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The Influence of Transformational Leadership on Employee Innovation in Tech Startups: A Mixed-Methods Study

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Abstract
This mixed-methods study examines how transformational leadership influences employee innovative behavior within early-stage technology ventures. Drawing on transformational leadership theory and the job-demands-resources model, we surveyed 333 employees nested in 42 U.S. tech-startup teams across three time-points and conducted 18 follow-up semi-structured interviews. Hierarchical linear modelling and bootstrap mediation analyses revealed that transformational leadership positively predicts employee innovative behavior ($\beta = 0.284$, $p < 0.001$). Psychological capital and thriving at work sequentially mediate this relationship (indirect effect $\beta = 0.0324$, 95 % CI [0.0095, 0.0582]). Qualitative findings corroborate that intellectual stimulation and individualized consideration foster psychological safety and experimentation norms. The study extends leadership theory to resource-scarce startup contexts and provides actionable guidance for founders and accelerators seeking to cultivate innovation

Keywords: *Transformational Leadership; Employee Innovation; Tech Startups; Psychological Capital; Thriving at Work; Mixed Methods*

Introduction

With the increasing pace in which technology is advancing, the new ventures have surpassed innovation as just another way to achieve a competitive edge but rather a matter of survival (Acs, Stam, Audretsch, & OConnor, 2017). Worldwide figures also show that every year more than 100 million start-ups are launched around the world and fewer than ten percent remain after five years (GEM, 2023). The inability to develop, test and commercialize novel products or business models quickly, comes at no.30 of the top reasons behind failures in general, after the lack of a market need and the lack of cash flow (CB Insights, 2024). Unceasing innovation is thus a skill that is not debatable, however, the same circumstances that define early-stage companies' scarcity of resources, excessive uncertainty, and a swiftly changing environment make standard control-focused leadership solutions insufficient (Klotz, Hmieleski, Bradley, & Busenitz, 2022). There is also the suggestion that transformational leadership (TL) promises to be a far more effective driver of innovation in the form of raising the aspirations of the followers; supporting creative problem-solving in them (Niessen, Mder, & Kong, 2022).

The initial idea of transformational leadership has been conceptualized by Burns (1978) and put into practice by Bass (1985). It includes four behavioural dimensions: idealised influence (role-modeling and moral conviction), inspirational motivation (articulating an enticing future), intellectual stimulation (challenging assumptions and encouraging experimentation) and individualized consideration (mentoring and personalized development). According to meta-analytic evidence provided by established organizations, TL has been shown to be one of the strongest preconditions of individual creativity ($r = .35$), innovative behaviour ($r = .31$) (Hammond, Neff, Farr, Schwall, & Zhao, 2011). But this research has to a great extent been carried out in large bureaucratic companies having formal structures, predictable routines, and

slack resources which are completely opposite of the start-up reality (Agarwal, Audretsch, & Sarkar, 2010). Mature-stage undertakings have rich environments in comparison to the early-stage business, which operate under what Baker and Nelson (2005) call penurious environments where the volatility in cash flow, role ambiguity, and pivot pressure force acute psychological demands (Podsakoff, MacKenzie, & Podsakoff, 2012). It is still an open empirical question to what extent transformational behaviours still have their potency when constrained in such ways.

One of the poorly constructed bundles of hints is through recent studies on organizational psychology. Niessen et al. (2022) proposed that German new-technology venture CEOs were transformational, and this accompanied psychological empowerment of their innovativeness within the team. Likewise, Zheng, Khilji, and Wang (2021) determined that founder transformational behaviors affected the employee creative self-efficacy in the Chinese start-ups. The associated studies are, however, restricted by cross-sectional designs, single nation surveys, or only self-reports of creativity whilst ignoring behavioral innovation results. What is more, psychological mechanisms according to which TL may be transformed into innovative behavior in resource-scarce settings are not yet fully explained (Zhang & Zhou, 2022).

As the solutions to these gaps, the study of the present paper combines the transformational leadership theory and the Job-Demands-Resources (JD-R) model (Bakker & Demerouti, 2017). According to the JD-R theory, all working conditions feature both demands and resources that restore energy and the two are relative in terms of employee outcomes. Transformational leaders provide contextual resource in having followers increase their psychological capital (PsyCap) which is a higher order concept composed of hope, efficacy, resilience and optimism (Luthans, Avolio, Avey, & Norman, 2007). PsyCap, in turn, drives flourishing at work, a state of mind that is energized and learning (Spreitzer, Sutcliffe, Dutton, Sonenshein, & Grant, 2005). A flourishing employee will have high chances of contributing discretionary effort in idea generating, experimentation, and implementation activities (Carmeli & Spreitzer, 2009). PsyCap espoused in a chain of PsyCapgoto thriving innovation has been shown to be true in established firms, but the relationship has not been explored in start-ups where role flexibility and economic insecurity might attenuate or enhance the effect (Paterson, Luthans, & Jeung, 2014).

The salience of leader resources can be enhanced given the fact that start-ups are typified by a poorly defined role (Klotz et al., 2022). In cases where job boundaries are short, employees are likely to get their cues on how to conduct themselves at work depending on the leaders; transformational behaviours that present vision, intellectual stimulation and individualization support are essential (Zhang & Bartol, 2010). In contrast, the scarcity of resources can limit the leader in providing the tangible incentives, which also contributes to the prominence of the intangible ones, such as PsyCap and thriving. Comprehending these processes is critical to both academics and practitioners: accelerators, venture capitalists and scale-up programmes are investing more in leadership development but there is little evidence on what works, and why.

Research Questions

It is against this as background that the following three interrelated research questions are answered in the study:

1. How far transformational leadership predetermines innovative behaviour of the employee in tech start-ups?
2. Does psychological capital and successful living at work come before or after this relationship?

3. What are the underlying mechanisms (e.g. psychological safety, risk taking norms) that would describe how transformational leaders develop innovation in the environment that is typified by high role ambiguity and uncertainty?

In addressing such questions as they are, the research offers three main contributions. To begin with, it applies the transformational theory of leadership to small new-venture formations, providing a more subtle view regarding the restrictions of the concept. Second, it clarifies a multi-stage psychological process of the relation between leadership resources and behavioural innovation, which fleshes out JD-R framework. Third, it has evidence-based recommendations to help the founders of start-ups, incubators, and, policy-makers to create sustainable innovation cultures.

Literature Review

In this context, to gain appreciation of how transformational leadership contributes innovativeness within resource-constrained tech start-ups, there is need to put the construct in its conceptual context as well as to compare and contrast the wealth of research available on large-established organizations with that dearth of research available on start-ups at the early managerial stage. The review below hence follows the chronological developments of transformational leadership theory, lays down the well-established impacts on employee creativity and proceeds to focus a critical review on the boundary conditions which can buffer or enhance the impacts in entrepreneurial settings.

Theory and growing evidences, transformational leadership: theory and the accumulating evidences

Following the seminal characterization of transforming leadership by Burns (1978) as a relation of mutual elevation between leader and follower, the construct has been narrowed down, operationally defined, and tested empirically to a large extent. Bass (1985) Full Range Leadership Model moved the phenomenon into a new conceptualization, which considered the phenomenon in terms of four dimensions of behaviour namely; idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, which combine to mobilize followers beyond self-interest to embrace higher-order goals. The meta-analyses of forty years (e.g., Judge & Piccolo, 2004; Wang et al., 2011) confirm that TL took a stable positive path to individual-level criteria of performance (r 688699 ,44), creativity (r 688699 ,35), and organizational citizenship behaviour (r 688699 ,32).

Within the narrower focused domain of innovation research, a quantitative review by Hammond et al. (2011) of 104 studies included, reported the corrected mean correlation of .31 between TL and innovative behaviour and the same measure with .35 between TL and creative performance. According to Amabile (1996), these effects can usually be described as social-cognitive and affective routes: transformational leaders increase creative self-efficacy, a readiness in cognitive complexity, and produce positive affective state, which increases the thought-action repertoires of employees (Fredrickson, 2001). Notably, most of these studies have been done in ageing organizations, those rich in resources, such as Fortune 500 companies, government agencies, and major healthcare organizations, where formalized structures, predictable routines, and surplus resources dilute environmental uncertainty.

The highly complicated psychological mechanisms were: the social-cognitive and the resource-based approach

The process by which transformational behaviours are converted to innovative results is being elucidated more and more. Based on the Social Cognitive Theory (Bandura, 1986), the researchers revealed that inspirational motivation and intellectual encouragement result in an increment in creative self-efficacy which, subsequently, foresees subsequent generation of ideas and implementation (Zhang & Bartol, 2010). Through a parallel effort based on the Job-Demands Resources (JD-R) model (Bakker & Demerouti, 2017), transformation leadership is suggested as a resource in context, which restores the motivational levels of workers, filling the gap created by high levels of job demand. In this construct, the concept of psychological capital as a higher-order composition including hope, efficacy, resiliency, and optimism (Luthans et al., 2007) can be seen as a dominant influencing variable. Empirical investigations in organizations established for some time (e.g., Afsar & Umrani, 2020) reveal that TL is a predictor of PsyCap (0.48) that further exerts its beneficial effects on innovative work behaviour along both the direct and the indirect (thriving) route.

The second and complementary mediator has been discovered to be thriving at work, a psychological state defined as shared experience of vitality and learning (Spreitzer et al., 2005). Paterson et al. (2014) also discovered that PsyCap fosters thriving (beta =.39) and this thriving in turn predicts discretionary innovative behaviours above the impacts of job characteristics and positive affect. The latter is implied in the following findings: The innovation is driven by the transformational leadership (TL) that strengthens the psychological capital (PsyCap) and leads to thriving. This pathway has only been experimented in larger, bureaucratic organizations to this point, however, and the individual applicability of this pathway to the dynamic, resource-constrained settings that are the hallmarks of young, rapidly growing businesses is a still-open empirical question.

The start-up environment where the resources are limited, and the position is ambiguous, and the level of uncertainty is high

In early-stage technology ventures, the conditions under which they operate are not similar to any assumptions that are found in any of the TL research. An ethnographic study conducted by Baker and Nelson (2005) indicated that business owners do face what they termed penurious environments which are identified as chronically unstable cash flows, minimal workforce and dynamically changing strategic goals. Role ambiguity is an epidemic: According to Klotz et al., 68 % of the respondents in a study on start-up employees noted a significant shift in the job content over a period of six months. Financial uncertainty intensifies the feeling of need and the lack of slack assets puts a cap on the availability of conventional extrinsic reward by an organisation. Contextual features of this type can ameliorate or diminish the strength of transformational behaviours in warring tendencies.

In one hand, scarcity of resources might increase the salience of intangible resources of leaders. Where people are deprived of finances and the ability to scale up the career hierarchy, they could be more eager to find out the information about vision, mental development, and one-to-one coaching (Zhang & Zhou, 2022). At the same time, role ambiguity can enhance the dependency of employees on leaders as sources of information similar to how to act and therefore enhance the implication of transformational signals. Conversely, the insane time constraints and pivot imperatives may limit the abilities of leaders to participate in time-absorbing behaviours that belong to intellectual stimulation and individualised consideration. The founders spend much of their time alternating between firefighting and approaching the strategic articulation, and thus taking little space to develop their followers in an organized manner (Klotz et al., 2022).

So far, there are few studies that have explored TL during start-ups or in small-and-medium-enterprise (SME) settings, all of which are promising but terribly disjointed. According to Niessen et al. (2022), 63 new-technology ventures in Germany were surveyed, and it was identified that transformational CEOs promoted creativity within teams through psychological empowerment (.41). In the same manner, Zheng et al. (2021) found that founder TL predicted employee creative self-efficacy (beta =.36), and later creative performance in Chinese start-ups. These studies are however limited by the cross sections, single country samples and the exclusive particularities of these studies being on creativity and not the outcome of behaviour innovation. Besides, both publications did not investigate the sequential mediational route suggested in the JD-R theory.

There are two more limitations that can be discussed. To begin with, current research on start-ups has been based more on self-report measures of creativity, which can be subjected to common method bias (Podsakoff et al., 2012). Second, they fail to consider that resource limits can be mitigated. According to the post-mortem compilation conducted by CB Insights (2024), the second most common matter leading to start-up failure is running out of cash, thus implying that resource shortage is not only likely to restrict the behaviours of leaders but potentially also modify the psychological mechanisms through which TL can affect innovation. the integrations gives and gaps of the research opportunity

The literature, in general, leads to the identification of three key gaps. First, the external validity of the effects of TL in start-ups is unknown as previous research has taken place in expansive, resource-rich organisations where the moderating conditions (e.g., slack resources, formal HR systems) do not work. Second, the conditional psychological route between TL and innovation (through psychological capital and thriving) has not been empirically examined in contexts of entrepreneurial environments, where fluidity of their roles prevails and funding is precarious. Third, there is very little qualitative knowledge about how innovation is fostered by transformational founders in a daily way (e.g., psychological safety, norms around risk-taking).

Closing of these gaps is not an academic affair. Increasingly, accelerators, venture capitalists, and scale-up programmes are invested in leadership development, but there is little evidence on what works, and more importantly why. Using a combination of transformational leadership theory and the JD-R model and data comprising a mixture of methods gathered in U.S. tech start-ups, the current study aims to expand the leadership theory to the situation of resource constraints and to present the useful directions that can be used by the founders and other stakeholders of the ecosystem.

Theoretical Framework

The study we have combined the Avolio Full Range Leadership (FRL) Model with an employee effects Job-Demands-Resources (JD-R) framework because we believe that the leadership can impact on the results of the employees. The FRL model which is made up of transformational, transactional and laissez faire styles of leadership attach great significance of leaders in inspiring and motivating followers to attain high performance levels. Transformational leadership especially is a well-known way of creating an environment in which the employees feel taken care of, they feel appreciated and they feel motivated to go above and beyond the minimum requirements of their job.

On the other hand, JD-R model emphasises the contribution of both demands and resource on the job in determining the wellbeing of the employees and performance. In such a combined approach, transformational leadership is perceived as a contextual resource that can contribute to psychological capital of the employee, and this psychological capital involves self-efficacy, hope, and resilience. These emotional qualities are fundamental in overcoming obstacles and ensuring that the employees have a positive attitude towards problematic circumstances. Moreover, investigation is expected to encourage prosperity that will be characterized as vitality and learning that are essential in encouraging innovation. A combination of these factors can make an environment that fosters the innovative behaviour, where the employees are empowered to present the innovative solutions and approaches to the problem, to the end benefit of the organization.

Methodology

The research design of the study was an explanation sequential mode of mixed research (Creswell & Plano-Clark, 2018). It initiated three waves of a multi-source quantitative panel, which examined the causal links and concluded with a qualitative stage that explained the mechanisms behind the aforementioned links. The two stages were integrated at three levels: qualitative sample selection was based on quantitative results; common displays were made to counter-check the statistic results and meta-inferences were made to conclude practical recommendations.

This was carried out in two stages of research. During the initial stage, we joined California, New York, Texas, and Massachusetts accelerators, welcoming the founders of 42 venture-capital backed technology start-ups to the program. The firms had to be less than five years old, less than 50 full time employment and produce software or hardware products. A list of their non-founder employees (n = 450) was provided by the founders and these non-founder employees were invited to a survey through email. Data was collected in three waves with four weeks between them, the first wave was to assess transformational leadership, psychological capital, and controls, the second wave to measure thriving at work, and the third wave to measure the employee innovative behavior. Of 333 respondents who participated in all the three waves, the response rate was 74 percent with no significant differences identified between the dropouts and the respondents. 38 percent of respondents in the ultimate sample were in engineering, 24 percent were in product, 21 percent were in sales/marketing and 17 percent were in other functions.

The second phase consisted in choosing 18 employees of 9 start-ups with different innovation results in the course of a criterion sampling strategy. Teams with higher innovation were in the top 25 percent on the Scott & Bruce scale and teams with less innovation on the bottom 25 percent. Each of the teams was interviewed with one technical and one non-technical employee to make perspective. Preliminary research interviews were carried out over Zoom and lasted about 47 minutes in average, audio-recorded, and transcribed. The interview protocol was purified and worked on before its utilization.

Notable assessments in the study were the Multifactor Leadership Questionnaire (MLQ-5X Short Form) to determine transformational leadership, the Scott & Bruce scale to determine employee innovative behavior, Psychological Capital Questionnaire (PCQ-12) to find out psychological capital and a thriving at work scale. The control variables were gender, age, education, seniority and type of role.

It used hierarchical linear modeling (HLM) to test the hypotheses, taking into consideration the fact that the employees were nested within the teams and start-ups. Bootstrapping was done in mediation analysis The analysis of qualitative data was performed with the use of flexive thematic analytical approach, where two coders generated codes and developed themes to the point of saturation.

Issues concerning ethics were taken into account The research was approved by the IRB and every participant signed the informed consent. Data were under encrypted and highly secured storage and ends with e-gift cards and honoraria on the part of the participants therefore completing a survey and interview.

Results and Evaluation

To build up on hypothesis testing we established the distribution, reliability and validity of all the study variables. Skewness and kurtosis scores were within the desired range and Cronbach alpha was above.85 which shows good internal consistencies of each scale (Curran, West, & Finch, 1996). As identified by CFA, the four-factor measurement model fitted the data very well, (chi2 = 312.4, df = 164, CFI = .96, TLI = .95, RMSEA = .05, SRMR =.04), and other models were not suitable. To rule out any substantial common-method bias, Harman one-factor test and marker-variable procedure of Podsakoff was used (Podsakoff et al., 2012).

Correlation and descriptive statistics showed most of the variables that had an essential relationship in the study. Transformational leadership (T1) had a positive correlation with psychological capital (r = .52), thriving at work (r = .48) and employee innovative behavior (r = .46). Acquiring components of psychological capital itself was highly associated with thriving (r = .57) and the degree of convergence with innovative behavior (r = .38) hinted at the initial backing of the proposed model.

Hypothesis testing was carried out in three steps with control variables, transformational leadership, psychological capital and thriving. Transformational leadership was also a significant predictor of employee innovative behavior (Model 2: 284, SE = 043, p < 001) and this increased the amount of outcomes by 20.4% within individual teams. In the mediation effect, it was observed that psychological capital and thriving were significant mediators. The complete model provided 47 per cent of the variance on innovative behavior with psychological capital and thriving mediating between innovative behavior and some of its components (Preacher, Zyphur, & Zhang, 2010).

Alternative measures of innovative behavior, robust standard errors and use of cross-lagged panel design were involved in robustness tests. All the checks indicated the main findings

Qualitative Findings

Intellectual Stimulation, Psychological Safety, and Resource Enabling were identified as the three key themes through a reflexive thematic analysis carried out in this study (Braun and Clarke, 2021). These themes were very much in line with the quantitative findings as well as Job Demands-Sources (JD-R) model (Bakker & Demerouti, 2007).

Intellectual Stimulation: Employees in high-transformational leadership teams referred to leaders who supported the questioning of assumptions and who allowed them to experiment in terms of new ideas. One source said, the CEO asked everyone during one of the stand-up meetings every

Monday, what was the assumption they were most certain about, and how to kill it that week (P12, product manager). On the other hand, low- transformational leadership teams emphasised more on implementation without consultation of early plans.

Psychological Safety and Risk-Taking: High-innovation teams emphasized the need to create the environment where failure is acceptable, and the team leaders need to focus on creating a learning environment. It was through mistakes that learning occurred in such teams. This was in contrast with low-innovation teams where employees were resisted and were made to feel shy of experimentations (Edmondson, 1999).

Transformational Leadership in Emphasis of Personalised Coaching: Emphasis was not placed on tangible rewards, but rather, transformational leadership in high-innovation teams focused on personalised coaching of team employee. The result of these interactions was the increase of the psychological capital and thriving of the employees that, in turn, led to additional innovation (Luthans et al., 2007).

A combined show of both qualitative and quantitative data indicated that high-transformational leadership team experienced more product iterations. The qualitative interviews confirmed these results, as it shows that innovative behavior also increased due to intellectual stimulation, psychological safety, and personal coaching.

Discussion

The work has some great merit (and contribution) towards the theory of transformational leadership (TL) and specially for an early-stage tech start-up. It also indicates a clear route of transformational leadership (TL), psychological capital (PsyCap), and thriving on employee innovative behavior (EIB) therefore provides a new contribution into how TL affects innovation during resource-scarce situations. The research is especially helpful because it applies the Job Demands-Resources (JD-R) model, which was originally designed in a larger organization, to more fluid and rapidly changing environment of start-ups (Bakker & Demerouti, 2007).

On the one hand, the paper enhances the external generalizability of the JD-R model because it demonstrates that TL can affect innovation positively despite the limited resources in some environments like start-ups at an early stage of development. The JD-R model portrays the role of balancing the job demands and resources as a means of promoting employee well-being and effective performance (Bakker & Demerouti, 2007). Leadership is even more central in start-ups where the resources are usually scarce. In the environments where transformational leaders operate, they do not only inspire innovative activities but also offer the resources that are both psychological and emotional to facilitate in the growth of employees. The researcher who advances JD-R model proves that transformative leadership is an essential asset that contributes to add psychological capital thus provokes thriving and innovation. This sophisticated perspective on the role of TL in a resource-constrained context is very helpful to the scholars and practitioners.

Second, the mixed-methods design of the study allows distinguishing between micro-processes in the form of which TL contributes to innovation. The qualitative data indicated various leadership practices that emerged as vital in stimulating innovation in tech start-up, which include; intellectual reframing, safety signaling, and personalized coaching in TL. Intelectual reframing is the process in which leaders engage employees in a reframing process that makes them feel that

the problems are just hypotheses that can be tested and not barriers. This is one of the primary practices in enhancement of innovation and creative thinking (Zhu, Avolio, & Walumbwa, 2009). Safety signaling, which is explored under the qualitative findings, can be understood as the establishment of the setting in which the employees can feel free to innovate, make errors, and learn based on them. Edmondson (1999) said that psychological safety is important when it comes to developing a culture of innovation and learning. Individual coaching is more than the usual management input feedback; it is an element of specifically channeling support and input to individual strengths and weaknesses thus enriching their psychological capital and motivating the individual to attain optimum performance (Luthans et al., 2007). These micro-processes can be used to explain better the role of TL in shaping innovation by decomposing it to a smaller scale when there is a significant level of uncertainty and rapidity of change like in the case of a tech start-up environment.

Third, the research takes over the lack of research on leadership in high-growth, uncertain environments noted by Klotz et al. (2022), otherwise known as the start-up gap. The results indicate that transformational leadership can be specifically useful in achieving innovation within such environments, especially where the circumstances amidst are very uncertain and resourceful. This contributes much to the literature in that most research conducted on TL concentrate on bigger and more stable organizations (Judge 2004). This study can therefore serve as an addition to the understanding of how transformational leadership works in other organization contexts as research shows that it is also effective in start-up organizations.

The three practices proposed by the study as essential leadership elements to improve innovation in start-ups concern the creation of involvement, the listening-based approach to leadership, and leadership as shared responsibility. The first one is to carry out assumption-killing rituals each week. These rituals promote intellectual exploration and experimentation as they ask the employees to analyze their assumptions towards the business, products, or market. Research indicates that these practices have the capacity of boosting creativity and innovation as they stimulate people to think more critically and can get alternative thoughts (West, 2002). The rituals can enable leaders to trigger out-of-the-box thinking so that an innovative environment is the new rank rather than obscurity.

The second practice is the modeling of learning-oriented responses to failure and rewarding the latter. High-innovation teams discussed in this paper underlined the significance of psychological safety where employees feel free to bring forward new ideas and make risks without the fear of ridicule or any form of punishment. In order to achieve innovation, Edmondson (1999) explains that it is imperative to cultivate a culture of psychological safety so that employees are able to undertake behaviours such as idea generation and taking risks which are vital in innovation. Leaders can also demonstrate how to behave in the face of failure with learning-oriented behaviors by making setbacks a source of learning (not incompetence). Rewing staff who make well-calculated risks or introduce new ideas, even when it has not worked too well, helps introduce this learning culture and make staffs think even more of bringing in innovation.

The third practice that has been indicated is personalized coaching. Transformational leaders do not have the ability to provide material gains in the early-stage start-ups where resources can be scarce. Nevertheless, they may offer specific feedback which makes the employees understand how their personal performances relate to that of the company. Individualized coaching is applicable in making the employees realize the big picture of their work, how they add value to

the customers and how they can be consistently better. Not only does this enhance psychological capital (Luthans et al., 2007), but as a result, people develop a sense of ownership, and investment in the success of the company.

Accelerators, that are important in helping the start-ups, can inculcate these leadership behaviors in their programs. In this way, they will be able to assist founders in creating the leadership qualities required to create an ethos of innovation and expansion. Accelerators would be able to provide training on the significance of intellectual stimulation, psychological safety, and individualized coaching to make sure that founders have tools in their possession that would allow them to make necessary environments in which their ideas can be cultivated and turned into creative and innovative ideas.

Although the research study is helpful, there are a number of limitations that need to be mentioned. First, though the use of three waves in panel design addresses shortcomings related to the temporal direction of cause, experimentation or quasi-experimental studies are hard to avoid when causal inference is sought. Scores of people may examine such designs in future, more decisively determining cause-and-effect relationships. Secondly, the sample used by the study was geographically focused in the U.S., so one cannot claim that the results could be applied to other regions (i.e., the potential in generalizability might be low). Further study may be on how such findings extend to other cultures or other countries with different organizational cultures and styles. Third, the innovative behavior that has been measured was self-reported thereby posing the risk of generating response biases. It is possible that the self-reports could be supplemented in the further research with objective innovation-related outcome measures, such as patents or, the revenue generated by products (Scott & Bruce, 1994). Last, although the study held team membership type constant, it did not test any team level characteristics, i.e. functional diversity, which might play a part along with the transformational leadership in affecting innovation. The relationships could be examined under further studies to learn more about influences on the success of TL in spurring innovations.

This research study has important contributions to the existing body of knowledge related to the dynamics of transformational leadership in terms of innovation activity among early-stage, tech start-ups. It is expected that the extension of the JD-R model to the resource-scarce circumstances not only allows the identification of major micro-processes in which TL functions but sheds light on bridging the start-up gap in leadership studies, thus is of benefit to both researchers and those working in the field. According to the study, to contribute to innovation, founders and managers should take extra care of intellectual stimulation, psychological safety and personal coaching. Although this study has a number of weaknesses, the results have helped in highlighting the significance of incorporating transformational leadership in promoting innovation under uncertain and quickly evolving conditions.

Conclusion

By triangulating hard multi-level panel data with juicy first-hand accounts by employees in the early stages of their careers in the start-up world, this study provides convincing evidence of transformational leadership as an organizational strategic resource multiplier in the start-up world crucible. The quantitative pathway how transformation behaviours iteratively boost psychological capital and thriving shows that leaders do not have to possess deep pockets or formal hierarchies to drive innovation; they must, however, provide vision, intellectual provocation, and support in the individualised manner. This mechanism is corroborated at the ground level through

qualitative narratives of engineers who used to be reluctant to pitch out half cooked ideas because they became prolific prototypes when their founders created an example of being curious, made the idea of intelligent failure then the norm, and provided micro-coaching that connected daily work to customer impact.

This evidence can be used directly as the founders and managers of accelerators and sellers of venture-capital talent can act on it. Incorporating Palm-Sized weekly practices of assumption-shattering; making a fuss of learning focused failures with the entire team at the end of each sprint, and finding time during the daily scrum fielding 15-minute 1-on-1 coaching sessions can be implemented at zero-cost within the planned sprint timetables. Accelerators can thus go beyond generic, perhaps even vaguely defined, vision workshops into evidence-based modules whose components of intellectual stimulation, safety signaling and individualized consideration as indicated here would translate directly into product iterations.

Nevertheless, even in spite of the limitations, i.e., the self-reporting of the results, the U.S.-centric sample, and objective and quantifiable measures of innovation being absent, the study serves as a stepping stone in future experiments and cross-cultural trials. Nevertheless, the aggregation of statistical effect degrees and direct experience suggests that transformational leadership is not a future use case to aspire to once internal capital is replenished; on the contrary, transformational leadership is a mechanism that can be integrated immediately by a founder. By doing so they translate these limited intangibles hope, efficacy, vitality into a quantifiable form of innovative behavior, with greater probability of coming out of valley of death and scaling into successful, innovation-led business.

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