

Maneuvering to the Top: STEM Women Persistence

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The paper aims to find out the relationship between psychological empowerment and innovative output among women employees in the STEM (Science, Technology, Engineering and Maths) fields. Data was collected from among 216 women employees of STEM fields in select cities employing an experimental survey. The data was analyzed and the results showed that psychological empowerment has a positive effect on innovative output. Organizations can continue to engage in psychological empowerment initiatives for employees, fostering a positive work atmosphere that enables individuals to use their leadership talents to encourage people to pursue careers in STEM fields. This research employs Value Percept Theory and Social Exchange Theory to explain psychological empowerment in India's STEM industry,

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Introduction

The debate over women's underrepresentation in the workplace persists despite two decades of efforts to attain gender parity in the workplace (Christie et al, 2017). This essay analyses the methodical development of existing women in STEM (Science, Technology, Engineering and Maths) disciplines to serve as a model for future aspirants interested in increasing their participation in STEM subjects. The variables under consideration were carefully chosen in order to understand more about what and how these STEM women endure despite personal and professional socio-cultural problems at work. Psychological empowerment, emotional agility, and learning agility all contribute to increased endurance for problem at work. Additionally, they also have a positive impact on job aspects such as task performance, innovative work behavior, work values, and work-life balance.

Background of the study

That women are underrepresented in STEM fields has been well documented. Women's advancement in STEM disciplines has become a double-barreled problem for them as they battle to balance their commitments at home and at work. Different kinds of biases exist in the workplace for STEM women, including 'prove it again' bias wherein being a woman she has to prove her worth time and again. The tightrope bias forces her to become more feminine at the job where more masculine traits are required. The maternal wall bias i.e., motherhood which renders her further less competent and low on commitment to job on becoming a mother. Tug of war bias wherein the women themselves along with men discriminate against women in traditionally masculine domain (Williams et al. 2016).

Although organizations are thought to be gender-neutral, this isn't always the case. The gendered nature of professions is largely concealed by the perplexing nature of the tasks assigned, which definitely produces the picture of a man. Furthermore, this image of an employee marginalizes and attempts to highlight a woman's feminism through her body and femininity and as a procreator, encourages her to adopt feministic methods of behaving in a male-dominated workplace, as well as to subsume a subservient position. The creation of gender-neutral administrative structures and work relations is part of a larger control strategy in industrial capitalist societies, which are founded, at least in part, on a deeply

rooted substructure of gender variance. (Acker, 2009)

Review of Literature

Psychological empowerment refers to a person's internal dogmas about their abilities to execute a work, as expressed through the four ideologies of meaning, self-determination, competence, and impact. (Fenn & Scior, 2019). Organizations are continuously working to recruit a diversified workforce that can fill in all the gaps in terms of essential skill sets. As a result, it works to ensure that the proper resources are available at all times. Psychological empowerment influences a person's organizational appropriateness and performance in specific roles (Gregory, et al. 2010)

Positive self-mannerism evaluations are linked to psychological empowerment and are heavily influenced by environmental circumstances. Exposure to female STEM role models increased affirmative attitudes and a stronger natural connection to STEM, resulting in better subjective identification and connectivity with these people. Seeing more identical sex experts leads to increased efficacy in the individual and increased STEM effort, which in turn predicts more effectiveness, implying affection for and commitment to pursuing a career in the STEM field. In particular, females' own self-perception is enhanced by forming connections with female experts, despite negative stereotypes about their sex in STEM fields that remains operational (Stout et al, 2011). Psychological empowerment has also been described as an

innate motivation to conduct more important and rewarding tasks as a motivational construct (Thomas & Velthouse, 1990).

Organizations that want to boost performance urge people to take on extra responsibilities (Onyishi et al., 2012). Individuals may feel compelled to take on additional responsibilities in order to innovate at work (Williams et al., 2016). An empowered employee is meticulous and dedicated to his work. (Sun, 2016).

Innovative work behavior (IWB) is defined by Farr and Ford (1990) as a person's demeanor with the purpose of initiating and launching fresh and useful thoughts, practices, outcomes, or procedures (within a task function, team, or organization). IWB is clearly intended to provide a specific benefit.

Innovative work behavior, according to Janssen (2000), is the deliberate production, institution, and presentation of unique concepts in a task function, team, or business with the goal of advancing functional operations, the team, or the organization. Furthermore, employees are not expected to engage in "innovative work behavior" in their formal functions as employees, nor is it part of an expressed contract between the employees and the business. Extra-role activity is a type of discretionary activity that is rarely recognized by administrative incentive schemes (Organ, 1988).

The level of innovation done by employees is influenced by the work environment. The influence of self-efficacy based on creativity for creative conduct

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was stronger in a work context characterized by heightened information exchange (Teng et al., 2020). Work-based learning takes on task-related and interactional aspects as a result of information sharing. Innovative work behavior is facilitated by a supportive communication context, which has been observed in both men and women. In comparison to men, women exhibit task behavior that is characterized by greater inventiveness and is more welcoming of supportive communication environment (Arif et al., 2006). Instead of standardized jobs, heterogeneous jobs would make use of a variety of abilities to complete various tasks, fostering more innovative work behavior at the workplace (Luoh et al., 2013). Because of the demanding nature of the activities itself, knowledge gained for the duties performed has a positive association with innovative behavior (Battistelli et al., 2019).

Theory Development

Value percept theory and Social exchange theory are used in this paper to explain psychological empowerment. According to the theory, employees appreciate various things at work (Locke, 1967). In a job, there are various components, some of which are more significant and valuable than others. If some aspects of a job may provide the value that an employee values, he will be satisfied and immersed in it. If an employee

cannot get what he values most in the required amount from his job, he or she will grow disenchanted and disengaged. As a result, firms that invest in an employee's competency development improve her capacity to perform a task or skill, boosts her self-esteem and self-image and thus empowering her at work. She feels valued and appreciated, and she is grateful that her boss believes in her capacity to do the job. She desires to repay the favor by doing her best (as per social exchange theory). Furthermore, assigning an employee to a project that she thinks significantly more essential to her personally will increase her self-esteem, she will be happier with her job, and she will take a personal interest in completing it rather than regarding it as a routine office duty. She may, if necessary, draw on her internal resources, i.e., her inner power, to finish something that she considers personally soul fulfilling or worthwhile.

Instead of being told to follow precise processes mechanically to complete tasks, an employee may find it more satisfying if she is given the freedom to perform the work in her own ways, allowing her to use approaches which she feels would be more appropriate to complete the task. If she is merely told to achieve the goal and given the flexibility to select how to do so, she will demonstrate more initiative and drive, making it more appealing to her. Such an approach will give her the confidence to try out new skills or methods to reach the goals. As a result, the worker who values autonomy should be a self-starter capable of doing a great deal on her own, regardless of

availability of resources. (Muzafary, Ali, & Hussain, 2021). She will feel confident in her own abilities and will make use of previously underutilized resources to complete the task assigned by her boss, such as networking and analytical skills, which are not typically required in her day-to-day job.

When a company assigns a task to an employee that has a significant impact on the company in terms of revenue, policy development, compliance, or customer impact, the employee feels energized and happy because the company has put faith in her ability to complete the task, which increases her confidence and motivates her to work harder to achieve it. Employees valuing impact should be self-motivated to put in the effort required to ensure that she becomes the catalyst for the actions that produce such an impact. All of this motivates the employee to think outside the box or come up with fresh ways to complete the task at hand in order to meet the objective of completing it.

Research Objective

To explore the relationship among psychological empowerment and innovative output.

Methodology

A survey was devised keeping the study's objectives in mind, and it was distributed to a sample of women working in STEM fields. The questionnaire had three sections. First section was on demographic details of the respondents.

Second sections dealt with multiple choice questions on study variables on a 5-point Likert scale, in the range 1 to 5. 1 indicates 'strongly disagree', 2 indicates 'disagree', 3 indicates 'can't say', 4 indicates 'agree', and 5 indicates 'strongly agree'. And third section had three open ended questions to elicit their opinion about current status of women in STEM roles.

All measures used in this survey were adopted from established scales in the domain of organizational behavior.

The survey contains 18 questions which were prepared after referring to established scales. The questionnaire on psychological empowerment is composed of 12 items taken from the scale developed by Spreitzer's (1995) workforce agility. The questionnaire on innovative output is composed of 6 items designed by Jeroen and Deanne Hartog (2008) in measuring individual work performance.

Sample

The sampling unit consisted of women employees in the fields of STEM. A sample of 216 replies was considered for the research work, although the questionnaires were distributed among 375 respondents. Therefore, comeback proportion was 57.8%. All the staffs of the various establishments were mailed the online survey via Google forms. In some cases, printed forms of the questionnaire were also circulated, and the objective of the survey was conveyed verbally. The work experience of majority of respon-

dents varied from 0 to 5 years as shown in Table 1.

Table 1 Descriptive Statistics

	N	Mean	Std. Deviation
PE1	216	4.519	.6467
PE2	216	4.380	.6850
PE3	216	4.537	.6089
PE4	216	4.616	.5331
PE5	216	4.463	.6387
PE6	216	4.241	.6594
PE7	216	4.019	.8009
PE8	216	4.023	.7560
PE9	216	3.986	.8097
PE10	216	3.699	.9287
PE11	216	3.190	1.0144
PE12	216	3.421	.9515
Valid(listwise)N	216		

PE: Psychological Empowerment:

Purposive sampling technique was used which is a non-probability sampling method. Women employees at the entry level, middle level, and senior level working in the domain of STEM in cities of Hyderabad, Chennai, Bangalore and Thiruvananthapuram were considered as respondents for the study.

The team had made a visit to all the establishments located in different parts of the cities of Hyderabad, Chennai, Bangalore and Thiruvananthapuram to meet the HR managers or Head of the departments or contacted them via mail and had telephonic conversations to describe the concept of the questionnaire. Upon getting the consent, online mails were sent and telephonic conversations with chosen divisional representatives and functional leaders were also placed thereby ensuring full involvement.

To avoid common method bias which might occur since the data regarding dependent and independent variables were being collected from the respondents at one point, the Harman test was conducted (Podsakoff, 2003). The main factor accounted less than 50% of the variance. Hence, the data does not suffer from common method bias.

Data Analysis & Results

Analysis of the data was done employing Statistical Package for Social Science version 23.0. After the data collection, coding, tabulation, and analysis of the same was done with the assistance of SPSS software version 23.

Demographics (N=216)

26% belong to 22-27years age bracket while 24.5% belong to 28-33years age group. 34-39years respondents comprise 25.5% while 15% belong to 40-45y age group. The remaining 9% falls in the 45 & above age group. 77.3% respondents have a PG degree while 8.3% have a degree while 14.4% consist of other diplomas. 75.4% were married while rest 24.6 % were single. 90% of the respondents were regular employees while rest were working on contract. 57.8% were government employees while 16.6% were employed in semi govt sector. Whereas 19.4% were working in autonomous organizations while the rest were in private sector.

49.9 % belong to science fields while 26% had studied engineering, 20.1% belong to the field of technology and 4%

worked in the field of mathematics. 66.6% have more than 4 years of work experience while 5% had only less than 1 year of experience. While 10% had 1-2 years of experience, 11% had 2 - 3 years of experience and only 7.4% had 3-4 years of experience. 66% had less than 2 dependents while 31% had 3 - 5 dependents and the remaining 3% had more than 5 dependents.

57.4% belonged to joint family while rest 42.6% belonged to nuclear family. 34.7% had more than 5 family members while 31% of the respondents had only 4 members the remaining had 3 family members. 46.3% had single child only while 31% of the respondents had two children, respondents with three children were 10.7% and four children was 7% while 5% had 5 children. Fathers had a major role in career decision for 66% of the respondent while 16.6% took career decisions on their own, for 10% of the respondents their mother was an influencing factor and remaining 7.4 % were advised by friends.

The descriptive statistics shows that psychological empowerment items have a mean from 3.190 to 4.616 and the standard deviation extends from 0.5331 to 1.01. The Cronbach alpha of 12 items of psychological empowerment is 0.865

The descriptive statistics shows that innovative output items have a mean from 4.120 to 4.824 and the standard deviation extends from 1.47 to 1.8718. The Cronbach alpha of 6 items of innovative output is 0.770.

Table 2 Descriptive Statistics

	N	Mean	Std. Deviation
IO 37.	215	4.349	1.6160
IO38.	216	4.120	1.5890
IO 39.	216	4.824	1.8718
IO 40.	216	4.153	1.4941
IO 41.	216	4.269	1.4761
IO 42	216	4.306	1.5963
Valid(listwise)N	215		

IO : Innovative Output

Chi Square Test

The study conducted a Chi – square analysis between qualification and income, age and income. The results are as in Table 3.

Table 3 Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.597 ^a	12	.012
Likelihood Ratio	27.018	12	.008
Linear-by-Linear Association	1.992	1	.158
N of Valid Cases	214		

a. 6 cells (30.0%) have expected count less than 5. The minimum expected count is .52.

There is a significant association between qualification and income as shown by the chi-square test, where Pearson

Chi-square is 0.12 which is less than 0.05 also seen in the table.

Table 4 Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	26.162 ^a	16	.052
Likelihood Ratio	26.677	16	.045
Linear-by-Linear Association	.000	1	.995
N of Valid Cases	214		

a. 6 cells (24.0%) have expected count less than 5. The minimum expected count is 4.06.

There is no significant association between age and income as shown by the chi-square test done, where Pearson

Chi-square is 0.052 which is greater than 0.05 also seen in the table.

Table 5 Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	115.168 ^a	8	.000
Likelihood Ratio	101.017	8	.000
Linear-by-Linear Association	63.798	1	.000
N of Valid Cases	215		

a. 5 cells (33.3%) have expected count less than 5. The minimum expected count is .43.

There is a significant association between qualification and income as shown by the chi-square test, where Chi-square is .000 which is less than 0.05 also seen in the table.

Linear regression analysis was used to analyze the relationship between a dependent variable (Innovative output) and independent variable psychological empowerment.

To test this hypothesis, the following regression model was used.

$Y = a + b_1$ (Psychological Empowerment)

$Y = a + b_1$

$Y =$ Innovative output;

$a =$ constant;

$b_1 =$ coefficients of independent variables;

Fig. 1 Proposed Research Model



The hypothesis formulated is as follows as per this model:

H1: There is significant relationship between Psychological empowerment and Innovative output.

Table 6 Multiple Linear Regression for Innovative Output as a Function of Psychological Empowerment: Model Summary^b

Model	R	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1	.153 ^a	.024	.019	1.090599875571910	0.024

a. Predictors: (Constant), PE: Psychological Empowerment?

b. Dependent Variable: IO: Innovative Output?

Multiple Linear Regression

The proposed model is adequate as the F-statistics (F value = 5.161, p value = 0.024) in Table 6 shows statistically significant relationship between psychological

empowerment and innovative output. The coefficient of determination (adjusted R²) was 0.019, which means that 1.9% of the innovative output is explained by the psychological empowerment variable.

Table 7 Coefficients ^b

Model	R	AdjustedR	Std. Error of	the	F	Sig.
	R	Square	Square	Estimate		
1	.153 ^a	.024	.019	1.090599875571910	5.161	0.024

a. Predictors: (Constant), PE: Psychological Empowerment

b. Dependent Variable: IO: Innovative Output

Table 7 shows the multiple linear regression estimates including the intercept and significance levels. The t-values for psychological empowerment are significant at 5%. Hence, the null hypothesis that there is no significant impact of the independent variables on the dependent variable innovative output is rejected. Hence, we accept the alternate hypothesis H1.

Discussion

Psychological empowerment being a contextual phenomenon can be used effectively to get the desired outcome from the employees by letting them try out different options while at work (Bhatnagar, 2012). In trying out new ways of doing the same job employees tend to innovate and create value for the organization (Ahmed, 1998). To think differently and visualize new ways or new uses for existing or new products, mind needs to have fertile imagination. This can be facilitated by being psychologically empowered (Knezovic & Musrati, 2018) which leads to right kind of motivation to do good at work in situations where women have to prove their worth time and again. To promote creativity in the office, managers can allow women to be involved in decision making, foster independent thinking on issues from multiple perspectives to come up with solutions, give them

autonomy to do their jobs and deliver results which would boost their confidence and enhance their self-image and determination despite many stereotypical issues in the STEM workplace. Such practices shall compel women to think on their own for solutions instead of depending on team members leading to enhanced ability to think independently and become empowered psychologically.

All the facilities and support created in terms of infrastructure, manpower, finances, multiple trainings should be made available to make ideas germinate.

For an organization to continuously discover new things and come up with new ideas or alternative methods the employees should be given a conducive environment to think differently, allow them to take risk, make mistakes and learn from mistakes for future projects. All the facilities and support created in terms of infrastructure, manpower, finances, multiple trainings should be made available to make ideas germinate which is translated into real products or processes and not remain on paper only (Gunduz et. al. 2013). This shall enhance the feeling that they do not have to tread time tested paths for innovation but take creative liberties and with leap of faith

design things which may fail but shall teach many lessons for future endeavors. Instead of side-lining them for taking creative liberties for making novel products, acknowledging their contribution and making them an important part of the future projects and further giving them lots of decision making opportunities shall also boost their confidence. This shall benefit organizational innovativeness in a big way in the long run.

Psychological empowerment stimulates work engagement among employees (Bhatnagar, 2012). All the facilitating factors at work shall make women employees engrossed in their work. This deep involvement with work shall stimulate creativity and problem solving for new innovations in STEM fields (Aslam, 2017). Then the empowered women employees use their dedication to start thinking innovatively and come out with innovative products benefiting the company's bottom line.

Managerial Implications

The companies can have a fast track career program designed for select women working to groom them for leadership position. Regular training sessions on how to manage team members, how to get work done from employees and leadership programs for senior roles can be organized so that women feel that the organization itself wants them to dream bigger roles and supports them in becoming leaders for the future. These shall make them feel empowered and believe in their abilities. They can be trained on using creativity and on critical thinking and

design thinking to improve their skills on a regular basis so that they can look at projects from multiple perspectives while designing or creating innovative output.

Design thinking training can be given to all employees when they join the company so that their orientation from the beginning is to apply it in all the aspects of a job they dispense their responsibilities at work. Design thinking shall stimulate their ability to look at different perspectives for an issue before finalizing the final path to accomplishing the task. Design thinking can be applied to anything like office procedures, production processes followed, products being made to enhance work agility and productivity. This shall also lead to innovative output and streamlined processes ensuring redundant processes are done away with etc.

Mentoring sessions with senior managers can be done to introduce or enhance a particular way of problem solving as every company has a unique way to approaching the issues and may want to continue following such tried and tested methods and path for optimum results. For this one-to-one discussions or guidance shall help employees feel the confidence that they can do the way the company expects them to do. Mentoring activities can also be extended to personal and professional needs of the subordinates so that general wellbeing of the individuals is also ensured.

Flexi timings, work-from-home where situations warrants, emergency leaves can be accommodated and incorporated as part of HR policies for mothers or care

givers so that they can be fully engrossed in their work and their attention is not divided due to personal matters during work. All such policies built into the work processes makes the environment more conducive thereby empowering employees which shall have a ripple effect on increasing creativity and lead to enhanced innovative output for the company.

Limitations of the Study

This study is confined only to women staff of establishment in STEM domain having branches in Hyderabad, Chennai, Bangalore and Thiruvananthapuram city. It is assumed that the sample responses provided honest information based on correct understanding.

For a better generalization of the findings, the study can be performed in various Indian states with institutions that excel in the field of STEM. Although this study was limited to a few businesses, other industries might be studied, and comparative research for several domains such as medicines, chemicals, and steel might also be undertaken.

Conclusion

According to the literature review, psychological empowerment allows an employee to function with a great deal of autonomy. When an employee's mind is free to think exclusively about work, she will be able to think deeply about numerous aspects of the job, as well as do out-of-the-box thinking to solve the problems in all situations. This shall lead to innovative output which may be more

feasible in all aspects than the conventional way of working or methodology followed. Our empirical research has confirmed the same. As a result, it is preferable for businesses to encourage employee empowerment by providing them with all of the necessary workplace amenities as well as the liberty to carry out their duties, resulting in increased productivity and creative ideas. Innovative strategies can be employed before an organization settles on a specific course of action to ensure that it is the most feasible in all aspects and benefits all stakeholders.

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