The study identified five social factors including an aging workforce, changes in customer needs, Equity-Diversity-Inclusion efforts, pressure from non-governmental organizations, and reduced flow of young workers. The "change in the needs and preferences of customers" factor was the most selected factor for driving change regardless of the type of work or age maturity of capital project organizations. Such a result is not surprising as the objective of any project is to add value to the client and ensure customer satisfaction.
- The study identified five technology factors related to aging infrastructure, data analytics, increase in off-site construction, new/first-of-a-kind technology, and 3D printing. Technological factors are important to all organizations notably due to the disruption potential that technologies can create to operations and the ways of conducting business. Results highlighted that younger companies tend to embrace newer innovations and willingness to invest in promising technologies that can bring long-term benefits. Results also highlighted the importance of adopting technologies that can help owners monitor, manage, and maintain aging infrastructure projects.
- The study identified four environmental factors including pressure from environmentally conscious owners and investors, the rising trend in renovation projects, and the increase in legislation on greenhouse emissions and resource efficiencies. Environmental factors do not affect contemporary organizations as such organizations are expected to have environmentally friendly practices "built-in" within their business models. They also do not affect service providers mainly because service providers focus on offering services and their line of work does not tend to be heavily restricted by environmental legislations and regulations when compared to owners or contractors.
- The study identified two legal factors related to new delivery systems and project development models. Results highlighted differences mainly at the level of age maturity where contemporary organizations are driven by new delivery systems that promote collaboration as it would provide them with the opportunity to gain experience and get exposure to more complex heritage knowledge, while legacy organizations prioritize finding or developing new project business models that would allow them to reinvent their *status quo*.

Overall, a very clear delineation of the key factors can be associated when viewing the PESTEL from the perspective of contemporary organizations and Service Providers. This is attributed to the very nature of the needs and requirements of an organization's focus on survivability versus long-term sustainability. Moreover, owners and contractors are more closely aligned when considering the PESTEL factors and the drivers of change.

Findings from this study have research implications as well as practical applications. From a research perspective, the study dives into the external environment of capital project organizations and defines the external factors shaping change. This research area remains well-understudied in the context, notably with limited work on providing a holistic understanding of the external environment change practices for the capital project industry. From a practical perspective, findings can provide decision-makers and leaders in capital projects organizations with a comprehensive understanding of the external factors driving change within their line of business and operations. This is particularly achieved with the breakdown between age and type, as practitioners can understand how the external factors between organizations' years of experience as well as types of experience.

Despite the contributions of the study's findings, limitations are instinct to research. First, the insights gathered are limited to 22 factors identified at the time of this study. In a changing environment, more factors could emerge. Moreover, the results of the survey are limited to the data points gathered from the participating organizations, and the analysis was restricted to the normalized scores based on multi-choice selections. Further research can expand on the identified factors, quantify the impact of these factors on the change efforts, and present measures that capital project organizations can use to track the impact of every change factor.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

Author SM was employed by Faithful+Gould.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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