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# SCSR

## SUPPLY CHAIN AND SUSTAINABILITY RESEARCH

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**SUPPLY CHAIN AND SUSTAINABILITY RESEARCH: SCSR**

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Supply Chain and Sustainability Research (SCSR) is an independently run non-profit journal dedicated to serve the worldwide scientific community through periodical of high-quality and high-impact scholarly, multi, and inter-disciplinary research that broadly resides in the arenas of supply chain and sustainability research. SCSR is committed to provide a platform that disseminates academic work, findings, and knowledge promptly, openly, and freely to all, and thus promote practical and public conversation and communication. By this, SCSR strives to be one of the important supply chain and sustainability journals in the world.

The Purpose: To support and encourage the writing of academic works. Disseminate academic works of faculty, academics and students both internally and externally as well as being a medium for education, research and dissemination of academic knowledge.

The goal is to serve as a hub for scholarly support, knowledge transfer, and dissemination. along with quality research The SCSR strives to publish insightful, innovative, and pertinent research that describes or may have an impact on management and/or innovation within the SCSR framework. Benefits to society, the community, and the country as a whole are frequently published in electronic journals by the SCSR. is diverse and interdisciplinary in character. The magazine accepts essays on all topics related to management as well as those relevant to innovation, regardless of discipline or subject area.

SCSR uses a "double-blind peer review system," meaning that the authors do not know who the reviewers are, and the reviewers do not know who the authors are. All submitted manuscripts are to be reviewed by three expert reviewers per paper. Reviewers are chosen because of their expertise in the topic area and/or methodology used in the paper. Each article is judged based solely on its contribution, merits, and alignment with the journal's mission. Should any revision be required, our instructions to authors are designed to move authors towards a successfully published article.

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## Greetings from Editor-in-Chief: Supply Chain and Sustainability Review (SCSR)

Jirasek Trimetsoothorn

The application of sustainability issues to supply chain management, logistics, transportation, and various optimization methods has been increasingly popular in recent years. One of the numerous issues that supply chain management encounters on an ongoing basis is operating in a sustainable manner. The goal of the SCSR is to investigate the use of sustainability in supply chain management, operation management, logistics, transportation, healthcare management, and fuzzy sets theory. The first issue of SCSR is to serve this purpose as how sustainable development must go hand in hand with logistics and supply chain management.

We invite academics from a variety of management-related disciplines to submit original, high-quality research papers that primarily address sustainability-management-related challenges and contribute to the SCSR's mission. The articles in the SCSR will emphasize both theoretical and empirical research. Literature reviews, conceptual theory development, qualitative survey research, such as case studies, and quantitative empirical methodologies may all be included in academic papers. SCSR rules must be adhered to by all submitted papers.

In view of current disruptions in global supply chains (e.g., chip crisis), the implications of supply chains for the climate and biodiversity discourse, new supply chain laws to increase social responsibility, and technological innovations (e.g., blockchain), supply chain management has become an imperative for global business.

In this issue, 6 research papers are presented.

(1) A study on technical employees' intention to leave a job a case study of X Tire manufacturing company

(2) Exploring Work Engagement among Chinese Student Affairs Educators: A Literature Review on Supply Chain and Sustainability Management

(3) Enhance supply chain dynamics education: Evaluate insights from beer game simulations

(4) Evaluating Sustainable Practices in Supply Chains: A Conceptual Framework for ESG Performance Assessment

(5) Comprehensive Study on the Supply Chain of Vacuum Thermal Cracking System for Sustainable Development: A Case of Waste-to-Energy and Resource Recovery

(6) An In-Depth Analysis of Tariq Malik's Impact on Global Business, Innovation, and Sustainability: A Rigorous Examination

In addition, we would like to inform you about our next issues (Volume 3 No.1,...) in 2024. Recent announcement of the call for papers is accessible on the SCSR website. This issue marks the debut of the SCSR and its birth. It is my pleasure to address you on this occasion. I would like to express a warm welcome to the SCSR readership on behalf of the SCSR Editorial Team. I would like to thank our authors, editors, and anonymous reviewers, who have all voluntarily contributed to the journal's success. Without your participation, this initial issue would not exist.

We look forward to receiving your contributions.

## Editorial Team

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**Guideline for Authors**

SUPPLY CHAIN AND SUSTAINABILITY RESEARCH: SCSR
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# A study on technical employees' intention to leave a job a case study of X Tire manufacturing company

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## Abstract

Talent is the most important strategic resource in the development of enterprises, and effective management is the most important thing to enhance the core competitiveness of enterprises. The company should not only focus on recruiting new employees but should explore the real reasons behind the resignation of old employees and find ways to avoid the resignation of skilled employees, which also puts higher requirements on the company's technology accumulation. By collecting and analyzing data through questionnaire survey, this study deeply analyzed the reasons behind the brain drain, and proposed corresponding win-win countermeasures, which not only enabled technical talents to fully enhance their personal value, but also strengthened the company's attraction to employees, retained technical backbone talents, improved the current situation of enterprise talents' turnover intention, and controlled the turnover intention rate of talents. Reduce the impact of skilled employees' turnover intention (work) on enterprise development.

**Keywords:** Reason for Intention to leave (job), Intention to resign, Brain drain, Job satisfaction, sustainable management of enterprise.

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## Introduction

The stability of the technical talent team is the main body of enterprise development, and the increasingly refined production requirements and advanced technology research and development are undertaken by all personnel in the technical system. The stability of the technical talent team directly affects the high-quality and sustainable development of the enterprise. Nowadays, the Intention to technical personnel has become a common phenomenon, especially the loss of grassroots technical personnel and frequent "job hopping" of senior technical talents, which is worthy of our deep consideration. Employees are a valuable asset for an organization to carry out its activities. An organization must retain its best employees so they do not leave or move to work for another organization. The fact is that there is still a large number of employees who choose to resign and work for another organization. Especially because of employee wishes and resulting turnover (Safwan et al., 2023). If turnover is high, the organization will hire people to fill or replace those who leave e (Ahmad et al., 2022) Job satisfaction is a subject of extensive research and holds significant importance. For organizations to be successful, they must continuously ensure employee satisfaction. Ali and Anwar (2021) defined job satisfaction as the emotional state and overall sentiment of individuals toward their current employment. It is widely acknowledged that contented employees tend to exhibit enhanced effectiveness and productivity within their organizations. (According to Aburumman et al. 2020), focusing on job satisfaction enables organizations to foster positive outcomes, such as employee contentment, while reducing employee turnover. Employee turnover represents a substantial challenge for human resource management practices and organizational achievements.

This study explores the reasons that affect the Intention to technical personnel, establishes a research framework for job satisfaction and stress, welfare benefits, and technical personnel's Intention to Leave (job), and explores the on relationship between the three. According to the research framework, relevant survey questionnaires were designed, and actual research work was carried out. Conduct a questionnaire survey and specific analysis on 200 technical personnel who have worked in X Company in the past 10 years and conduct quantitative and statistical analysis of the research results. Finally, summarize the analysis results and research findings, and propose more targeted improvement measures to avoid the negative impact of high Intention to Leave (job) rates of technical employees on the development of the enterprise. To this end we have formulated three research questions:

1. To study the influence of monetary compensation on intention to leave
2. To study the influence of intrinsic job satisfaction on the intention to leave and
3. To investigate the overall impact of monetary compensation and intrinsic job satisfaction on "intention to leave".

The research results can enable enterprises to fully and truly understand the harm of technical employee Intention to Leave (job) to the company, promote effective transformation of enterprise management, improve job satisfaction and sense of happiness and honor of technical employees, strengthen their loyalty and dedication, reduce the Intention to Leave (job) rate of technical talent team, help enterprises better and stable development, achieve a win-win situation for technical employees, and truly achieve the common development and progress of individuals and organizations.

## Literature Review and Related Research

### A. Intention to leave (job) theory

Intention to Leave (job) theory refers to the reasons and motivations for employees to leave an organization or job. (Pfeffer & O' Reilly,1987) (Bigliardi et al., 2005) Intention to leave (job) is a common phenomenon in the organization, which has certain influence on the stability and development of the organization. The financial cost of replacing a knowledge worker had been estimated to be more than a year's salary Michaud, 2000). This is incurred in addition to the indirect loss to the company through loss of knowledge and organizational memory (Hansen et al.,1999), decreased productivity, lowered morale of existing staffs (Tziner & Birati,1996) and customer dissatisfaction (Hansen et al.,1999). Reasons for absolute Intention to leave (job) include employee personal reasons, working environment, work content, organizational culture, etc. Among them, (Heilmann et al., 2008) employees' personal reasons are one of the most common reasons, mainly: dissatisfaction with work, salary, career development, etc. The working environment is also an important factor affecting employee intention to leave (job), such as unsafe workplaces, excessive work pressure, etc. There are also many motivations for personal exit, including employees' personal development needs, career planning, work environment needs, etc. IOSR. Journal Of Humanities and Social Science (2013). According to him (Chiu & Francesco, 2003), Among them, the personal development needs of employees are one of the most common motivations, for example, employees want to improve their skills and abilities, want to seek better career opportunities, and so on.

### B. Job satisfaction

Buliń ska-Stangrecka and Bagień ska (2021) defined job satisfaction as a positive emotional state that arises when one's expectations are met and one 0derive value from their current employment position. Other than that, according to cited in Ramadhani (2014), employee job satisfaction refers to the feeling of contentment, pleasure, and pride that one derives from one's work; employees quit their job due to reasons that include: lack of opportunities for professional development, inadequate compensation, poor work/life balance, job stress and unfair treatment (Tepper, 2007).

Intrinsic job satisfaction (Akosile and Ekemen 2022) is an unquantifiable metric defined as the positive emotional response you experience while working or coming to work. Leading organizations are now trying to measure this feeling, with intrinsic job satisfaction surveys becoming a staple in most workplaces. Common job satisfaction facets include co- workers, appreciation, benefits (Anthony Vandarakis, 2020), job conditions (Wright & Brehm, 1982), pay, promotion, supervision, and organization's policies or procedures. Job satisfaction varies from employee to employee. (Gregory, K. 2011). What helps one employee feel good about work may not work for another, Since job consists of various spectrums, job satisfaction is often conceptualized as a multidimensional construct that consists of many elements, typically called job satisfaction facets (Law et al

,1998) employee in the same workplace under the same conditions. Therefore, a multidimensional approach must be taken to improve employee satisfaction, (Lok & Crawford, 2004).

**C. Monetary compensation**

Monetary compensation is various forms of remuneration received by employees for services provided to their organizations. Remuneration in a narrow sense refers to money and remuneration that can be converted into money (Anthony Vandarakis , 2020). Remuneration in a broad sense includes various non-monetary forms of satisfaction in addition to salary in a narrow sense. It can be said that good compensation and benefits can lead to job satisfaction and commitment to the organization, thereby reducing Intention to Leave (job). Attractive compensation is negatively related to Intention to Leave (job) (Gupta & Shaw, 1998) and the claim that compensation is higher than the equilibrium rate (Akerlof, 1982) because higher salaries maximize employee self-interest, which leads to higher satisfaction (Williams & Dreher, 1992) The same positive outcome is observed with generous benefits (Tsai et al.,1989). By induction, monetary compensation, including salary and all benefits, plays an important role in influencing Intention to Leave (job) intentions because it is the prevailing materialistic culture (Lim, 2010).

In the real business management environment, using cash and material to measure personal returns can be called monetary compensation (Anthony Vandarakis, 2020). If the company has no spirit and emotion, employees will feel that they have no future, dreams and sense of security, and they can only talk about money with the company, which will not give employees a sense of belonging (IOSR, 2013). In view of the above theories, if you want to retain more talents with monetary compensation, you must establish an effective system, which should include the following points:

(1) Fairness, organically integrated with the performance system, making the system more fair;

(2) Design the plan under the premise of ensuring that the overall monetary compensation of employees does not increase significantly.

(3) Design the welfare system of each group to meet the needs of different types of employees

**D. Organizational commitment and Intention to Leave (job) intention**

Organizational commitment refers to a state of mind that binds an individual to an organization (Meyer & Allen,1990). In contrast to linking job satisfaction to work, organizational commitment emphasizes the connection to the organization. attachment to goals and values, the individual's role in it, and attachment to the organization, rather than purely instrumental values (Cook & Wall, 1980). In essence, measuring organizational commitment is a measure of Assessment of alignment between own values and beliefs and those of the organization (Swailes ,2002). By understanding commitment, practitioners will be in a better position to predict the impact of a particular policy or practice on the organization (Meyer & Allen, 1997). In a organizations, commitment will promote a stable self-concept and thus more predictable and consistent behavior and performance. Reference (Mathieu & Zajac, 1990) asserts that the more conscientious employees are, the more they exhibit role behaviors such as innovation and innovation. This is often what keeps an organization competitive. Reference (Meyer & Allen, 1997) noted that committed employees have a higher tendency to stay in their jobs. Research has consistently supported that increased organizational commitment is positively associated with individual behaviors such as lower willingness to seek a new job and reduced Intention to Leave (job). (Meyer & Allen ,1997; Bergmann et al., 2000; James et al., 2007).

**E. Characteristics of Technical Employees**

Knowledge-based staff Knowledge Winkelhaus et al. (2022): able to master and use symbols and concepts, the use of knowledge or information work people. In this way, technical employees belong to a special category of knowledge-based employees, they need to master specialized professional knowledge, and these professional knowledge can meet the needs of the specific post of the enterprise staff compared with ordinary staff, technical staff usually have a higher level of professional skills and knowledge, having strong self-understanding ability in knowledge learning and subjective creativity can make greater contribution to enterprise technology development. (Konigová & Urbancova, 2012) The technical personnel studied in this paper are those who have mastered systematic scientific knowledge and professional skills and can help enterprises to carry out relevant R & D and design in actual production, at the same time according to customer needs to provide related technical solutions to solve the problems encountered in production and use, and use their own knowledge to support and promote the company's technical innovation. who have more opportunities because their skills and knowledge "gives them freedom to move since(their) knowledge has a multitude of applications in the information or knowledge age". Organizations also struggle with having to throw in more money to keep their people (Tomich, 2012).

**Hypotheses under This Study**

The purpose of this study is to explore the relationship between Intention to Leave (job) of technical employees in X Tire Production Company and influencing factors. After conducting a literature review, researchers will propose some hypotheses based on the existing structure. This study proposes two hypotheses to validate the impact of monetary compensation and intrinsic job satisfaction on the Intention to leave of the technical personnel. The following are two hypotheses:

H1 : Monetary compensation has a significant impact on the intention to leave of the technical personnel of X Tire Production Company.

H2 : Intrinsic job satisfaction has a significant impact on intention to leave of the technical staff of X Tire Production Company.

**Conceptual framework**

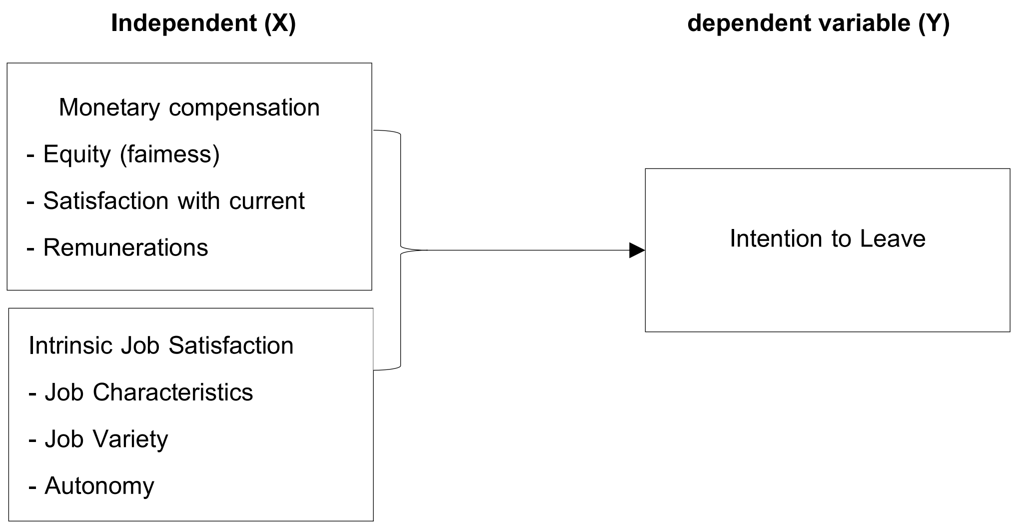


**Figure 1** Research framework

## Research methods

**Types of research**

This article adopts a quantitative analysis method and obtains the specific reasons for the Intention to leave (job) of technical employees through questionnaire surveys.

Population and sample

1. The population is 200 employees of X tire production company.

2. The sample is 145 technicians who have worked for X tire production company, and the simple random sampling method is adopted.

Research Tools

The instrument used in this study is a questionnaire survey for data collection. The questionnaire is divided into the following 3 parts:

The first part: X tire production company's checklist questionnaire on respondents' gender, working years, education and other personal information factors.

The second part: the 5-interval self-assessment questionnaire on the impact of intrinsic job satisfaction, monetary compensation on intention to leave of technical personnel. There are 5 levels of recognition, which are scored according to the following scale. Rating satisfaction 5 Strongly agree, 4 relatively agree with, 3 generally agreed, 2 do not agree and 1 Strongly disagree.

The third part: Conduct a 5-level evaluation questionnaire on the turnover intention of technical personnel. There are a total of 5 levels of identification, which are rated according to the following scale. Rating satisfaction 5 Strongly agree, 4 relatively agree with, 3 generally agreed, 2 do not agree and 1 Strongly disagree.

Research tools.

The instruments prepared by the author are as follows:

1. Research and literature focusing on intrinsic job satisfaction, monetary compensation, and skilled worker turnover.

2. Use the information from Step 1 to construct the questionnaire, including the conceptual framework and definitions of terms used in the study.

3. Taking "reasons and countermeasures for technical employees' Intention to leave (job)" as the research theme, construct a questionnaire.

**Inspection Tools and Data collection methods**

The author checked the quality of the research instruments as follows: 1) The questionnaire to an independent study consultant who will check the suitability of the questionnaire. 2) The questionnaire for assessing content validity and analyzing the Index of Congruence (IOC) between the content and questionnaires used in the study and select questions with a consistency index of 1.00. and modify questionnaire. 3) Try – out and reliability analysis.

The information collected by the author is as follows: 1) Distribute the questionnaire to 200 technicians who are working in the X tire production company, Zaozhuang city, Shandong province, and wait for the collection of the questionnaire. 2) Check the completeness of the questionnaire collection, then use the software package to classify the data and use the software Package for analyzing statistical data.

Data analysis

The authors used computer software packages to analyze the data as follows: 1) the frequency and percentage 2. Analyze the impact of each dimension of internal satisfaction on the turnover of technical employees and the impact of monetary compensation on the turnover of technical employees. 3. Verifying research hypotheses. Average Satisfaction Level: 4.46 - 5.00 Means Highest, 3.46 - 4.45 Means High, 2.46 - 3.45 Means Moderate 1.46 - 2.45 Means Low and 1.00 - 1.45 Means Lowest.

Statistical methods

The statistical method used in this study is the sampling survey method, and the statistical data are: 1. Frequency 2. Percentage 3. Arithmetic Mean 4. Standard Deviation (S) and 5. Pearson's Correlation coefficient (R)

**Analysis of Personal Factor Data**

An analysis of personal factors, including gender, age, educational level, working experience, professional title and thought of importance of technical personnel to development of enterprises, and number of technical personnel resigning around you, was conducted for this study. The data was analyzed using frequency and percentage analysis.

**Table 1** presents the number and percentage of responses.

| | Personal Factor | Number | Percentage (%) |
|---|---|---|---|
| Gender | | | |
| | Male | 83 | 53.90 |
| | Female | 71 | 46.10 |
| | **Total** | **154** | **100** |
| Age | | | |
| | less than 25-30 years old | 44 | 28.57 |
| | 30-40 years old | 47 | 30.52 |
| | 40-50 years old | 32 | 20.78 |
| | more than 50 | 31 | 20.13 |
| | **Total** | **154** | **100** |
| Educational level | | | |
| | Lower than high school | 42 | 27.27 |
| | junior college | 56 | 36.36 |
| | undergraduate | 53 | 34.42 |
| | doctoral and above | 3 | 1.95 |
| | **Total** | **154** | **100** |
| Working experience | | | |
| | Less than 1 year | 15 | 9.74 |
| | 1-5 years | 43 | 27.92 |
| | 6-10 years | 29 | 18.83 |
| | 10-15 years | 39 | 25.32 |
| | Over 15 years | 28 | 18.18 |
| | **Total** | **154** | **100** |
| Professional title | | | |
| | technician | 22 | 14.29 |
| | junior engineer | 49 | 31.82 |
| | intermediate engineer | 54 | 35.06 |
| | senior engineer or above | 29 | 18.83 |
| | **Total** | **154** | **100** |

**Table 1** (Continued)

| Personal Factor | | Number | Percentage (%) |
|---|---|---|---|
| Do you think technical personnel are important for the development of enterprises? | | | |
| | Not important | 15 | 9.74 |
| | Generally important | 24 | 15.58 |
| | Important | 65 | 42.21 |
| | Very important | 50 | 32.47 |
| **Total** | | **154** | **100** |
| Are there many technical personnel who have resigned around you? | | | |
| | never heard of it | 19 | 12.34 |
| | not many | 24 | 15.58 |
| | always heard about this | 65 | 42.21 |
| | usual thing here | 46 | 29.87 |
| **Total** | | **154** | **100** |

The sample size of this study is 154 units, consisting of 83 males (53.90%) and 71 females (46.10%). In the distribution of age, the 30-40 age group accounted for the largest number of respondents, accounting for 30.52%, followed by 25-30 years old, accounting for 28.57%, and the least number of respondents were over 50 years old, accounting for only 20.13%.

In the distribution of education level, college degree accounted for the highest proportion, accounting for 36.36%, while the respondents with a doctorate degree were the least, only about 1.95%.

In the distribution of work experience, the work experience of 1-5 years is the most, accounting for 27.92%, followed by 10-15 years, accounting for 25.32%, and the work experience of less than 1 year is the least, accounting for only 9.74%.

In the distribution of titles, the number of intermediate engineers is the largest, accounting for 35.06%, and the number of technicians is the least, accounting for only 14.29%.

In response to the question "Do you think technical personnel are important to the development of your business?" More than 90 percent of respondents believe that technical personnel are important to the growth of their business.

As for the question "Do many technical staff resign around you?", 72.08% of the respondents believe that the turnover phenomenon is more common around them.

**Table 2** Reliability analysis

| Variable | Reliability Statistics | | |
|---|---|---|---|
| | Cronbach's Alpha | Cronbach's Alpha based on standardized terms | Number of items |
| Job characteristics | 0.84 | 0.83 | 8 |
| Job variety | 0.83 | 0.83 | 5 |
| Autonomy | 0.76 | 0.75 | 5 |
| Monetary compensation | 0.87 | 0.86 | 10 |
| Intention to Leave Questionnaire | 0.91 | 0.92 | 7 |

This article uses the descriptive statistics method to analyze the data of factors affecting the Intention to Leave of technical personnel of X tire production company and analyzes the mean ( $\bar{X}$) and standard deviation (SD). The specific analysis is shown in Table 3

**Table 3** descriptive statistics method to analyze the data of factors

| influence factor | N=154 | |
|---|---|---|
| | $\bar{X}$ | S.D |
| Job characteristics | 3.71 | 0.65 |
| Job variety | 3.52 | 0.77 |
| Job variety | 3.77 | 0.67 |
| Monetary compensation | 3.77 | 0.64 |
| Total average | 3.52 | 0.87 |

The Job characteristics, Job variety, Job variety and Monetary compensation. The researcher presents the results of analysis on average and standard deviation in Table 3. The five-level frequency range principle, we can see that the mean values of the three variables are all over 3.52, It shows that the factors affecting the resignation of technical employees of X tire production company are at a high level in Job characteristics, Job variety, Job variety and Monetary compensation and other aspects.

**Table 4** Shows the mean ( $\bar{X}$) and standard deviation (SD) of the Job Characteristics Items among technical personnel of X Tire Manufacturing Company

| Job Characteristics | N=154 | |
|---|---|---|
| | $\bar{X}$ | S.D |
| 1. Are you happy with the current work routines and daily operations of your own | 3.78 | 0.85 |
| 2. You are still happy even though you need to work long hours | 3.55 | 1.14 |
| 3. Are you happy with how your work process is controlled | 3.79 | 0.81 |
| 4. Are you happy with your current work pressure? | 3.45 | 1.12 |
| 5. Do you think the workload is distributed fairly? | 3.81 | 0.81 |
| 6. Do you have a good relationship with your colleagues? | 3.63 | 1.04 |
| 7. Do you think you have gained a lot since joining the company? | 3.86 | 0.84 |
| 8. How satisfied are you with the company overall? | 3.87 | 0.88 |
| **Total average** | **3.71** | **0.65** |

It can be seen from Table 4 that the technical staff of X Tire Manufacturing Company have Job Characteristics to work( $\bar{X}$ = 3.71 , SD = 0.65), As shown in the figure, there are still areas of dissatisfaction among employees regarding their overall satisfaction with the company( $\bar{X}$ = 3.87 , SD = 0.88), Compared with other items in the same scale, the problem of work pressure is more prominent. From the lowest attitude score of employees, it can be inferred that work pressure is high ( $\bar{X}$ = 3.45, SD = 1.12).

**Table 5** Shows the ( $\bar{X}$) and standard deviation (SD) of Job Diversity among technical personnel of X Tire Manufacturing Company

| Job Diversity | N=154 | |
|---|---|---|
| | $\bar{X}$ | S.D |
| 9. Are you satisfied with multiple tasking type of job demanding many skills | 3.89 | 0.85 |
| 10. Are you happy with the company's various job choice available here? | 3.47 | 1.15 |
| 11. Are you confident in the company's development prospects and strategic planning? | 3.86 | 0.82 |
| 12. Are you free enough in choosing your current work process? | 2.92 | 0.98 |
| 13. Do you think the variety of work is valid? | 3.48 | 1.13 |
| **Total average** | **3.52** | **0.77** |

As can be seen from Table 5, the overall perceived job diversity among technicians in X tire manufacturing enterprise is moderately high ( $\bar{X}$ =3.52, SD = 0.77) which shows that the jobs are various enough for employees to divert their attention. Most technicians of X tire manufacturing enterprise believe that multi-skilled multi-task type work satisfied them ( $\bar{X}$ = 3.89, SD = 0.85), but their attitudes towards choice of freedom in work processes are shown as unsatisfactory ( $\bar{X}$ =2.92, S.D=0.98)

**Table 6** Shows the mean ( $\bar{X}$) and standard deviation (SD) of Job Autonomy among technical staff of X Tire Manufacturing Company

| **job autonomy** | **N=154** | |
|---|---|---|
| | $\bar{X}$ | **S.D** |
| 14. Are you happy with the rules and regulations of the company? | 3.80 | .91 |
| 15. Are you happy with the cooperation and communication of your team at work? | 3.84 | .86 |
| 16. Are you happy with the importance your company places on employees' personal development? | 3.62 | 1.12 |
| 17. Do you feel stressed with the ways people do things around here because this is their corporate culture and values? | 3.84 | .83 |
| 18. Are you happy the work ability and comprehensive quality of your superiors? | 3.77 | .95 |
| **Total average** | **3.77** | **.67** |

It can be seen from Table 6 that the technical staff of X Tire Manufacturing Company have a job autonomy to work ( $\bar{X}$ =3.77, SD=0.67). Employees are still stressed in coping with organizational culture and values as shown ( $\bar{X}$ =3.84, SD=0.83), however, they have their own approach and methods of resolving psychological conflicts by teaming up among themselves through group communication and team cooperation to create internal consistency and friendships. This can be justified by the fact of the evidence ( $\bar{X}$ =3.84, SD=0.83). Employees do learn how to adjust themselves well as how to survive in a stressful environment and unacquainted atmosphere. Compared to the other items in the same scale, the company may not put enough significant importance on the personal development of employees, as shown in the employees' lowest scores in attitudes ( $\bar{X}$ =3.62, SD=1.21).

**Table 7** Shows the mean ( $\bar{X}$) and standard deviation (SD) of the Monetary compensation Items among technical personnel of X Tire Manufacturing Company.

| Monetary compensation | N=154 | |
|---|---|---|
| | $\bar{X}$ | SD |
| 1. Are you happy with your current salary? | 3.81 | 0.89 |
| 2. Are you happy with your current benefits package? | 3.60 | 1.05 |
| 3. Are you happy with the current performance appraisal? | 3.56 | 1.13 |
| 4. Are you happy with promotion opportunities within the company? | 3.78 | 1.06 |
| 5. Are you happy with your compensation package compared to other companies? | 3.90 | 0.87 |
| 6. Are you happy with the position offered to you by the company? | 3.85 | 0.80 |
| 7. Do you believe in the organization's commitment? | 3.86 | 0.82 |
| 8. Do you think the salary distribution is fair and reasonable? | 3.92 | 0.84 |
| 9. Do you think the salary you receive matches your efforts? | 3.62 | 1.03 |
| 10. Is this job important to you? (family , Life) | 3.87 | 0.92 |
| **Total average** | **3.77** | **0.64** |

It can be seen from Table 7 that the technical staff of X tire production company have the lowest score in performance appraisal as expressed by the technical personnel ( $\bar{X}$ = 3.56, SD = 1.13), while most of them feel that compensation distribution is fair among technical personnel ( $\bar{X}$ = 3.92, SD = 0.84). In terms of Monetary compensation, employees at X tire production company feel relatively happy and satisfied with their Monetary compensation by showing their attitudes at ( $\bar{X}$ = 3.77, SD = 0.64).

**Table 8** shows the mean ( $\bar{X}$) and standard deviation (SD) of the Intention to leave intention among technical staff of X Tire Manufacturing Company.

| Intention to leave | N=154 | |
|---|---|---|
| | $\bar{X}$ | S.D |
| 1. I actively look for a new job outside my company even though it will give me less pay and worse welfare. | 3.46 | 1.04 |
| 2. Currently, I stumble into hardship of conflicts and tolerate to remain stable wishing that bad things will go by after this period of time. | 3.56 | 1.01 |
| 3. I start looking for a new job outside my company and I am willing to move to a new company when the pay is higher than here. | 3.51 | 1.09 |

**Table 8** (Continued)

| Intention to leave | N=154 | |
|---|---|---|
| | $\bar{X}$ | S.D |
| 4. Life overall here is no longer easy. I passively look for a new job but different position in the competitor's company wishing them "hunting" me at higher price. | 3.47 | 1.07 |
| 5. Despite strong competition, I will remain here as an employee because the chance of job progress is more enlightened. | 3.53 | 1.04 |
| 6. Stress brings me lots of organizational problems. Other organization also have many problems causing stress. | 3.58 | 1.14 |
| 7. When tomorrow comes, I will definitely be in a new position in a new organization and start a new life. | 3.53 | 1.06 |
| **Total average** | **3.52** | **0.87** |

It can be seen from Table 8 that the technical staff of X Tire Manufacturing Company scored low on turnover intention ( $\bar{X}$ =3.52, S.D=0.87). Although most technical staff are relatively able to accept the problems caused by stress through self-adjustment, after all, other organizations also have many stress problems, but the overall satisfaction level is not too high. ( $\bar{X}$ =3.58, SD=1.14) Employees' thoughts, emotions and psychology are more important. Once their intention to leave is determined, they will actively look for new jobs externally. Even if the salary is not high and the benefits are not good, they will choose to leave their current position. ( $\bar{X}$ =3.46, SD=1.04).

**Table 9** shows the correlation between variables.

| Correlations Matrix between Dependent and Independent Variables | | | | | | |
|---|---|---|---|---|---|---|
| | | Job characteristics | Job variety | Autonomy | Monetary compensation | Intention to Leave Questionnaire (DV) |
| Job characteristics | Pearson correlation | 1 | 0.84** | 0.84** | 0.86** | -0.89** |
| | Sig. (two-tailed) | | 0.00 | 0.00 | 0.00 | 0.00 |
| | Number of cases | | 154 | 154 | 154 | 154 |
| Job variety | Pearson correlation | | 1 | 0.83** | 0.86** | -0.87** |
| | Sig. (two-tailed) | | | 0.00 | 0.00 | 0.00 |
| | Number of cases | | | 154 | 154 | 154 |

**Table 9** (Continued)

| Correlations Matrix between Dependent and Independent Variables | | | | | | |
|---|---|---|---|---|---|---|
| | | Job characteristics | Job variety | Autonomy | Monetary compensation | Intention to Leave Questionnaire (DV) |
| autonomy | Pearson correlation | | | 1 | 0.85** | -0.84** |
| | Sig. (two-tailed) | | | | 0.00 | 0.00 |
| | Number of cases | | | | 154 | 154 |
| Monetary compensation | Pearson correlation | | | | 1 | -0.91** |
| | Sig. (two-tailed) | | | | | 0.00 |
| | Number of cases | | | | | 154 |
| Intention to Leave Questionnaire | Pearson correlation | | | | | 1 |
| | Sig. (two-tailed) | | | | | |
| | Number of cases | | | | | |

** significant level = 0.05

As can be seen from Table 9, variables such as Job characteristics, Job variety, autonomy, and Monetary compensation has a negative relationship with Intention to Leave.

（1） Intention to Leave job (DV) has negative correlations with job characteristics (IV) whose Pearson's r = 0.89. Their relationships are statistically significant at 0.05.

（2） Intention to Leave job (DV) has negative correlations with Job variety (IV) whose Pearson's r = 0.87. Their relationships are statistically at 0.05. significant.

（3） Intention to Leave job (DV) has negative correlations with autonomy (IV) whose Pearson's r = 0.84. Their relationships are statistically significant at 0.05.

（4） Intention to Leave job (DV) has negative correlations with Monetary compensation (IV) whose Pearson's r = 0.91. Their relationships are statistically significant at 0.05.

## Study Results Discussion and Recommendations

" An Investigation on Intention to Leave a job: A Survey from Technical Employees " is a quantitative survey research characteristics using a questionnaire to collect data from 154 technical staff and uses descriptive and inferential statistics to analyze the data. The study adopted the test using descriptive statistics (frequency, average, standard deviation, variance) and Pearson's correlations, and the literature study is presented, discussed and suggested as follows.

**Summary of research results**

Research results show that most of the technical employees who responded to the questionnaire were male, 30-40 years old, and most had 1-5 years of work experience, followed by 10-15 years; their academic qualifications were generally junior college, bachelor's degree, and fewer had doctorates or above. There are the most people with intermediate professional titles, and the lowest are technicians. More than 90% of employees believe that technical personnel are important to the development of the company, and 72.08% of the respondents always heard that technical people around them always resigned from the company because of unknown reasons.

## Discussion

Judging from the research results actually solution for technical personnel's willingness to leave (work), the results can be discussed as follows:

Discussion on the influencing factors of job satisfaction on turnover intention

The importance of job satisfaction is well-established in research. Employee job satisfaction is closely related not only to their commitment to the organization but also to their propensity to leave. This finding highlights the need for organizations to pay attention to employees' work experience, including factors such as work environment, task arrangement, leadership style, etc. (IOSR, 2013) By improving these factors, organizations can increase employee job satisfaction, reduce employee turnover, and provide employees with a more engaging work environment. Additionally, employees' job satisfaction is related to their willingness to seek alternative employment opportunities. When employees feel satisfied with their organization, they are more likely to view other job opportunities as less attractive than staying with their current organization. Therefore, organizations can reduce employee turnover by providing development opportunities, job satisfaction, and support that reduces employees' incentives to seek alternative employment. These findings are consistent with previous research:

Thakre and Shroff (2016) and Kalidass and Bahron (2015), research conducted also found a negative impact on the relationship between organizational commitment and turnover intention. To address this issue, the article states that organizations should strive to close this gap by focusing on increasing employee satisfaction and decreasing employee satisfaction (Wu and Chi 2020). It is further emphasized that satisfied employees tend to perceive other job opportunities as less attractive, resulting in less motivation to actively seek alternative employment. Mawardi (2022), the findings also show that there is a significant correlation between job satisfaction and job satisfaction (Ahakwa et al., 2021), An organization that emphasizes that engaged employees typically provide a safe work environment and are happy to demonstrate loyalty.

Discussion on the influencing factors of monetary compensation on turnover intention

The importance of monetary compensation in employees' intention to leave was also highlighted. Employees' pay levels and perceptions of pay fairness have a direct impact on their willingness to stay. Findings indicate that employees tend to be more likely to seek alternative employment opportunities when they are dissatisfied in terms of pay. To reduce employee turnover, organizations should review and adjust compensation structures to ensure employees receive fair and competitive compensation packages. Additionally, organizations can increase employee pay satisfaction by offering additional incentives such as bonuses, benefits, and promotion opportunities. These measures not only reduce employee turnover intentions but also enhance employee loyalty to the organization. These findings are consistent with previous research, making it clear people performing equal jobs should receive equal pay, study tackles gender bias pay. Christl et al. (2022); It means that companies pay high wages to reduce employee turnover, and ultimately concludes: companies with high wages are those with the lowest turnover rates.

Akerlof (1982), Says companies need to conduct a salary review because it allows companies to measure how their salaries compare to their competitors. Failure to do so may have adverse effects, as dissatisfaction with pay can lead to higher employee turnover. Kahneman et al. (1986), The study points out that the Fair Wage Model predicts that the most profitable industries will be those companies in industries that pay high wages. The model also predicts that teamwork and high-wage cooperation among workers are particularly important. The view is that if workers are willing to put in more effort, they will be paid more and believe their pay is fair. Shafiq and Naseem (2011), Signs of employee dissatisfaction and low motivation at work may come from a poorly planned compensation package by the organization.

## Recommendations

Recommendations for applying research results.

Here are some recommendations based on the findings of this article that can help companies better manage technical employee turnover:

1. Improve the salary system: According to research results, salary satisfaction has an important impact on the turnover intention of technical employees. Therefore, companies can consider reviewing and improving their compensation system to ensure that it is both competitive and fair. Transparent compensation policies and benefits packages can increase employee satisfaction.

2. Provide career development opportunities: Cultivating employees' career development is the key to retaining technical employees. Businesses can develop programs to provide training and advancement opportunities to meet employees' career goals. This can include in-house training, mentorship programs and cross-department opportunities.

3. Improve the working environment: An excellent working environment is crucial to employee satisfaction and willingness to leave. Companies should pay attention to employees' workload, work stress and work-life balance. Providing flexible work arrangements, measures to reduce workplace stress and employee wellness support can all improve the work environment.

4. Strengthen leadership and communication: Effective leadership and good communication have a positive impact on employee satisfaction. Training and developing leadership teams to improve teamwork and employee management skills helps increase employee satisfaction.

5. Pay attention to technology industry trends: The technology industry is constantly changing, and employees may leave in search of more advanced technology opportunities. Enterprises should pay close


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attention to technological trends to remain competitive and provide corresponding skills training according to market demand.

6. Knowledge management: Establish a knowledge management system to capture and inherit the professional knowledge and experience of departing employees. This can include documented workflows; knowledge bases and training programs so new employees can take over smoothly.

7. Employee engagement: Improving employee engagement helps increase employee loyalty. Companies can encourage employees to participate in company decisions and projects to enhance employees' sense of belonging and satisfaction.

8. Social responsibility plan: Implementing a social responsibility plan, caring for employees' physical and mental health, and supporting employees' social participation can improve employee satisfaction and loyalty.

These recommendations can help companies better cope with technical employee turnover and create a more stable and competitive work environment. Businesses can adopt these recommendations based on their own circumstances and regularly evaluate the effectiveness of their HR strategies.

Here are some recommendations based on the findings of this article to ensure technology workers make smart career choices and have a smooth transition:

1. Line decision: Before leaving your job, think carefully about your decision. Make sure you have good reasons for leaving and not just temporary dissatisfaction or emotional reasons.

2. Establish close contact: Maintain positive relationships with colleagues, leaders and partners. These individuals may provide support and opportunities for future career development.

3. Summarize work results: Organize and save key achievements and projects in your current role for future job applications and interviews.

4. Continuous learning: Continue to develop your skills and knowledge to enhance your career through training, online courses, or certifications.

5. Adjust career goals: It may be necessary to re-evaluate your career goals and aspirations to ensure they are consistent with your personal and professional development.

6. Maintain active communication: Maintain positive contact with previous employers and colleagues, and there may be opportunities for collaboration and referrals.

Leaving a job is a part of your career, so stay confident and fully prepared to face new challenges and opportunities. Be calm and cautious when making decisions to ensure your next step is wise and beneficial to your career.

**Suggestions for Future Research**

The following are some research suggestions for next research questions and findings, which can help future research explore the issue of technical employee turnover in more depth:

1. Cross-cultural comparison: Expand the scope of research, conduct cross-cultural comparison, and explore the turnover intention and satisfaction of technical employees under different cultural backgrounds, so that companies can better respond to the challenges of multicultural teams.

2. Research on the impact of long-term turnover: In-depth research on the potential impact of long-term employee turnover on enterprises, including knowledge loss, reduced innovation capabilities and changes in market competitiveness, in order to provide enterprises with more comprehensive strategic planning suggestions.

3. Trend analysis in the technology industry: Track trends in the technology industry, including changes in technology development, market demand and competitive landscape, to help companies better predict employees' intention to leave and adjust human resource strategies.

4. Knowledge management and employee inheritance: Study how to better manage and inherit employees' knowledge and experience, especially after technical employees leave, to reduce the impact of knowledge loss on the enterprise.

These research recommendations can help further deepen the understanding of the technical employee turnover problem and provide enterprises with more effective human resource management strategies. Future research can fill gaps in knowledge by implementing these recommendations to help organizations better address employee turnover challenges.

## Conclusion

In short, the problem of technical employee turnover is a complex issue affected by multiple factors, which requires companies to take comprehensive countermeasures to reduce employee turnover rates. In this highly competitive technology field, retaining high-quality technical employees is critical to a company's long-term competitiveness. By maintaining employee satisfaction, providing career development opportunities, balancing compensation and benefits, and focusing on social responsibilities, companies can better deal with employee turnover and achieve stable and sustainable development. However, it's important to note that employee turnover is the norm, not the exception. Therefore, companies should view employee mobility as a long-term management challenge and continuously improve and adjust strategies to adapt to the changing needs of the market and employees. Future research and practice should continue to explore new methods and strategies to help companies better manage employee turnover and achieve successful human resource management.

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# Exploring Work Engagement among Chinese Student Affairs Educators: A Literature Review on Supply Chain and Sustainability Management

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## Abstract

Employee burnout and work engagement issues are a key focus in the field of human resource management. Through the literature analysis of the job characteristics of student affairs educators (SAE), SAE groups are prone to burnout and low work commitment. Through the combing of JD-R theory, it is found that JD-R theory still has some research space in improving the job input of SAE groups, solving work-family conflicts, and improving SAE health problems.

**Keywords:** Student Affairs, Work Engagement, Burnout, JD-R Model

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## Introduction

Employee burnout and engagement issues are a key focus in the field of human resource management. In most national universities, professional student affairs administrators are often seen as an important part of higher education personnel (Winston et al, 2013). Student affairs educator in Chinese colleges and universities with the function of student affairs are "an important part of the university teaching team and school education management team" in China (Ministry of Education of the People's Republic of China, 2017). Studying burnout and work engagement studied burnout and worked engagement in this group can inform research on work engagement in similar groups.

**The concept of Chinese and Western staff engaged in student affairs**

1) The title of Chinese and Western staff engaged in student affairs

The Western terms for student affairs administrators include Student Affairs Administrator, Student Affairs Professional, Student Affairs Staff, and Student Service Professional, These terms are interchangeable for student affairs practitioners, who provide services and support to students at colleges and universities (Miller & Winstonl, 1991). In past research literature, student personnel workers, student service experts, and student affairs educators have also been used in the West are the terms for Student Affairs Workers. However, the vast majority of academic papers use the concept of Student Affairs Administrator as the keyword (Li, 2013).

The main body engaged in student affairs work in China is "full-time Student Affairs Administrator", combined with the requirements of the Ministry of Education of China: handling student affairs requires "whole-process" and "all-round" educating students (Yang, 2018), that is, student affairs staff are required to pay attention to the ideological and moral guidance of students in the process of handling each student affairs. Moreover, the actual nature of the work of China's "full-time Student Affairs Administrator" is to carry out ideological education as the primary task. This is in line with Western student affairs educators' focus on "out-of-classroom student education, hands-on student education" is relatively close (Clevenger, 2015; Reece & Rish, 2020), so it is appropriate to use "Student Affairs Educator" (SAE) as a "bridge" to connect such groups with similar work in China and the West. The following SAE is also generalized to include the concepts of Student Affairs Administrator, Student Affairs Professional, and so on.

2) The specific work of student affairs staff

In the West, the construction of the student affairs team of American colleges and universities is at the forefront of the world, and the professionalization and professionalization of the student affairs team of American colleges and universities have a wide impact on the world's higher education student affairs and have become a model for Canada, Australia, the United Kingdom, New Zealand, and many other countries to follow (Li, 2013).

SAE is an important part of human resource management in China's higher education, and its number and importance are increasing. China's Ministry of Education requires that the number of SAEs in each university must reach "a ratio of SAEs to students of more than 1:200" (Ministry of Education of the People's Republic of China, 2017). In recent years, the scale of enrollment in Chinese universities has shown a straight-line increase, according to the data released by the official channels of the Ministry of Education of China, "the general undergraduate enrollment in 2022 will be 4,679,400, an increase of 233,400 over the previous year", and as of March 2022, the SAE of Chinese universities reached 240,800, an increase of 52,000 over 2019 (Ministry of Education of the People's Republic of China, 2023). The SAE group is very large and annual growth.

China and the West have a lot in common in SAE group building: for example, the two countries have always attached importance to this group building, and the United States has major management departments and associations for this type of group, the American College Personnel Association (ACPA) and the National Association of Student Personnel Administrators, or NASPA, have identified ten basic competencies for student affairs practitioners, and experts from related associations have compiled a series of professional code books, such as The professional student affairs administrator clearly defining the nature of work and professional development direction of student affairs staff in the United States (Winston et al,, 2013); China also has a special management department, which has formulated professional competency standards and professional development directions (Li, 2015). At the same time, there are such groups in the two countries with a large workload, many roles, heavy responsibilities, and high commonality of competence.

However, due to differences in national conditions and systems, Chinese and Western universities have certain differences in terms of the specific content, focus and entry threshold of student work. In order to facilitate comparison, the author combed through the relevant literature of China and the United States and sorted out the main differences as shown in Table 1 and Table 2:

**Table 1** Comparison of student affairs workers in the United States and China

| | **United States** | **China** |
|---|---|---|
| Communication trigger points | Most students find SAE according to their business needs | Most of them are SAEs who take the initiative to find students for educational guidance |
| Primary transactions | Most of them are pure affairs, but also include the construction of moral education | Thought guidance is the first responsibility, and daily work is transactional content that occupies most of the time |
| Transaction characteristics | Specificity of tasks | Multiple tasks |
| Form of work | Dedicated educational design | All affairs run through ideological and moral guidance, and ideological guidance is rejected by one vote |
| Entry threshold | Student Service Professional generally requires at least a master's degree in student affairs, counseling, or higher education administration | A master's degree is generally required, and a major is generally not required, but a member of the Communist Party of China is required |

**Table 2** Comparison of student affairs objectives in China and the United States (Huang & Wu., 2015)

| United States | China |
|---|---|
| High-quality/complete learning experience | Improve the overall quality of students |
| Equal access to higher education | Cultivate well-rounded innovative talents |
| Students make greater progress, higher graduation rates | Establish working mechanisms and institutional norms for managing students |
| Enhance career education and lifelong learning | Create a good nurturing environment |
| Develop responsible and dedicated citizens | Maintain the stability of colleges and universities and social stability |

**The problem of burnout in SAE**

SAE work is different from general transactional labor work, it does not directly act on labor products but acts on the most active and active "people" in social productivity, and it is easy to produce problems such as large workload, complicated work, excessive emotional investment and role conflicts in the work, and eventually lead to burnout. As the opposite of burnout, work engagement will also decrease (Bakker & Leiter, 2010). This has been studied in both Chinese and Western academic circles.

1) Western student affairs administrators are prone to burnout

Teaching in colleges and universities is a complex and demanding task that teachers need to be fully involved in every day (Fried, 2001; Elliott & Crosswell, 2001; Day, 2004), teachers will face burnout in increasingly stressful work environments (Nias, 1996). As a member of the university faculty, Western college student affairs administrators also experience varying degrees of burnout. Western researchers have been studying burnout among student affairs professionals since 1982 (Forney et al, 1982). The study of Holmes also showed that the turnover rate of master's degree students in student affairs within 6 years of graduation is 60%, and the main reasons for leaving are low wages, higher burnout, and lower work status (Holmes, 1983). Howard-Hamilton et al. demonstrated that female student affairs professionals exhibit higher levels of emotional exhaustion (Howard-Hamilton et al.,1998). Research by Brewer and Clippard showed that there was an inverse correlation between student support staff fatigue and overall job satisfaction (Brewer & Clippard, 2002). A survey by Tull found that 50-60% of student affairs professionals leave within five years of their first five years of employment (Tull, 2006). Lombardi studied mid-level student affairs professionals and found that negative job satisfaction leads to burnout (Lombardi, 2012). Stoves research showed that the higher the emotional connection with students, the more likely it is to develop compassion fatigue among student support service staff (Stoves, 2014). Marshall et al. (2016) study proves that burnout is the reason for student affairs professionals to leave. According to Marshall et al., the field of student affairs management tends to place extremely high and unrealistic demands on the time and energy of its members and generate burnout. A 2022

Gallup workforce study of 12,319 full-time U.S. employees found that 35% of college student affairs staff always or often feel burned out (Marken & Agrawal, 2022).

**Table 3** A table of the work transactions of a common SAE on a given day

| TIME | ITEM |
|---|---|
| AM 7:10-7:45 AM | From home to work |
| AT 8:00-8:20 | Go to the classroom and check on the students' arrival |
| AM 8:30-8:45 AM | Back in the office to start dealing with daily affairs, approving student leave appli cations |
| AM 8:50-10:00 AM | Write work report materials |
| AT 10:00-11:00 | Talk to students with psychological problems |
| AT 11:00-11:20 | Have some communication and feedback with the parents |
| AT 11:20-11:45 | Write work report materials |
| AM 11:45-PM00:10 | Have lunch |
| PM 00:30-1:20 | Use the time after lunch to organize a class meetings for class 1 |
| PM 1:20-1:50 | Prepare lesson |
| PM 2:00-3:40 | Take career guidance classes to student |
| PM 4:00-5:00 | Hold a class meeting for Class 2 |
| PM 5:30-5:50 | Have dinner |
| PM 6:00-7 ： 00 | Use the time after dinner to organize a group building activity for class 3 |
| PM 8:00-9:40 | Come to the student dormitory and talk with the students |
| PM 9:50 | Go home |

**(Source:** Internet College of Anhui University)

**Relevant models for promoting work inputs**

The J-DR model is an important model of management, which can be applied to explore the problems of employee burnout and work engagement in the field of human resources. According to previous studies, SAE is prone to burnout. So how can you reduce burnout and increase their engagement?

According to Work Engagement: A Handbook of Essential Theory and Research edited by Bakker et al. in 2010, the current academic community directly revolves around burnout and work engagement with more representative theoretical models.There are Job characteristics model (JCM), Conservation of resources model (COR), Job demands-control model (JD-C), and Effort-reward imbalance model. ERI), Job demand-resource model (JD-R), etc.

1) The main theories on work input

The Job characteristics model (JCM) believes that work autonomy, work integrity, work importance, work feedback and skill diversity are the five core characteristics of work, which can produce three key psychological states to promote employees to show intrinsic self-motivation, good work performance, high work recognition, low absenteeism rate and turnover rate and other work output performance (Hackman & Oldhan, 1976) (Figure 1). In contrast to the JD-R model, the JCM model only emphasizes the importance of work resources, but does not make specific assumptions about job demand (Bakker & Leiter, 2010).

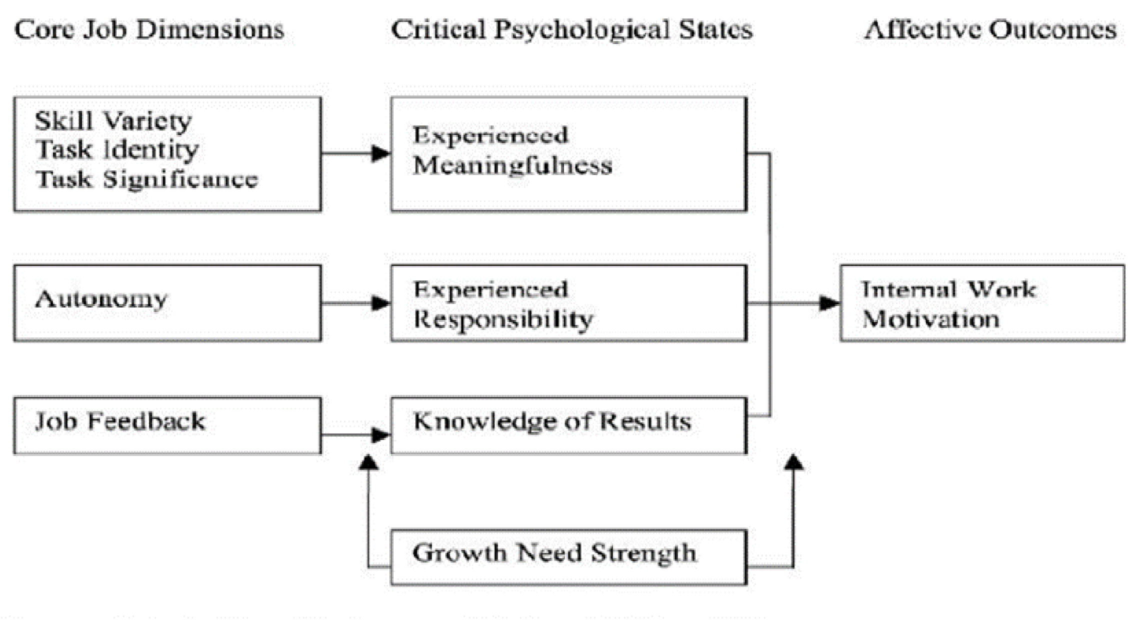


**Figure 1** Job characteristics model

The Conservation of resources model (COR) believes that various resources are important factors in obtaining new resources and improving welfare. Individuals invest resources in order to respond to threatening situations and protect themselves from negative influences; Individuals strive to protect the resources they have acquired, and strive to accumulate them, resulting in positive outcomes (Hobfoll et al, 2003) (Figure 2). The assumptions about work resources in the JD-R model are consistent with the two main assumptions of the COR model, which is the specific application of COR theory in organizational contexts.

Job demands-control model (JD-C) believes that job pressure is the result of the joint influence of job demand and job control, when the job requirements are higher, and the degree of influence of employees on their job behavior is low, greater job pressure will be perceived, the advantage of the model is that it clarifies the impact of the structure of task configuration on employee health (Karasek, 1979) (Figure 3). It is a heuristic model that includes two specific sets of working conditions, job demands and job resources, in its prediction of employee well-being, regardless of occupational group (Demerouti et al., 2001).

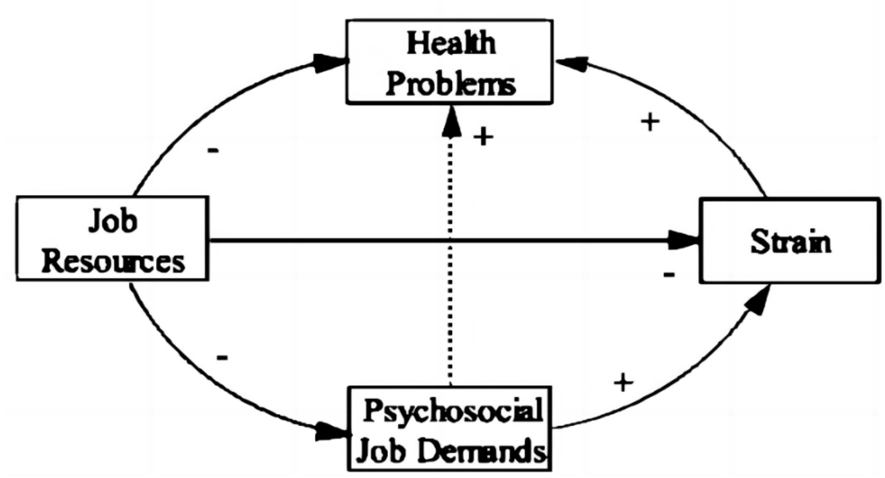


**Figure 2** Conservation of resources model

Job demands-control model (JD-C) believes that job pressure is the result of the joint influence of job demand and job control, when the job requirements are higher, and the degree of influence of employees on their job behavior is low, greater job pressure will be perceived, the advantage of the model is that it clarifies the impact of the structure of task configuration on employee health (Karasek, 1979) (Figure 3). It is a heuristic model that includes two specific sets of working conditions, job demands and job resources, in its prediction of employee well-being, regardless of occupational group (Demerouti et al., 2001).

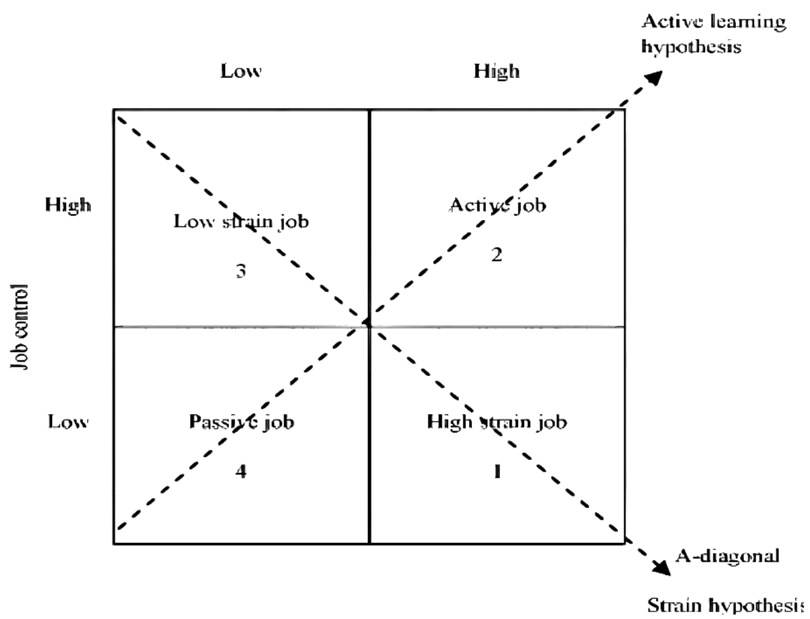


**Figure 3** Demands-control model

The Effort-reward imbalance model (ERI) argues that individual self-regulation function mainly depends on social exchange through social roles, and the positive effects of social roles on emotional and motivational self-regulation are conditional on social exchange. Individuals devote time and effort to job, etc., and receive money, respect, and status from the organization as compensation based on a social exchange contract. If the organization does not give the individual a corresponding return, it can cause individual-related nervous responses, which can lead to emotional distress and stressful experiences (Siegrist, 1996) (Figure 4). Compared with the ERI model, the JD-R model not only covers job requirements and job control and social support, but also includes other aspects, such as performance feedback, career development opportunities, etc., which is more comprehensive than the ERI model (Bakker & Demerouti, 2007).

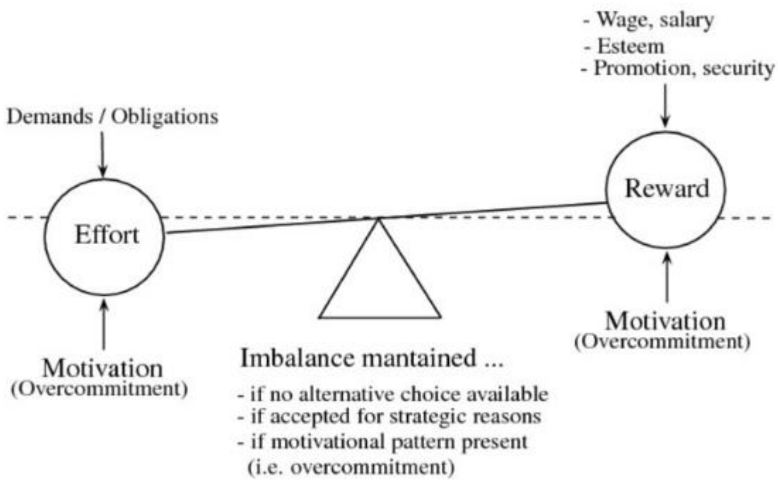


**Figure 4** Effort-reward imbalance model

Compared with the above four theories, it is generally believed that JD-R theory integrates various views of job pressure and motivation in previous theories, integrates many different requirements and resources, and makes the model more flexible because it can be targeted at the job requirements and job resources of a particular occupation (Bakker et al, 2023; Bakker & Demerouti, 2017; Van Veldhoven, et al., 2020). Moreover, JD-R theory has the best match with SAE's working environment and job characteristics, and JD-R theory can be selected to analyze issues such as burnout and job engagement in SAE.

2) The core content of the JD-R model

Job characteristics and influencing factors

JD-R theory states that certain physiological, social, or psychological aspects of the work and organizational environment may directly or indirectly affect employees' physical health, job behavior, and job performance (Demerouti et l., 2001), and any job characteristics can be classified as job requirements and job resources, but according to different research backgrounds and objects. The specific content of job requirements and job resources will vary (Bakker et al., 2023), as detailed in Table 4.

Job requirements are the "negative factors" that consume individual energy at job, requiring individuals to pay continuous physical or psychological efforts, so there is a certain physiological and psychological consumption, such as the amount of job tasks, role conflicts, time pressure, psychoemotional requirements, interpersonal relationship requirements, job insecurity, etc., although the job requirements are not necessarily negative for the individual, but if the job requirements are difficult to achieve, it will produce job pressure, which in turn affects the level of job engagement (Bakker et al., 2023).

Job resources are "positive factors" in job, factors related to physical, psychological, social or organizational aspects at job and have one or more of the following functions (Lesener et al., 2020): (1) promote the achievement of job goals; (2) reduce job requirements and the psychological and physical costs associated with them; (3) Promote individual growth, learning in development, and so on. Such as support from the organization, leadership support (Mazzetti et al., 2023) (e.g., affirmation of job), support from colleagues (e.g., helping to achieve work goals, et al) (Christian et al., 2011; Halbesleben, 2010). These resources help employees achieve their work goals and reduce the physical and psychological costs of their job.

**Table 4** List of characteristic factors of JD-R model operation

| Questionnaire name | Influencing factors | researcher |
|---|---|---|
| Word engagement questionnaire | physical, cognitive, emotional, mental | Kahn (1990) |
| Gallup Q12 | involvement, enthusiasm | Harter et al. (2002) |
| The Utrecht Work Engagement Scale | Vigor, dedication, absorption | Schaufeli et al. (2002) |
| MAY Scale | cognitive, emotional, physical engagement | May et al. (2004) |
| JES Scale | Physical Engagement, Emotional Engagement, Cognitive Engagement | Rich et al. (2010) |

Individual characteristics and influencing factors

The factors that affect job engagement at the individual level include the study of individual characteristic factors, such as optimism and self-efficacy (Halbesleben, 2010; Mazzetti et al, 2023), responsibility (Christian et al, 2011), emotional intelligence (Akhtar et al, 2015), Young also includes the study of demographic variables such as gender, age, education, job position, position, length of service, etc (Young et al, 2018).

Three core assumptions

First, the two-process hypothesis states that there are two paths of loss and gain of job on employees (Alarcon, 2011; Christian et al., 2011; Halbesleben, 2010; Nahrgang et al, 2011). In the attrition path, the type, number or intensity of job demands lead to increased stress and burnout, deplete employees' physical health, emotions, and may lead to conditions such as sick leave, exhaustion, low job performance (Demerouti et al, 2001; Li et al., 2023) .In the gain path, job resources (e.g., skill diversity, social support, feedback) meet basic psychological needs and increase employee engagement, resulting in high organizational commitment, high retention intention, high job performance, etc (Bakker & Xanthopoulou, 2013). (See Figure 5 for details).

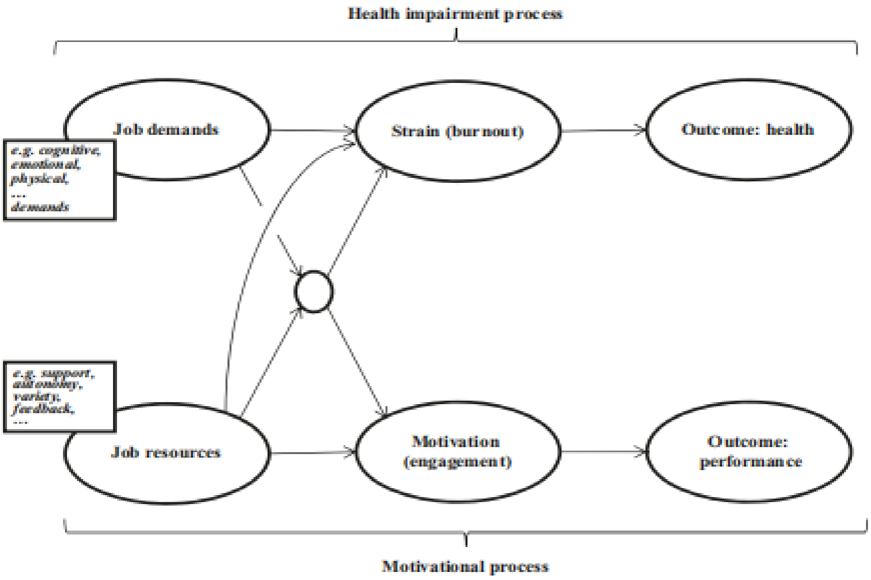


**Figure 5** Dual-process model diagram of job requirements and resources

Second, the Buffer hypothesis: that is, job resources can buffer the wear and tear of high job requirements on employees, that is, job resources can mitigate the negative impact of job requirements on employees (Lavoie-Tremblay et al., 2014; De Jonge & Huter, 2021). Job resources play a moderating role in the impact of job requirements on employee burnout: the negative impact of job requirements on employee burnout is weakened under high job resources; The negative impact of job requirements on employee burnout is enhanced with low job resources (Bakker et al., 2005).

Third, the Boost hypothesis: that employees are better able to translate high job resources into high levels of job performance in challenging environments (high job requirements). Under high job requirements, employees will be more fully engaged in job, call on existing job resources to complete job goals, and obtain more new resources. For example, being forced to complete a project in a very limited amount of time boosts employee performance. That is to say, under high job requirements, employees will make full use of job resources to better engage in job and achieve job goals (Bakker et al., 2007; TadiĆ, M. et al., 2015; Breevaart & Bakker, 2018; Hobfoll et al., 2018).

3) Job requirements for JD-R model

According to the basic assumptions of JD-R theory, many scholars have constructed a job requirement-resource model according to the specific job situation, and explained and verified the mechanism of job input through the model, such as the model constructed by Bakker in 2008 (Bakker & Demerouti, 2008) (Figure 6), after continuous exploration, Bakker et al. proposed a more complete JD-R model in 2017 on the basis of integrating the research of other students (Bakker & Demerouti, 2017) (Figure 7).

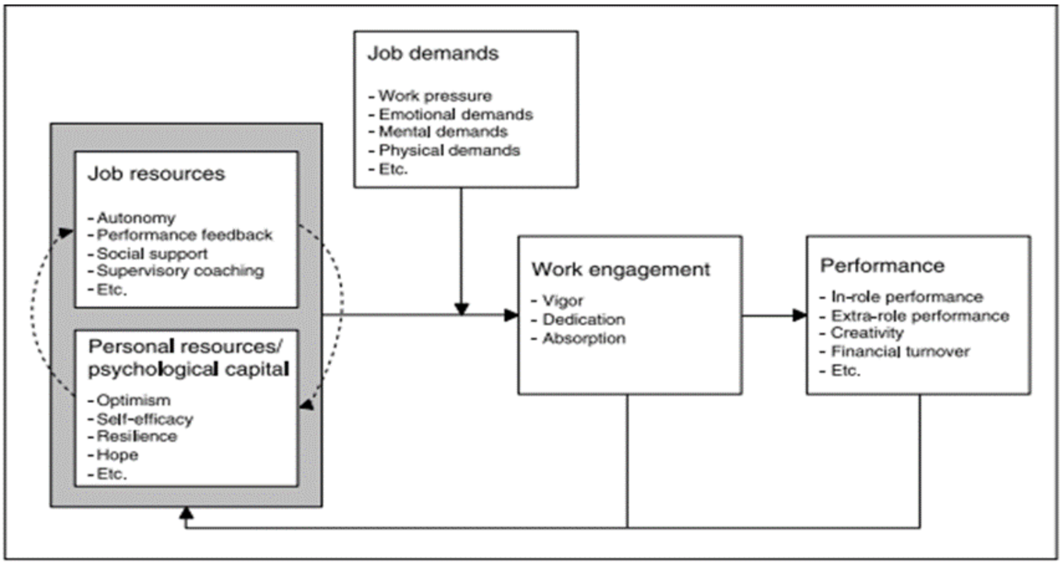


**Figure 6** JD-R model

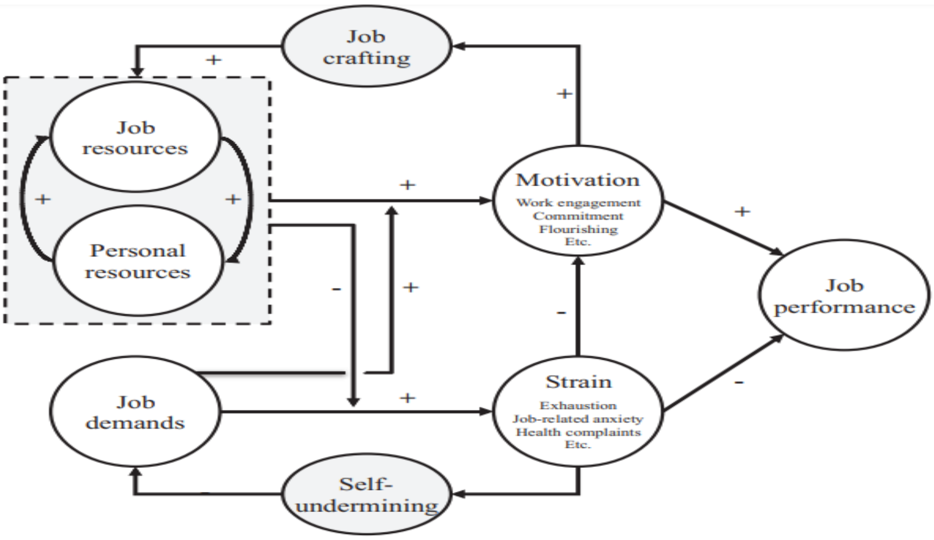


**Figure 7** Improved JD-R model

The JD-R model is a highly integrated theoretical model that can be applied to the study of the relationship between job requirements, job resources, personal resources and job engagemen t(Bakker et al., 2023). In specific research, researchers can construct complete or incomplete models of job requirements-resources according to different research situations and objectives. The JD-R model is applicable to all job situations as well as specific occupations, and each occupational group will have different job characteristics depending on the job environment, such as nurses and police officers paying special attention to emotional and physical needs, but programmers and scientists paying more attention to cognitive needs (Bakker et al., 2023). The SAE job has certain particularities, and the JD-R model can introduce the research of SAE job input problems.

4. The research prospect of SAE job input based on JD-R model

The above highlights the concept of SAE in China and the West, burnout and job engagement in this group, and theories that can be used to increase job engagement, especially JD-R theory. According to the Google Scholar search engine, there are only 27 valuable literature searched after the combination of student affairs and JD-R, and most of the research analysis of the causes of SAE job engagement is mainly carried out in the way of empirical induction or theoretical speculation, lacking a systematic and integrated SAE burnout and individual characteristic factors of job input. The empirical study of job characteristic factors lacks research on the mechanism of each influencing factor, and lacks the construction of SAE job engagement structure model. There is some room for research in this field, and we look forward to making breakthroughs in the following aspects in future research:

1) Use JD-R theory to study the job engagement of SAE groups

It can be seen from the above that the West's exploration of job input is relatively deep, China's research on job input lags behind the West in both theory and empirical evidence, and has not yet formed a complete system, and the main research objects are mainly aimed at enterprise employees, and there are fewer studies on the job engagement of SAE groups in Chinese universities. Future research can combine the educational scenarios of different countries and use JD-R theory to study the characteristics of SAE work, the characteristics of roles and the characteristics of the working environment.

At the same time, university SAEs are particularly prone to burnout because of their unique work needs, such as long working hours, large workloads, role conflicts, changeable job environments, and the need for a high degree of empathy (Lynner, 2023; Bakker & Schaufeli, 2000). However, the observable behavior of employees who have experienced burnout is often difficult to explain (Bakker et al., 2014), and as a result, many opportunities are missed where interventions can be applied to mitigate SAE burnout. Therefore, it is necessary to apply JD-R theory more widely to the study of SAE community job engagement.

2) Add fairness sensitivity factors to JD-R theory

Due to the unequal distribution of job resources and job requirements in the process of job development, it is a real and natural problem, such as in the same unit, due to the inconsistency of special job, the tasks assigned by the leader to employees are prone to inequality, and the distribution of job resources is also prone to inconsistencies. In the JD-R model, the interaction between fairness sensitivity and job resources and job requirements of research subjects is less studied, and the concept of fairness sensitivity is introduced, which has important theoretical value. In future research, variables such as SAE fairness sensitivity can be introduced to the job requirements and the mechanism of job resources on job input in the JD-R model to verify the multiple interactions between fairness sensitivity and job resources, job requirements and job inputs.

3) Improve the relationship between job and family in SAE with the help of JD-R theory

In actual job, SAE is prone to work-family conflicts due to its large workload and complicated job affairs. Ten Brummelhuis combines spillover theories with JD-R theory to propose that family needs and resources may affect job outcomes through individual resources at the same time (Ten Brummelhuis & Bakker, 2012). Aw investigated the work-to-home spillover effect, where employees feel a sense of personal fulfillment when they offer help and assistance to their colleagues, but also feel more fatigued, and exhaustion can lead to withdrawn behavior at home and reduce family performance (Aw et al., 2021). Du et al. found that when employees have a rich family life, that is, after full interaction with their children, there is a positive correlation between job requirements and task performance (Du et al., 2020). Demerouti (2023) suggests that the needs of individuals, families, jobs, and organizations may enhance the impact of various resources on work engagement (Demerouti & Bakker, 2023). Meanwhile, during the COVID-19 pandemic, SAE is working from home, blurring the lines between home and the world of work. Landolfi found that job life began to interfere with family life, but household resources were also used to buffer the impact of job demands (Landolfi et al., 2021). According to the nature of SAE job, it is necessary to further explore SAE work-family conflict in combination with JD-R theory to improve their work engagement.

4) Improve SAE health with the help of JD-R theory

Burnout often leads to negative health-related outcomes (Demerouti et al, 2001), which is amply demonstrated in SAE, which may manifest as sleep disturbances, headaches, respiratory infections, gastrointestinal infections, musculoskeletal disorders, myocardial infarction, and cardiovascular disease in terms of physical health (Ahola, 2007; Armon et al., 2010; Kim et al., 2011). One of the reasons JD-R theory is respected by many scholars is that it helps guide interventions (Bakker et al., 2023). For example, JD-R theory suggests that if the organizational climate promotes attention to employee mental health, employees can actively report to leaders when they experience stress at work, and leaders can regularly implement structural interventions to protect employees' mental health, thereby increasing work engagement and performance (Dollard, 2010). This kind of research inspires us to explore measures to improve the health of SAEs in conjunction with JD-R theory.

## Conclusion

In this paper, we review the concept, job characteristics, burnout, work engagement, and application of JD-R theory in SAE groups, which is a review and reflection on the literature on improving SAE work engagement in the field of human resource management, and hope that through review and thinking, it can have a positive role in promoting scholars' research on SAE work engagement in the future.

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# Enhance supply chain dynamics education: Evaluate insights from beer game simulations.

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## Abstract

With the rapidly changing global trade environment, consumer preferences and sustainability issues are becoming increasingly prominent, and supply chain management issues are becoming increasingly important. The purpose of this paper is to explore a newly designed game simulation teaching software, Beer Game, which introduces its development and theory. The software will provide consumers' true experience, by utilizing this application learners will simulate playing different roles to take the challenges of competing in the marketplace in the modern supply chains.

Therefore, the experience of the beer game immerses learners with great significance in understanding the concept of supply chain management during the competition. Through a practical experience, the game starts with running in the marketplace, to experience the results of the business performance. Students had positive responses with highly engaged attitudes towards the Beer Game system. Instructors facilitate the operations with satisfactory results.

**Keywords:** Supply Chain Management, Game Teaching, Beer Games, Bullwhip Effect

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## Introduction

Supply chain management involves various important activities in the modern industrial and global commercial world. From the supply of raw materials upstream side to the middle stream side of production, manufacturing, and the downstream of distribution, to sales, etc., those will affect all parties of stakeholders. And in an increasingly globalized and connected world, supply chain management has become more complex. As companies are constantly striving to optimize the management of their supply chains, it is important to understand the performance of supply chain management and the basic principles and dynamics that affect its operations (Otto & Kotzab, 2003).

Because supply chain management is so complex, it is more than difficult to teach because the various factors occur all at once and affect each other simultaneously. When facing a changing dynamic world, it is not easy to see it through pure observation, so with the help of computer simulation systems, managers can quickly grasp the subtle information and take appropriate and quick action from the competition, when there is a stimulus there will be a response. Similarly, it would be of great help for students to be aware of their learning if they could quickly experience the subtle changes in the result of the decision simulation system. Simulation allows students to quickly understand the changes through market competition, due to a game-based theory, students will feel the actual real world.

Computer-based teaching methodology has been evolved for a long time (Kulik & Kulik, 1986). It is a learner-based theory, and the simulation takes care of learners' psychology, theoretically and practically. While applying the supply chain management theory, many scholars have tried to develop more appropriate teaching methods through game-based simulation. The Beer Game is one of the most well-known examples among all in supply chain management.

Beer games are a powerful tool that can provide valuable pedagogical insights into the dynamics of the supply chain, Beer Game simulation software was developed by MIT in the late 50s in the 20th century. It started as a demonstration of the complexities of supply chain management, where it has been tested over a long period and become relevant to today's supply chain challenges.

The main purpose of the current beer game is to demonstrate the importance of collaboration, communication, and information sharing among the discussion in the classroom while students role-played as supply chain partners. The game demonstrates the challenges of managing inventory, demand fluctuations, and the bullwhip effect while simulating the need for a beer distribution system with participants taking on the roles of retailers, wholesalers, distributors, and breweries.

The core experience of the beer game applies great significance in the supply chain management system. As supply chain issues were the key issue for organizations that grapple with global disruptions, rapidly changing consumer preferences, and the growing importance of sustainability, the principles derived from the beer game provide valuable guidance for navigating these challenges.

This article will explore the history and theory of the beer game. It begins with a summary of the history and goals of the beer game, followed by a discussion of its main lessons. Later explain their application to contemporary supply chain challenges and real-world examples of successful implementation.

## Literature Review

### Supply chain management

A supply chain is a network between a company and its suppliers that is used to produce a specific product and distribute it to the final buyer. Supply chain networks include different activities, people, entities, information, and resources. The supply chain also represents the steps taken to deliver a product or service from its original condition to the customer. Supply chains are developed by companies so they can reduce costs and remain competitive in a business environment. It's important to know how to manage your supply chain in the right way.

Supply chain management is the management of the flow of goods and services, including all the processes that transform raw materials into final products. It involves actively streamlining the supply-side activities of a business to maximize customer value and gain a competitive advantage in the market. Supply chain management represents the efforts made by suppliers to develop and implement a supply chain that is as efficient and economical as possible. The supply chain encompasses everything from production to product development to the information systems needed to guide these undertakings (Kouvelis et al., 2006).

Supply chain management attempts to centralize or connect the production, transportation, and distribution of products. By managing the supply chain, companies can cut excess costs and deliver products to consumers faster. This is achieved through tighter control over internal inventory, internal production, distribution, sales, and inventory of the company's suppliers. It is based on the idea that almost every product that enters the market is the result of a joint effort by the various organizations that make up the supply chain. Although supply chains have been around for a long time, most companies have only recently started to look at them as a value-added to their operations (Fawcett, et al.,2008).

### Bullwhip effect

The bullwhip effect is an important phenomenon of coordination problems in traditional supply chains. (Wang & Disney, 2016). It refers to the role that cycling order volumes play as the supply chain moves upstream to production. Even when demand is stable, small changes in demand at the retail side may amplify dramatically upstream at the end of the supply chain. The effect is that the number of orders becomes very volatile. One week it is very high, then the next week becomes zero. The terminology was first coined around 1990 when Procter & Gamble found that order patterns in its baby diaper supply chain were erratic and amplified. Therefore, the bullwhip effect is an amplification of changes in demand. It moves the chain upstream through supply, resulting in inefficiencies, stockouts, or overstocking.

As a result of the bullwhip effect, a series of inefficiencies have emerged throughout the supply chain, as follows: (Kumar et al., 2007)

a. High (safety) stock levels
b. Poor customer service levels
c. Low-capacity utilization

d. The problem of demand forecasting is even more acute

e. High costs and low levels of intercompany trust

While this impact is not new, it remains a timely and pressing issue in contemporary supply chains. In general, the bullwhip effect occurs due to: (Kumar et al., 2007)

I. Order batch: This occurs when each member in the chain orders more than it needs, distorting the quantity of the original demand.

II. Price fluctuations: Special discounts and cost changes can cause buyers to take advantage, leading to irregular production and distorted demand.

III. Misuse of demand information: Past demand information is used for new estimates without taking into account fluctuations.

IV. Lack of communication: This can lead to limitations when processes don't work effectively, which often happens when organizations identify product needs in different ways at different points in the supply chain.

V. Free Return Policy: Customers may inflate demand due to shortages, and if customers are unable to return their products, retailers will continue to inflate their needs, cancel orders, and result in a surplus of products or materials.

**Game teaching**

Game Simulation through play, also known as gamification, is the use of gamification to learn to play theory. It is currently a popular teaching methodology and a powerful educational tool. Gamification of Learning is the holistic way of integrating all the learning elements into activity scenarios so that the classroom can truly experience real-world cases. but increases game mechanisms to trigger students' motivation to learn the simulation, so that students can enjoy the process of learning it, and then obtain the internal autonomy motivation.

It is human nature to play with teammates with games and to transform the love of games into motivation, learners' efforts can be multiplied with less effort. This is at the heart of gamers' chemistry.

At present, there are two tendencies in this viewpoint: The first view cites the theory of assessing secondary school learners through the use of educational game software or e-textbooks, to connect the content with players or online competitions, which will guide students while learning, while avoiding the rigidity and boredom of the traditional one-way teaching. Another view is that games are inherently. Therefore, by studying the characteristics of the game and using these characteristics to transform the mechanics of learning the game, the learning becomes a fun and interesting interaction in itself - rather than expressing the content through the game. This view is mainly found in European and American countries, especially New Zealand.

At present, the research on game chemistry has achieved initial results in Europe and the United States. Many schools incorporate game-playing elements into their teaching, especially activities that require physical exertion. For example: in the Game of Softball while asking students mathematical questions, so that students can come up with answers while playing and learning the experience and observation at the scene of catching the ball, which shows a more desirable result.

**Beer Game**

The beer game was invented in 1960 by Jay Wright Forrester of the MIT Sloan School of Management. The Beer Game is based on the research theory of system dynamics (Riemer, 2008; Kimbrough et al., 2002). Beer Game is a game simulation system developed by the Massachusetts Institute of Technology in the late 50s of the 20th centuries. It's a powerful tool that can provide valuable insights into the dynamics of supply chain management. Originally intended to illustrate the complexities of managing supply chains. As time evolves the Beer Game has been proven over time and is now functional enough to provide relevant experience and teaching applicable to today's supply chain challenges.

The beer dispensing game is an educational game that allows gamers to experience the typical coordination problems of supply chain management processes. It mirrors a role-playing simulation in which many participants play with each other. The game itself represents a supply chain with uncoordinated processes that are problematic due to a lack of information sharing (Kumar et al., 2007). The game outlines the importance of teams for information sharing, exchanging ideas and concepts of management, and collaboration throughout the whole supply chain process. Due to a lack of information, suppliers, manufacturers, salespeople, and customers are often blind-sided in predicting and understanding what the real demand is.

The most interesting part of the game is that each group has no control over the other part of the supply chain. As a result, each group only has limited control over its part of the supply chain. Therefore, the group can dramatically impact the entire supply chain by ordering too much or too little, leading to a bullwhip effect. Meanwhile, the orders of one group are also highly dependent and interlinked with the decisions of other groups (Riemer, 2008).

## Research Methods

**The rules in the beer game**

In the Develop Beer game, a total of four stages of supply chain units are designed for participants to participate in the game. Each participant is responsible for the production and delivery of beer: the factory is tasked with producing the beer, and the other three stages of delivering the beer until it reaches the customer at the lower end of the supply chain. Therefore, the goal of the game is to meet the needs of customers with minimal backorders and inventory expenditures.

The beer game is played for a total of 24 rounds at a time, and each round must follow the following four steps:

1. Check Delivery: Check how many units of beer the wholesaler has delivered to the player.
2. Check Order: Check how many pieces the customer ordered.
3. Serve Beer: Serve as many beers as possible to meet the player's needs. In this game, this step is automated.
4. Make order decisions: Decide how many units you need to order to maintain inventory.

As mentioned earlier, there are four stages, manufacturers, distributors, suppliers, and retailers, there is a two-week communication gap for upstream orders, and there are two weeks of supply chain delay for downstream products. Holding excess inventory incurs a 1-point cost, and any backlog of orders also incurs a 1 point cost (which means old backlog + orders - current inventory). In the game, players cannot see anything other than the message conveyed to them through a piece of paper with a number written on it, indicating an order or product. The retailer draws the customer's demand from a deck of cards, the manufacturer places an order, and then turns it into a product within four weeks (Kimbrough et al., 2002).

Players in the supply chain look at each other and try to figure out what the problem is. The result is decided by the team with the lowest total cost. At the end of the report, it was explained that these feelings are common and that responses based on these feelings in the supply chain create a bullwhip effect (Sterman,1989). The game was played in a very transparent manner, and the results illustrate the valuable lesson that poor system understanding and poor communication can have an impact even for relatively simple and idealized supply chains. Although players often cite the lack of perfect information about customer orders as the main reason for their team's poor performance in the game, an analysis of the minimum possible score for using the optimal strategy under different conditions shows that the expected value of perfect information is 0. Standard games (Thompson & Badizadegan, 2015) and simulations that include providing perfect information to players still show teams underperforming (Croson et al., 2014).

**Experimental Methods**

To find out whether the game is in line with the pedagogical principles, we designed a three-step assessment scheme as follows:

1. Gamification Assessment Step 1: Analyze the level of need for "motivation" in the classroom

2. Gamification Assessment Step 2: Screening the gamification elements that are suitable for the classroom

3. Gamification Assessment Step 3: Establish a play-based pedagogy that can be implemented

Gamified thinking refers to how to introduce gamified theory into the classroom in 3 steps so that teaching can be more in line with the teaching objectives and make students enjoy learning the game.

Gamification Assessment Step 1: Analyze the level of need for "motivation" in the classroom.

The degree of motivational need in the classroom refers to the degree of motivational need that causes students to learn the game. The first step in gamified theory is to analyze the level of motivational needs in the classroom because each lesson needs to motivate students who are different!

Not all lessons need a gamification element to motivate the teaching and learning to run smoothly, so an analysis is needed to assess whether and to what extent integration is really needed. In fact, when conducting an analysis, it is necessary to check the "Learning objectives", "Learning time", "number of students", "experienced time per person", etc., and then evaluate whether the game to be used is directly proportional to the Game learning effect behind it. If the game is played for too long but the Game effect does not increase, then it is easy to become just playing the game and not a lesson, that misses the learning objectives.

On the other hand, if the experience is too short and the essence of the activity is not conveyed to the students, then the purpose of the experience is also lost.

Gamification Assessment Step 2: Screening the gamification elements that are suitable for the classroom "Gamification elements" refers to the use of game elements in teaching activities, so that the classroom is no longer just a teaching mode of "teachers teach, students learn". By selecting suitable gamification elements, the lesson can be carried out more smoothly and in line with the teaching theme to achieve the educational purpose. To enable students to actively participate in the curriculum and learn Xi independently, breaking the established framework and model of "teaching and learning". However, if gamification elements and teaching games are applied arbitrarily without screening, the teaching progress and time will be delayed, the teaching theme will deviate from the teaching theme and the learning Xi will be ineffective. Filter the "gamification elements" in two steps:

1. Evaluate what game elements need to be used in this teaching activity, such as the rewarding mechanism, cooperation element, competition relationship, luck component, etc., and put game elements into the activity to add some fun for the students.

2. For example, if the topic of the lesson is "numeracy" in mathematics, then you can find games that require computation. Or, if the theme of the course is "communication", then find games with their own communication and interaction mechanisms, so that students can learn directly from the process of playing.

3. The core objectives of your teaching:

3.1) What is the pedagogical purpose of the lesson?

3.2) How did you achieve the gamification element?

3.3) How can you help students converge the game experience into the desirable result?

Gamification Teaching Evaluation Step 3: Establish a practical game teaching method.

Gamification teaching method refers to the use of game elements to improve students' motivation, experience and engagement of learning, and ultimately achieve the purpose of education. Another in-depth teaching method, I think is the "game-based simulation method", which aims to make the teaching activity itself a game by applying game mechanics, such as designing a board game with theme-based objectives, while in the classroom. If you don't have a game-based pedagogy that can be implemented, you may distract the learners. So, to misuse or be inappropriate for the game elements in the class. Here is the list that we designed for the student to answer as follows:

**Table 1** List of questions (students)

| item | Issue |
|---|---|
| 1 | I think the content of this game is more lively and vivid. |
| 2 | I think this game-based learning is easy to use. |
| 3 | I like to learn Xi game-based Xi supply chain management subjects. |
| 4 | I think the knowledge in the supply chain management course can be applied to the simulation game. |
| 5 | Overall, I think this game simulation is very helpful for students. |

Based on the above three principles of evaluation, we have also designed the following assessment form:

**Table 2** Interview topics (teachers)

| item | Gamified Teaching Assessment Steps | issue |
|---|---|---|
| A | The degree of "eliciting motivational needs" in the classroom is good | A1: The game is designed at the right time to motivate students while learning the game.<br>A2: The number of participants in the teaching of this game is appropriate to motivate students learning.<br>A3: The hands-on experience of the students in this game teaching is very appropriate and can arouse students' motivation learning. |
| B | The "gamification element" in the classroom is suitable | B1: Appropriate reward mechanisms are cited in this lesson.<br>B2: In this lesson, there is a reference to the element of cooperation.<br>B3: There is a reference to competing relationships in this lesson.<br>B4: There is an element of luck in this lesson.<br>B5: This course achieves the core objectives of supply chain management teaching.<br>B6: students can reflect on the learning objectives of the lesson through play. |
| C | The Play Pedagogy in the classroom is practical | C1: Is a game Learning method appropriate? The whole process of the C2 game meets the teaching requirements of supply chain management. |

**Table 3** Student satisfaction questionnaire

| item | issue |
|---|---|
| 1 | Do I think the content of this game review is lively and vivid? |
| 2 | I think this game is easy to learning? |
| 3 | I like this way of using games to experience supply chain management subjects. |
| 4 | If I can, next time I would like to use this game teaching. |

**Table 3** (Continued)

| item | issue |
|---|---|
| 7 | In game Xi, I know exactly what knowledge to use to pass the level successfully. |
| 8 | I hope that in the future, in the school curriculum, we can use this game to learn? |
| 9 | I would love to discuss and share tips and tricks with my classmates. |
| 10 | I think the whole learning process will be more interesting because I can compete with my classmates in the process of learning. |
| 11 | During the game, I struggled to solve problems so that I could get through the level? |
| 12 | Overall, I think this game teaching is very helpful for my learning. |

## Results & Discussion

Experiments and Sampling

The whole teaching/learning process was conducted in July 2003 at the Department of Business Administration of a university in Taiwan, with a class of 32 students participating, and the teacher questionnaire was filled out by 9 teachers from the Department of Marketing and Distribution of the university.

Gamification Teaching Evaluation Results

After the evaluation of 9 professors, the results of this gaming evaluation are shown in Figure 1. The ordinate in the figure is the quality of the assessment, and the abscissa is the evaluation indicator of gamified teaching, as shown in Table 2.

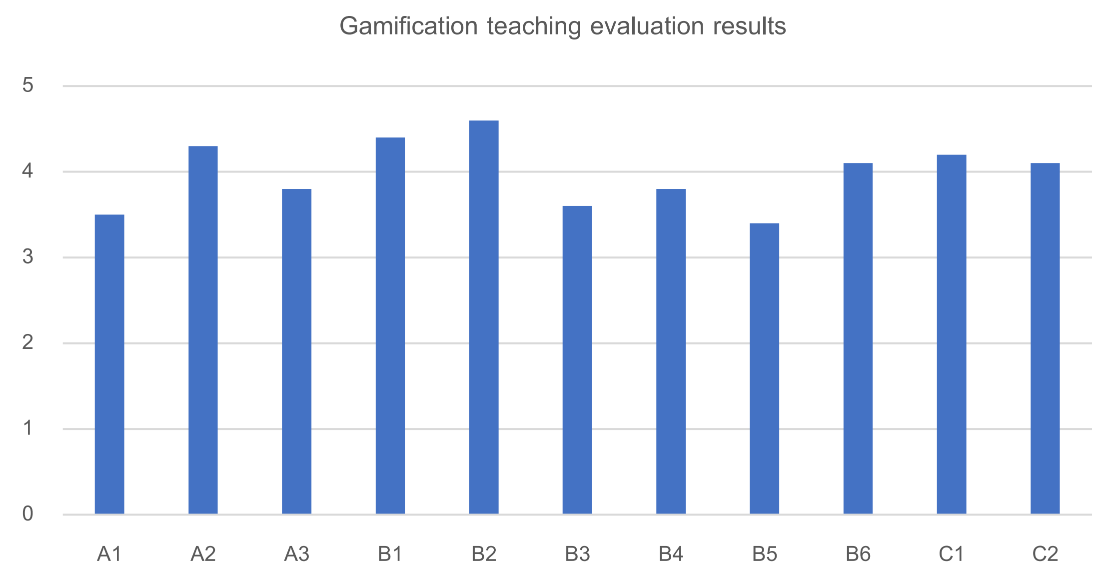


**Figure1** Evaluation results of gamified teaching

As you can be seen from this figure, the scores of each evaluation index are above 3, which means that the function of this game teaching can meet the requirements of learning objectives.

**Analysis of students' perceptions of game learning**

The survey results of students' views on game learning are shown in Figure 2.

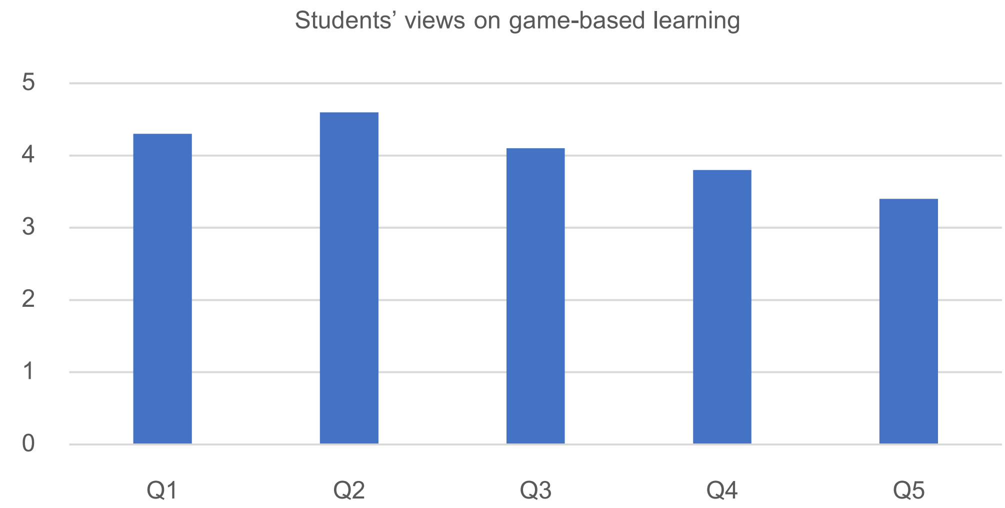


**Figure 2** Students' views on game learning Xi

As it can be seen from the figure, students generally have a positive view of game learning, and their evaluation are all above 3.

**Results of student Xi satisfaction analysis**

In order to understand how students, feel after using this game learning and software, we have conducted a satisfactory analysis, and the results are shown in Figure 3.

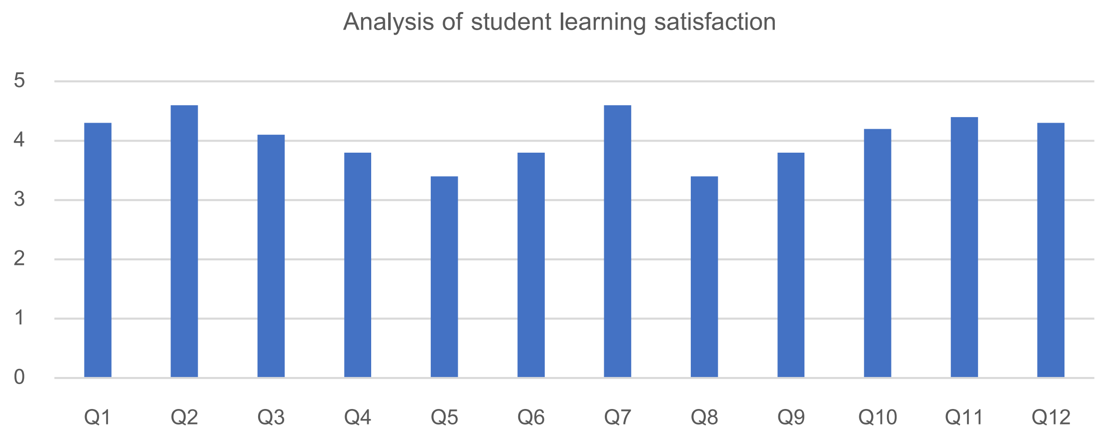


**Figure 3** Analysis results of student Xi satisfaction

As we can see from Figure 3, students' learning satisfaction level with this software is very high, and its evaluation are all above 3.

**Qualitative analysis results**

In the game-based teaching/learning, students can also experience the key points that can be easily expressed. Instead of one lecture, the students are very satisfied with the feedback shown below in the questionnaire:

(Student No. 003)

*In the past, I didn't understand how much the downstream sales volume affected the entire system, but now I know that a small change may cause a big change in the entire system.*

(Student No. 009)

*The teacher talked about the bullwhip effect in class for a long time, and I didn't expect that when we played online, I understood everything.*

(Student No. 011)

*This class is not boring at all, due to the experience of a close-to-a-real-world game, and it is amazing to let us know all the supply chain principles that are not easy to understand through one game.*

## Conclusion

In this study, we have recruited a department of marketing and supply chain management students to conduct the actual experiencing experiment. Where we find out that the Beer Game explores how its educational purpose of utilizing games to apply in today's business environment, to optimize the learning of supply chains, enhance collaboration, and improve overall performance. This game demonstrates the challenges of how to properly manage inventory and fluctuating demand. While we understand the bullwhip effect now, what should pay attention to avoid, and carefully to calculate the needs of the marketplace?

Therefore, by knowing the real-world experience, we should be considering the bullwhip effect while placing the order in the beer distribution system. Warming the participants when taking on the roles of retailers, wholesalers, distributors, and breweries.

The results demonstrated the students had a positive attitude towards the game teaching, and the teachers also had a positive attitude towards the gamification teaching evaluation of the game teaching system, and the results of the satisfaction analysis of the students' actual operation also showed that the beer game delivery system could make the students more thoughtful when they are facing a decision.

Besides the quantitative analysis showing that the system can meet the requirements of game simulation, the results of qualitative analysis also show that students can easily understand the things that were not easy to understand in the past through the process of playing game-based simulation. Therefore, it is suggested that schools with relevant courses in the future can make good use of this game teaching system to provide students with Xi learning results.

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# Evaluating Sustainable Practices in Supply Chains: A Conceptual Framework for ESG Performance Assessment.

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## Abstract

Assessing the sustainability of supply chains is a challenging research topic, and this study proposes a possible conceptual framework through a review of previous research literature. The study first delves into the impact of the supply chain at all levels and then proposes multiple variables that affect the sustainable supply chain, including the overall performance of the supply chain, the economic impact, the environmental impact, the social impact, and so on. In terms of supply chain performance evaluation, the study further proposes two different concepts, one is to regard the supply chain as the weighted sum of the participating enterprises according to the performance evaluation method of general corporate governance, and the evaluation method is to use the performance of input and output as the basis for evaluation, and the other is to consider the supply chain as a whole and conduct overall performance evaluation from the perspective of sustainable supply chain. At the end of this study, a possible conceptual architecture diagram is also presented as a reference for subsequent researchers.

**Keywords:** ESG, Supply Chain Performance, Sustainable Practice

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## Introduction

### Background

ESG has become a key indicator to promote the sustainable development of enterprises, including environmental protection, social responsibility, and corporate governance, and is an important cornerstone for building trust in enterprises by investors and consumers (Zhou et al., 2022). ESG emphasizes corporate subjectivity, highlights the added value of sustainable operation created by products and services, and connects the global consumer network, highlighting the importance of environmental investment, and promoting enterprises to formulate strategic layouts for environmental issues in advance.

At the same time, ESG can also be used as a specific indicator for external evaluation of a company's sustainability practices, and excellent ESG performance is usually more easily recognized by the capital market. Conversely, failure to disclose ESG-related information may be a barrier to companies expanding into internationally competitive markets (Arvidsson & Dumay, 2022). Therefore, the active practice of ESG has become a key issue that needs to be addressed urgently by major industrial enterprises. The supply chain is a system composed of many corporate activities, and as ESG has become an important criterion for enterprise evaluation, whether the supply chain also operates in the spirit of ESG has become one of the issues of concern to consumers and the public.

With the growing global focus on sustainability issues, companies must demonstrate their commitment to environmental sustainability and social responsibility to meet the expectations of customers, investors, and regulators. Internally, enterprises also need to accelerate transformation to achieve a balance between business development and environmental protection and actively promote the sustainable development of enterprises. Velte (2017) companies already have a set of methods to follow to measure ESG performance, but how to apply this method to the supply chain at the same time has become one of the challenges faced by supply chain managers today.

This article will explore the history and theory of the beer game. It begins with a summary of the history and goals of the beer game, followed by a discussion of its main lessons. Later explain their application to contemporary supply chain challenges and real-world examples of successful implementation.

### Main Research Objectives

The research objectives of this study include:

1. An in-depth look at the key aspects of ESG's impact on the supply chain.
2. Propose a conceptual framework for supply chain ESG performance evaluation.

## Literature Review

### Supply Chain Theory

In the operation of today's enterprises, activities are usually divided in the form of the organization of the supply chain. So, in this section, we'll give a clearer definition of the supply chain (Snyder & Shen, 2019).

A supply chain is a network of individuals and companies involved in the creation and delivery of products to consumers. The supply chain starts with the raw material producer and extends to the trucks delivering the finished product to the end user. Supply chain management is a crucial process because an optimized supply chain can reduce costs and increase the efficiency of the production cycle. As a result, today's businesses are actively looking to improve their supply chains to reduce costs and remain competitive.

**Sustainable supply chain**

In recent years, industries and enterprises have introduced and implemented ESG (E-Environmental, S-Social, G-Corporate Governance) as a key performance indicator to improve operational performance (Li, et al., 2021) Among the various management functions of enterprise operations, procurement has become an effective management tool with great potential. By developing sustainable procurement policies and practices, companies can make a substantial contribution to achieving sustainable development by changing the impact that may occur throughout the product or service life cycle, minimizing potential disadvantages.

The supply chain of an enterprise or organization plays a key and important role in this process. Effective management of the supply chain is an indispensable part of enhancing the competitiveness of an organization. In addition to the traditional evaluation considerations such as quality, cost, delivery time, and service, "sustainable development of the supply chain" is an important consideration in supplier management. In order to strengthen and improve the sustainability performance of the supply chain, it is necessary to first formulate a system of "Supplier Management Standards” and cooperate with quantitative mechanisms such as evaluation and satisfaction surveys to encourage suppliers to comply with and implement them and promote the overall supply chain to move towards the goal of sustainable development.

Traditional supplier management broadly includes the following mechanisms: (Spekman et al., 1999)

- Sourcing and investigation of new suppliers
- Supplier written information and on-site review
- Supplier selection and grading
- Supplier quality assurance system checks
- Supplier performance evaluation system

Nowadays, in response to the trend of sustainability, the following evaluation items have been added to supplier management (Zimmer et al., 2016):

- Optimize the supplier selection process
- Key Supplier Identification Criteria
- Corporate Sustainability and Social Responsibility Audit
- Supplier process quality audit

In addition, its system and supervision should be established concerning the following commonly used relevant international norms and norms:

Value Chain Management, VCM (McGuffog & Wadsley, 1999)

Responsible Business Alliance, RBA (Wicks, 2009)

Business Social Compliance Initiative, BSCI (Egels-Zandén & Wahlqvist, 2007)

Business Environmental Performance Initiative, BEPI (Roy et al, 2013)

Global Reporting Initiative, GRI (Tarquinio et al., 2018)

ISO 20400:2017 (Goebe et al., 2018)

United Nations Sustainable Development Goals UN SDGs (Lee, et al., 2020).

**Green supply chain**

The green supply chain is an environmentally sustainable business model that aims to minimize the adverse impact of production on the environment. It encompasses all phases of the product life cycle, including raw material procurement, manufacturing, transport logistics, and product use and recycling. (Lamba & Thareja, 2021).

The core goal of a green supply chain is to conserve resources, improve energy efficiency, reduce carbon emissions, and ensure product quality and sustainability. This business model focuses on the full range of environmental impacts and strives to adopt sustainable practices at every stage of product production to promote green development and reduce the impact of production on the natural environment.

There are many advantages to promoting green supply chains (Astawa et al., 2021):

1. Improve efficiency and reduce costs. A green supply chain is not only beneficial to environmental protection and reducing carbon emissions, but also brings tangible benefits to businesses in terms of business and production. By conserving resources and improving energy efficiency, companies can reduce production costs while reducing expenses on waste disposal and environmental burdens.

2. Enhance the positive image of the brand in addition to the advantages of production, the green supply chain can also improve the competitiveness and brand value of the enterprise. As global consumers pay more attention to environmental issues, more and more consumers are inclined to support environmentally friendly products and companies. By building a green supply chain, companies can build a positive image, meet consumers' demand for environmental protection, enhance brand image and loyalty, and enhance market competitiveness.

3. Comply with regulatory and policy requirements A green supply chain helps companies comply with relevant regulations and government environmental requirements. As more and more countries and regions implement environmental protection regulations, requiring companies to reduce carbon emissions, reduce waste generation and reduce pollutant emissions, establishing a green supply chain has become an effective way to ensure compliance and avoid possible fines and legal risks.

4. Promote collaboration between companies green supply chains promote close collaboration between companies and stakeholders. This requires collaboration with suppliers, partners, communities, and governments to achieve environmental sustainability goals. Such collaborations help build long-term partnerships, work together to find innovative solutions, share resources and knowledge, and achieve mutual economic and environmental benefits.

**Value chain of the supply chain**

Michael E. Porter first introduced the concept of Value Chain in 1985, which is primarily applicable to vertically integrated companies and emphasizes the competitive advantage of a single enterprise (Porter, 2001).

According to Porter, "Every business is a collection of activities that perform in the process of designing, producing, selling, distributing, and supporting its products. All of these activities can be demonstrated through a value chain."

A company's value creation is structured through a series of activities, which can be divided into two categories: basic and ancillary. Basic activities include internal logistics, production operations, external logistics, marketing and sales, service, etc., while ancillary activities include procurement, technology development, human resource management, and enterprise infrastructure. These distinct but interrelated production and business activities form a dynamic process of value creation, i.e., the value chain.

Since the supply chain is made up of many companies that participate together, the value chain of the supply chain is created by these participating companies. However, due to the different value chain orientations of individual enterprises, the value chain of the entire supply chain must be coordinated and run between these enterprises before it can be formed.

**Theory of ESG**

Origin and Development of ESG

Environmental, social, and corporate governance (ESG) is a range of factors that are considered when investing, including environmental, social, and corporate governance issues (Gelles, 2023). The term ESG was first widely used in 2004 in a report titled "Who Cares Who Wins", which was an initiative of financial institutions (UN Environment Programme-Finance Initiative, 2004) at the invitation of the United Nations. In less than 20 years, the ESG movement has evolved from a United Nations initiative for corporate social responsibility to a global phenomenon with more than $30 trillion in assets under management (Holder, 2019). According to Morningstar, Inc., in 2019 alone, ESG-related products attracted $176.7 billion in capital inflows, a growth rate of 525% from 2015. According to Morningstar, U.S. ESG investment funds saw $3.1 billion in capital inflows in 2022, while non-ESG funds lost $370 billion when the stock market fell during the same period (Chung &Michaels, 2019).

However, some critics claim that ESG-related products are unlikely to have the expected impact of raising the cost of capital for polluting companies (Berk &Van Binsbergen, 2021), while also blaming the greenwashing movement (Armstrong, 2021).

**The impact of ESG on financial investment Deloitte**

The challenges of ESG issues to enterprises mainly cover the following six aspects, and it is recommended that enterprises evaluate how to integrate ESG elements in their corporate development strategies through different aspects and respond quickly to market demand (Freiberg et al., 2020).

1. Economic: The issue of sustainable management affects the investment trend of the financial market has changed the structure of the financial market and has a broad and profound impact on the financing methods and investor relations management of enterprises.

2. Social aspect: The public generally expects companies to pay more attention to sustainability issues Consumers, investors, credit rating agencies, suppliers, etc. expect companies to strengthen sustainability issues, so the existing customer relationship management system should incorporate ESG issues for future optimization.

3. Technical: Promote relevant scientific research and technological innovation based on the concept of sustainability Environmental protection, energy saving, and waste reduction have become important issues that enterprises must consider when developing new products and services. Disruptive technologies can be developed with the potential to create new markets, new business models, and new value networks, which may further impact the way the entire supply chain operates, including procurement, production, and transportation.

4. Environment: Environmental factors need to be considered in the overall supply chain planning In the era of the global supply chain, environmental factors (such as forest fires, plastic pollution, etc.) will directly or indirectly increase the company's operational risks, and enterprises need to prepare for the possible impact of climate on their operations to enhance or maintain the interests of the enterprise.

5. Legal aspect: ESG concepts continue to influence global environmental regulations International and regional regulations related to sustainable operation continue to formulate new regulations related to sustainable operation, such as carbon tax, carbon neutrality, carbon dioxide emissions, environmentally friendly packaging, and other restrictions have been put on the road. Enterprises will face increasing operating pressure and need to optimize internal and external sustainability risk management and financial control processes in advance to cope with related challenges.

6. Politics: ESG changes the political discussion and guides the direction of policymaking in various countries The greening initiatives of many governments, as well as the environment-related financial grants or tax schemes of international organizations such as the United Nations and the European Union, have a significant impact on the development of corporate strategies, and will directly change the way companies transparently disclose their reports to shareholders and all stakeholders.

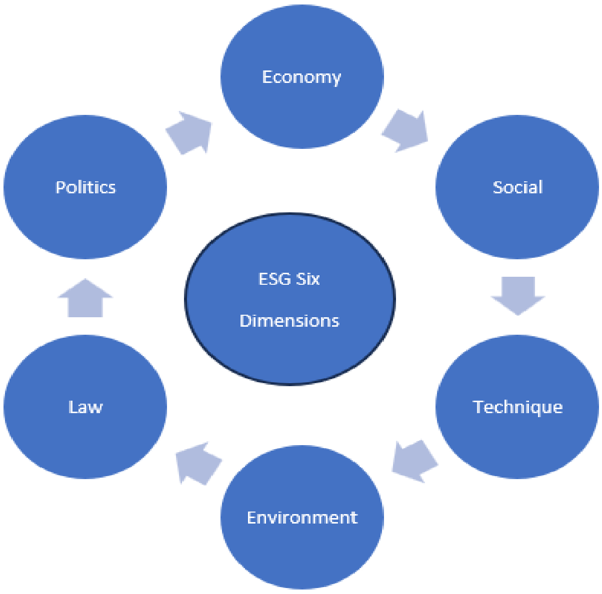


**Figure 1** Six aspects of the impact of ESG on enterprises

**ESG evaluation indicators**

Taking laptops as an example, Jiang proposed a factor analysis of output performance measurement in supply chain management, as shown in Table 1(Jiang, 2003).

**Table 1** Analysis of factors for output performance measurement of supply chain management

| factor | The name of the variable |
|---|---|
| Supplier performance | The supplier's ability to continuously improve the quality of delivery |
| | The ability of suppliers to respond quickly to changes in demand |
| | Supplier on-time delivery achievement rate |
| | Supplier ability to reduce lead time for delivery |
| Manufacturer performance | Reduced cost of product inventory |
| | Reduced product shipping costs |
| | Product quality improvement |
| | The cost of manufacturing products has decreased |
| | Improve the ability to adapt to uncertain situations |
| | The on-time delivery compliance rate has been improved |
| | The lead time for product delivery is very short |

**Table 1** (Continued)

| factor | The name of the variable |
|---|---|
| Customer satisfaction performance | Accuracy of market demand forecasts |
| | The out-of-stock rate decreases |
| | Adaptability to changes in market demand |
| | Respond quickly to customer needs |
| | Shipment accuracy improved |
| | Provide perfect after-sales service |
| | The number of customer complaints has decreased |
| | Increased customer loyalty |
| Overall supply chain performance | The supply chain is more responsive |
| | Total supply chain costs are reduced |
| | Improve the quality of products and services provided by the supply chain |
| | The ability of the supply chain to respond to fluctuations in demand |
| | The supply chain can quickly change product design and introduce new products |
| | The supply chain achieves strategic and organizational goals |

## Research Methods:

This study adopts a conceptual approach in which the main concepts of previous studies are first collected, and then these concepts are synthesized to propose a feasible research framework.

The main concepts explored in this study are as follows:

1. The concept of a sustainable supply chain
2. The concept of a green supply chain
3. The concept of ESG evaluation indicators
4. The concept of performance evaluation indicators for the supply chain
5. A performance evaluation model for inputs and outputs
6. What are the commonly used ESG evaluation indicators in the world?

## Results and Discussion

**Theory Development**

ESG evaluation indicators are commonly used in the world.

As a company's ESG performance requires a comprehensive and in-depth analysis, it usually relies on an impartial third-party organization to assist in the evaluation. However, there is a lack of unified regulations and judgment criteria for ESG scores of different institutions, so the ESG scoring criteria of a company in different institutions may be different. Nonetheless, these assessments will focus on three major areas:

environmental, social and corporate governance, although the specific details of focus in each area may vary. Here are the three main ESG scoring agencies:

1. MSCI Morgan Stanley is one of the world's leading index providers as a provider of financial information research services to help investors quickly understand market changes through indices. MSCI further subdivides the three scoring criteria into 10 themes and 35 specific sub-categories assigns different weights to each sub-category according to the industry sector, and finally calculates the ESG rating. Rated from highest to lowest, representing "leading", "average" and "lagging ", there are currently about 8,500 companies in the world, including about 120 companies in Taiwan that fall within the scope of MSCI's ESG rating research. If you want to know the ratings of other companies, you can check the official website of MSCI (Giese et al.,2021).

2. FTSE Russell, another index provider, FTSE Russell, has also launched a unique ESG evaluation mechanism, which is further subdivided into 14 themes and 300 indicators from the original three scoring criteria, and assigns corresponding weighted scores to each indicator according to the exposure of each industry and the importance of the theme. The rating is 0~5 points from high to low, and there are currently about 200 companies in Taiwan within the research scope of FTSE Russell, but FTSE Russell does not disclose the ratings of each company for free and can only refer to it from the constituent stocks of the Taiwan Sustainability Index (Tay & Tay, 2023).

3. Sustainalytics Sustainalytics is the most extensive authority on ESG scoring, rating more than 13,000 companies worldwide. The rating method is based on the scoring of enterprises in corporate governance, key ESG issues and the unique problems that may be encountered in various industries, and divides the risks faced by enterprises into two types: controllable and uncontrollable, and the controllable risks are further divided into controlled and uncontrolled, and then the controllable risks are further deducted from the uncontrollable risks, which is the final ESG score and rating. ESG ratings are classified from good to bad as no risk, low risk, medium risk, high risk, and severe risk, with lower scores representing better ESG ratings (Diez-Cañamero, et al., 2020).

**Green Supply Chain Assessment Indicators**

The green supply chain assessment index is the performance of the supply chain from the perspective of environmental protection, as shown in Table 5.

**Table 5** Evaluation factors of green supply chain performance

| Evaluation object | First-level indicator | Secondary indicators | Calculation formula |
|---|---|---|---|
| Green supply chain performance | Profitability | Net profit margin on sales (al) | Net profit margin on sales = net profits/sales revenue |
| | | Rate of return of investment (a2) | Rate of return of investment (ROI) = income before tax/total investment |
| | | Return on equity (a3) | Return on equity = net income/average shareholders' equity |
| | | Operating profit growth rate (a4) | Operating profit growth rate = operating profit growth this year/total operating profit for the previous year |
| | | Carbon intensity (bl) | Carbon intensity = carbon footprint/operating revenue |
| | Environmental performance | Carbon productivity (b2) | Carbon productivity = operating revenue/carbon footprint |
| | | Green revenue share (b3) | Green revenue share = green revenue/operating revenue |
| | | Inventory turnover (cl) | Inventory turnover = operating revenue/average balance of inventory |
| | Operational performance | The proportion of products sold (c2) | The proportion of products sold = sales (total inventory amount + sales amount) |
| | | Total asset turnover (c3) | Total asset turnover = sales/average total assets |

**Performance evaluation factors of supply chain governance**

The performance evaluation factors of supply chain governance include the following: (1) executive compensation; (2) bribery and corruption;(3) Political lobbying and donations;(4) Board diversity and structure;(5) Tax strategy, etc.

**Proposed Conceptual Architecture Diagram**

This study proposes a proposed conceptual architecture diagram for sustainable supply chain management, as shown in Figure 2

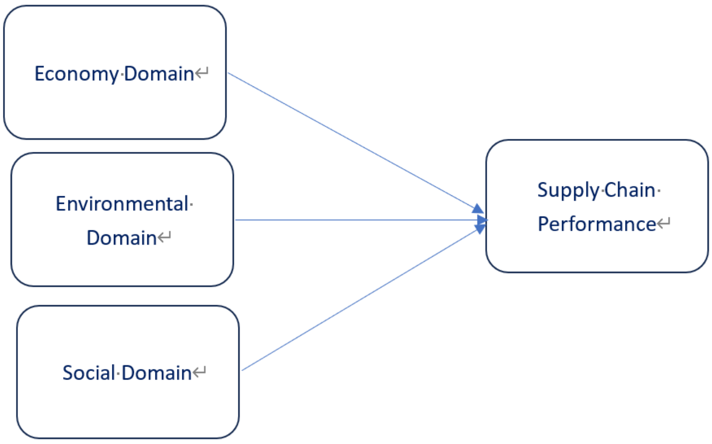


**Figure 2** Conceptual architecture diagram of supply chain sustainability management

This conceptual architecture diagram of supply chain sustainability management considers the environmental, social, and corporate governance aspects, and TASS also proposes three evaluation factors for this architecture, as shown in Table 3.

**Table 3** Aspects of comprehensive ESG performance evaluation

| Environmental Surfaces | Social aspect | Governance surface |
|---|---|---|
| Green Consumption, | Promote public interest participation | Operational and financial performance |
| renewable energy | Social services | Organizational Operations |
| Climate governance | Employee Care and Labor Relations | Material issues |
| Operational Processes | Workplace friendliness and diversity balance product responsibility | Internal control mechanism |
| Greenhouse gas inventory | Industry involvement | Risk Management Policy |
| Carbon management | Customer Benefits | Board Governance |
| Water management | Respond to international SD | Information, Disclosure and Transparency |
| Waste management | Award Records | Corporate Mission |
| Environmental Performance | | Regulatory issues |
| Exam administration | | Supply chain management |
| Energy efficiency | | |
| Green Finance | | |

## Conclusion

This study aims to take a closer look at the impact of ESG on the supply chain and identify what needs to be done to drive sustainability. By adopting a conceptual research approach, we study in detail the main aspects of ESG impact on the supply chain and propose a conceptual framework for ESG performance evaluation of the supply chain.

In the study, we mainly focus on the issues of sustainable supply chain, green supply chain, and supply chain evaluation under ESG indicators. At the same time, we delved into the concept of supply chain performance assessment, including the input-output performance model. In addition, we have conducted a detailed discussion on the ESG evaluation indicators commonly used internationally. Finally, we propose a framework for evaluating supply chain performance under the concept of ESG.

Due to the limited time, we were unable to conduct an empirical study, which provides room for extension for follow-up researchers. We hope that future research will build on our proposed framework to further validate the specific impact of ESG on supply chain performance.

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# Comprehensive Study on the Supply Chain of Vacuum Thermal Cracking System for Sustainable Development: A Case of Waste-to-Energy and Resource Recovery.

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## Abstract

The purpose of this study is to explore the possibility of applying a new technology, vacuum heating technology, to waste-to-energy and resources, and to explore the completeness and feasibility of its supply chain system. First, we'll take a closer look at the implications of vacuum heating technology and its past experience. Second, we will explore ways to convert waste into energy and resources, with a focus on the potential of this technology for sustainable development. Taking Taiwan as a case study, the results of this study show that the vacuum thermal decomposition system can be successfully applied to the recycling and reuse process of agricultural waste, and then generate a generator built into the system, and use the thermal structure to form the final production process. This not only results in the generation of four high-value goods, but also significantly increases the value of the entire system. From a sustainability perspective, such systems have the potential to have a positive impact and can play a positive role in promoting clean energy and resource recycling. However, in the process of promotion, there are still some challenges in supply chain management and the promotion of raw material markets. Successful promotion relies on the efforts of the operator, including active participation in the establishment and promotion of the supply chain, to ensure the viability and sustainability of the system. This study provides insight into the potential of vacuum heating technology in the field of waste treatment and energy recovery and provides a preliminary discussion of the feasibility study.

**Keywords:** Waste Energy Recovery, Resource Recovery, Vacuum Pyrolysis System, Supply Chain Management, Sustainable Development

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## Introduction

### Background

The main reason for the gradual increase in global temperature has been due to the global climate change caused by greenhouse gas emissions from combustion (Short & Neckles, 1999). To tackle this challenge, countries around the world actively promote energy conservation and carbon reduction measures and set goals in the direction of carbon footprint and minimum carbon emissions of various industrial processes (Huisingh et al.,2015).

In addition to reducing unnecessary resource consumption, we also need to focus on ways to effectively recycle and reuse waste and its environmental impact. This issue should be considered seriously, while we come up with feasible solutions, and think about how to effectively recycle waste. This is an important topic that requires in-depth investigations.

At present, the world is facing the problem of garbage disposal, with mountainous garbage being dumped over places, and agricultural waste is also causing a waste of resources during their treatment processes. Meanwhile, additional external energy may be needed for such treatment. This not only leads to the unnecessary waste of resources but also exacerbates the energy shortage we are facing, forming a double burden on society.

To improve this situation, we need to think about more efficient waste disposal methods, especially for agriculture to maximize resource recovery and reduce dependence on external energy sources. Such measures can not only alleviate the pressure of waste disposal but also help to mitigate energy shortages and provide a substantial contribution to the sustainable development of society.

### Current Situation and Problem Presentation

Environmental experts and academics are urgently looking for new technologies to solve the combined challenges of environmental protection and energy. According to Taiwan's Environmental Protection Agency, in 2022, Taiwan's general waste reached 11.8 million tons, of which about 47.09 million tons were general waste, 6.57 million tons were recyclable waste, and another 4 million tons were food waste. These are available resources that we need to use effectively to protect the planet (MOE, 2024).

This study focuses on the application of a new technology, a vacuum pyrolysis system. This system can make the disposal of Taiwan's garbage a non-toxic and harmless process, generating 250 GWh of green electricity capacity per year. According to the Council of Agriculture, agricultural waste has a huge potential resource in Taiwan, can this agricultural waste also generate more green electricity?.

The operation of the vacuum pyrolysis system includes the reuse of waste and agricultural waste, reducing pollution sources, achieving carbon reduction effects, and promoting the generation of green electricity. This will translate the negative effects of the entire industrial production into positive ones while maximizing the value of the waste itself. By operating such a system, we can not only solve environmental and energy problems but also contribute to the sustainable use of resources (Parku et al., 2020).

**Research Objectives**

The main objectives of this study are as follows:

A. Discuss the technology of the vacuum pyrolysis system

B. Understand the main content of the vacuum pyrolysis system supply chain

C. Discuss possible problems in the supply chain of the vacuum pyrolysis system

D. Understand the impact of vacuum pyrolysis system on sustainable development

**Research Questions**

In this study, the following two research questions will be explored:

A. Whether the vacuum pyrolysis system supply chain is viable

B. Can the vacuum pyrolysis system supply chain have a positive impact on sustainable development?

**Contribution to the Study**

Due to global environmental change and climate warming, energy conservation and carbon reduction have become issues that environmental scientists are actively solving. The purpose of this study is to explore whether it's practical and feasible to use a vacuum pyrolysis system for waste-to-energy recovery. If it can be proved that this system has significant energy saving and carbon reduction benefits in practical application, it will have a positive and far-reaching impact on solving the problem of environmental pollution

## Literature Review

**Vacuum pyrolysis system**

A vacuum pyrolysis system is a technology for chemical cracking at high temperatures and under vacuum conditions. It is typically applied to the treatment of organic substances, including municipal waste, biological resources, or fossil fuels, to produce useful products, such as energy or chemical feedstocks (Barth et al., 2004).

In addition, the vacuum pyrolysis system is also an organic synthesis technology, which breaks down organic substances into monomers and oligomers by heating them to high temperatures under vacuum conditions. This technique can be applied to the manufacture of nanoparticles, zirconia, and oxides. For example, a vacuum pyrolysis furnace can be used as a thermal cleaning system to remove organic polymer plastics and residual black carbon from heat-resistant metal parts under vacuum conditions using the principles of hot melting, pyrolysis, and oxidative carbon removal.

**Technical content of vacuum pyrolysis system**

In a vacuum pyrolysis system, the substance is subjected to high-temperature treatment in a vacuum environment, which helps to prevent the presence of oxygen and thus avoid complete combustion. Normally, high temperatures and vacuum cause organic matter to decompose into gases, liquids, and solid products.

These products can be further used to generate electricity, produce fuels, make chemical feedstocks, or other products.

**Table 1** The main technical contents of the vacuum pyrolysis system

| serial number | Technical content | description |
|---|---|---|
| 1 | High-temperature treatment | The system uses high temperatures, often above hundreds of degrees Celsius, to prompt the decomposition of organic matter into simpler molecules or monomers. |
| 2 | Vacuum conditions | Cracking in a high vacuum, i.e. decompression operation, helps to prevent the presence of oxygen and thus complete combustion for specific chemical transformations. |
| 3 | Organic matter decomposes | Organic substances are decomposed into monomers, oligomers or gases in a high-temperature and high-vacuum environment. This makes it possible to recover useful chemicals from waste or biological resources. |
| 4 | Energy recovery | The system is able to use the heat or gas generated during the cracking process for energy recovery, improving the energy efficiency of the system. |

**How to use a vacuum pyrolysis system to treat waste and recover energy**

Waste-to-energy technologies, including incineration, biomass utilization, methane gasification, etc (Hameed et al., 2021). Vacuum pyrolysis systems have a wide range of applications, including waste treatment, energy recovery, and the chemical industry. One of the advantages of this technology is its ability to handle multiple types of raw materials while reducing the need for finite natural resources, helping to promote environmental sustainability.

In terms of manufacturing, vacuum pyrolysis systems are widely used to produce products such as nanoparticles, zirconia, and oxides (Tsai et al., 2004). At the same time, in the industrial field, its application as a thermal cleaning system enables it to effectively remove organic polymer plastics and residual black carbon from heat-resistant metal parts.

In addition, vacuum pyrolysis systems are not only used to manufacture nanoparticles, zirconia, and oxides but are also used in thermal cleaning, using the principles of hot melting, pyrolysis, and oxidative carbon removal under vacuum conditions to remove organic polymer plastics and residual black carbon from heat-resistant metal parts. In terms of waste treatment, pyrolysis technology can convert waste into energy such as oil and gas. For example, waste plastics can be converted into products such as fuel oil, gas, and solid charcoal after thermal cracking. In addition, pyrolysis technology can also be used to treat waste rubber, waste rubber tires, waste wood, etc.

**Supply chain management.**

What is supply chain management?

Supply chain management is a management approach that aims to coordinate and optimize the flow of materials, information, and capital across multiple businesses (Cox,1999). It includes the effective management of material (product) flows, information flows, and capital flows. The main goal of supply chain management is to ensure that the right products are delivered to the right place at the right time, in the right quantity, in the right quality, and in the right condition. Through supply chain management, companies can improve production efficiency, reduce costs, and improve product quality, thereby enhancing their competitiveness.

Building a waste-to-energy vacuum pyrolysis system is challenging. From sourcing waste as a feedstock to establishing superior engineering know-how, to effectively marketing finished products, including energy and activated carbon, the entire process needs to be well coordinated (Cao et al., 2001). Therefore, when discussing how to build such a waste-to-energy vacuum pyrolysis system, we first need to carefully analyze its supply chain.

**How is the supply chain of a vacuum pyrolysis system composed?**

Here are some of the major parts that may make up the vacuum pyrolysis system supply chain:

The supply chain of a vacuum pyrolysis system consists of multiple parts that work together to ensure that the system operates smoothly and efficiently. Below are some of the major parts that may make up the vacuum pyrolysis system supply chain:

**Table 2** The main segments of the vacuum pyrolysis system supply chain

| serial number | Supply chain components | description |
|---|---|---|
| 1 | Raw material supply | This includes obtaining the waste or organic matter required by the pyrolysis system as a feedstock. Ensuring a reliable and stable supply of raw materials is the cornerstone of a successful supply chain. |
| 2 | Engineering & Manufacturing | Including the design, manufacture and technical support of vacuum pyrolysis system. Expertise is required to ensure the effectiveness and safety of the system. |

**Table 2** (Continued)

| serial number | Supply chain components | description |
|---|---|---|
| 3 | Equipment Vendors | Provide all kinds of equipment and technical equipment required for vacuum pyrolysis system, such as pyrolysis furnace, vacuum device, control system, etc. The choice of partner is critical to the functioning of the system. |
| 4 | Technical Support & Services | Provide technical support and services required for system installation, commissioning, maintenance, and upgrades. It helps to ensure the long-term stable operation of the system. |
| 5 | Energy recovery and utilization | Treat the energy generated by the system to enable the recovery and efficient use of energy, such as power generation or supply to other industrial processes. |
| 6 | Marketing and sales of finished products | Bring system-manufactured finished products (such as energy and activated carbon) to market, market and sell them to ensure that the value of the finished product is fully realized. |
| 7 | Environmental Compliance & Regulation | Comply with relevant environmental regulations and regulatory standards to ensure that the operation of the vacuum pyrolysis system meets regulatory requirements and contributes to environmental sustainability. |

This table collates the different parts of the vacuum pyrolysis system supply chain, as well as the main parts of each part, which together form the supply chain of the vacuum pyrolysis system, and the effective collaboration of each part is the key to achieving the efficient operation and sustainable development of the system.

**Sustainable development**

What is the significance of sustainable development?

Sustainable development is a development model that aims to meet the needs of the present without compromising the needs of future generations. In 2015, the United Nations announced the Sustainable Development Goals (SDGs) by 2030. There are 17 core goals, extending to 169 targets and 230 indicators, guiding global efforts to achieve sustainable development. These goals include, but are not limited to, 12 areas, including poverty eradication, climate change mitigation, and the promotion of gender equality. The United Nations expects that by 2030, the world will be able to achieve these goals and promote sustainable development (Persaud & Dagher, 2021). The following are the 17 core goals of the SDGs:

**Table 3** United Nations 2030 Sustainable Development Goals

| serial number | target | Specific projects |
|---|---|---|
| 1 | Eradication of poverty | Achieve economic and social development on a global scale and ensure equal economic opportunities for all |
| 2 | End hunger, achieve food security, improve nutrition and promote sustainable agriculture | Achieve food security, improve agricultural production and ensure adequate nutrition for people |
| 3 | Ensuring health and promoting well-being for all ages | Improve global health and ensure that everyone has access to timely and equitable health care |
| 4 | Ensure that education is inclusive, equitable and of high quality, and promote learning | Promote global education and ensure access to quality education for all |
| 5 | Achieve gender equality and empower women | Eliminate all forms of gender discrimination and promote women's rights to participate in social, economic and political affairs |
| 6 | Ensure access to water and sanitation for all and its sustainable management | Ensure access to safe drinking water and basic sanitation for all, and achieve sustainable water management |
| 7 | Ensure access to affordable, reliable, sustainable and modern energy for all | Promote global access to energy and promote the use of renewable energy |
| 8 | Promote inclusive and sustainable economic growth so that everyone has a good job | Promote global economic development and achieve full employment and economic growth |
| 9 | Build resilient infrastructure, promote inclusive and sustainable industries, and accelerate innovation | Develop global infrastructure and promote industrial upgrading and innovative development |
| 10 | Reducing inequality within and between countries | Reducing economic and social inequalities across regions and populations |

**Table 3** (Continued)

| serial number | target | Specific projects |
|---|---|---|
| 11 | Build inclusive, safe, resilient and sustainable cities and villages | Develop urban and rural planning, improve the quality of the living environment, and achieve inclusive development of urban and rural areas |
| 12 | Promote a green economy and ensure sustainable consumption and production patterns | Promote sustainable consumption and production to achieve efficient use of resources and environmental protection |
| 13 | Develop mitigation and adaptation actions to address climate change and its impacts | Take effective measures to combat climate change and reduce its negative impacts |
| 14 | Conservation and sustainable use of marine ecosystems to ensure biodiversity and prevent degradation of the marine environment | Protect the marine ecosystem, prevent marine pollution, and ensure the sustainable use of marine resources |
| 15 | Conserve and sustainably use terrestrial ecosystems to ensure biodiversity and prevent land degradation | Protect terrestrial ecosystems, prevent land degradation and ensure ecological diversity |
| 16 | Promote peaceful and pluralistic societies, ensure judicial equality, and build a credible and inclusive system | Promote peace, justice and justice, and build an inclusive and pluralistic social system |
| 17 | Establish multiple partnerships to promote a sustainable vision | Strengthen global cooperation, build diversified partnerships, and achieve the common goal of sustainable development |

**The impact of vacuum pyrolysis systems to treat waste and recover energy on sustainable development.**

Vacuum pyrolysis systems are used to treat waste and recover energy, which can have multiple positive impacts on sustainable development, some of which include: resource reuse, energy recovery, waste pollution reduction, climate change mitigation, technological innovation and employment opportunities, and compliance with sustainable development goals, as shown in the table below.

**Table 4** The impact of vacuum pyrolysis system to treat waste and recover energy on sustainable development

| serial number | Influence the project | description |
|---|---|---|
| 1 | Resource reuse | Vacuum pyrolysis systems are able to convert waste into useful products such as energy and activated carbon to maximize the reuse of resources and reduce the demand for natural resources. |
| 2 | Energy recovery | The system generates heat energy by pyrolyzing waste, which realizes energy recovery. It helps to reduce dependence on traditional energy sources and improve energy efficiency while reducing greenhouse gas emissions. |
| 3 | Reduce waste pollution | By turning waste into useful products, vacuum pyrolysis systems help reduce waste accumulation and environmental pollution. In line with the requirements of the Sustainable Development Goals on environmental protection and resource management. |
| 4 | Climate change mitigation | Through energy recovery and reduction of greenhouse gas emissions, vacuum pyrolysis systems help to mitigate the effects of climate change, in line with the requirements of the Sustainable Development Goals on climate action. |
| 5 | Technological innovation and employment opportunities | Promoting the application of vacuum pyrolysis technology may lead to technological innovation, while creating new jobs and promoting economic development. |
| 6 | In line with sustainable development goals | By addressing the twin challenges of waste treatment and energy recovery, vacuum pyrolysis systems contribute to the achievement of the United Nations 2030 Sustainable Development Goals, especially those on clean water and sanitation, sustainable cities and communities, and responsible production and consumption. |

## Research Methods

### Literature Search

First, previous relevant studies and literature will be analyzed to understand the existing knowledge of the vacuum pyrolysis system supply chain and sustainable development and to establish the theoretical basis for the research.

Database Analysis

Secondly, this study will search for technical information related to the supply chain of vacuum pyrolysis systems from the existing database.

**Case Studies**

In this study, we will use a case study in Taiwan to analyze the possible benefits of the system.

## Results and Discussion

**Results and analysis of research data**

Vacuum thermal, pyrolysis system

A typical vacuum pyrolysis system is applied in Taiwan, as shown in the figure below.

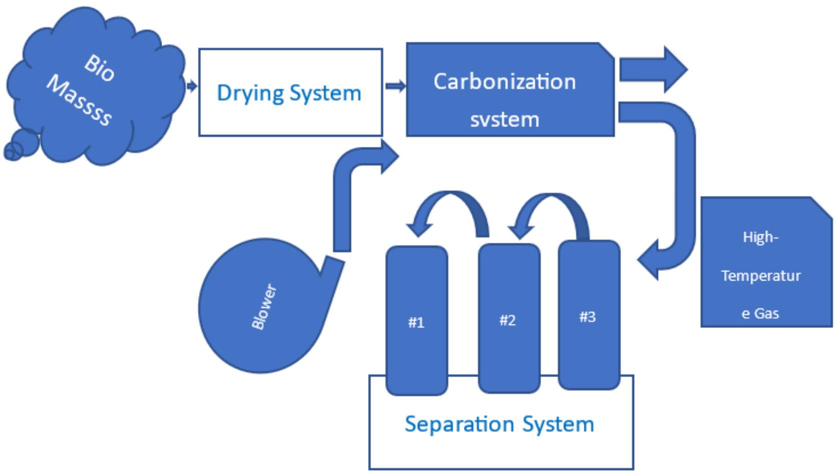


**Figure 1** Typical Vacuum thermal pyrolysis system

The system in the above diagram includes the biomass feed section, drying system, carbonization system, high-temperature gas discharge, and separation system (Ju et al.,2018).

Waste-to-energy and resource reuse systems

The conversion of waste into energy and resource reuse is an important feature of the system. Due to the built-in self-circulating power generation mechanism, the system can provide the power required by the pyrolysis equipment (Bishoge et al., 2019).

In a typical system applicable to Taiwan, biomass waste is used as raw material to achieve a heat recovery rate of more than 70% at a high temperature of 900℃. The methane produced during the cracking process is recycled for power generation, while the carbonaceous residue from the final product is converted into activated carbon, which becomes a high-value commodity.

Such a system demonstrates innovation in environmental management, reducing dependence on natural resources through efficient heat recovery and resource reuse, while at the same time bringing substantial improvements to the ecological environment and energy efficiency.

During the pyrolysis process, the methane produced can be used to drive a generator to generate electricity. After vacuum cracking, bio-organic waste is converted into activated carbon, which can be reused, enabling the entire system to achieve the goal of a circular economy.

Figure 2 shows the entire system of using pyrolysis equipment for waste to energy and resource reuse.

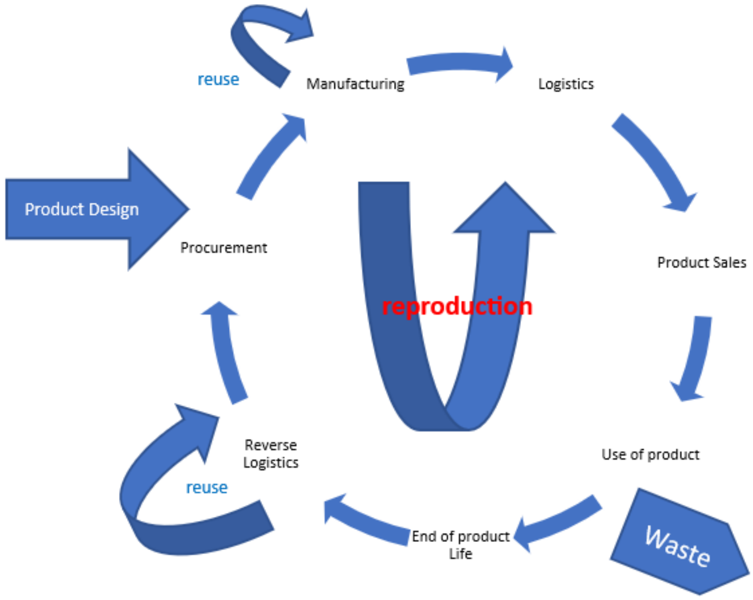


**Figure 2** shows the entire system of using pyrolysis equipment for waste to energy and resource reuse

## Discussion

**Possible problems faced by the supply chain of vacuum pyrolysis system**

Possible issues in the vacuum pyrolysis system supply chain include the following, as shown in the table below:

**Table 5** Possible issues in the vacuum pyrolysis system supply chain

| issue | description |
|---|---|
| The supply of raw materials is unstable | The supply of waste or organic substances as raw materials is subject to market fluctuations, regulatory changes, etc., which may lead to supply instability. |
| Technical equipment supply risk | The technical equipment required for the system may be dependent on a specific supplier, and its reliability, delivery time, and price fluctuations may affect the stability of the supply chain. |
| Cost pressures | Changes in the cost of technical equipment, raw materials and related services can have an impact on the economic performance of the supply chain, requiring effective cost management and risk control. |
| Technical support and maintenance challenges | Technical support and maintenance of the system is challenging, especially when it comes to resolving technical issues, providing real-time support, and ensuring the long-term operation of the system. |

**Table 5** (Continued)

| issue | description |
|---|---|
| Technical support and maintenance challenges | Technical support and maintenance of the system is challenging, especially when it comes to resolving technical issues, providing real-time support, and ensuring the long-term operation of the system. |
| Regulatory compliance risk | Changes in environmental regulations and regulatory standards can affect the compliance of systems and require constant adaptation and compliance with relevant regulations. |
| Difficulties in marketing and sales | Promoting and selling finished products manufactured by systems can face market acceptance, competitive pressures, and marketing challenges that require an effective marketing strategy. |
| Environmental and social responses | The heightened focus on environmental issues can create social and environmental pressures that require greater sustainability and environmental responsibility. |
| The speed of technological innovation | The rapidly evolving technology environment can make technology obsolete, and supply chains need to constantly keep up and adopt new technologies to stay competitive. |

**Whether the vacuum pyrolysis system supply chain is viable**

To ensure the stable operation of the vacuum pyrolysis system supply chain, the operations team needs to have an effective supply chain management strategy, which includes risk assessment, partner relationship management, technology refresh, regulatory compliance monitoring, and marketing strategy.

Attempts to convert waste to energy using vacuum pyrolysis systems are feasible, and although there are several difficulties mentioned above, these problems can be solved by technology. Vacuum pyrolysis systems are not difficult to process waste-to-energy or resource-based technology, but achieving continuous operation requires consideration of many factors, such as risk assessment throughout the supply chain, management of partners, the ability to continuously update technology, and changing regulations.

The smooth operation of the entire supply chain can be largely decided by two driving forces: manufacturing and commercial. The manufacturing supply chain includes circular supply and resource recovery, while the commercial side includes product life extension, shared platforms, and product services.

**Can the vacuum pyrolysis system supply chain have a positive impact on sustainable development?**

This system has a clear positive impact on environmental sustainability. The advantage of the system is that it is in line with the trend of environmental protection, can realize the reuse of resources, and reduces the secondary damage to the environment. This achievement is due to the self-circulating energy characteristics of the system, which can provide the required electrical energy for the pyrolysis plant.

During the pyrolysis process, the methane produced can be effectively used for gas-fired power generation, further reducing the need for traditional energy sources. The carbonaceous residue can be used as high-value activated carbon, opening up more possibilities for commercial applications.

Overall, the contribution of this system to environmental protection cannot be ignored. It not only effectively reduces energy consumption, but also realizes the transformation of waste into valuable products, promoting the process of environmental sustainability.

Since 2022, all listed companies in Taiwan have been required to implement carbon inventory as a standard for social corporate responsibility (ESG). Waste is regarded as one of the main sources of carbon emissions, so if waste can be effectively disposed of, it is expected to achieve ESG goals and meet the company's social responsibility commitment.

## Conclusions and Recommendations

### Conclusions of the Study

From the above study, we have derived the following conclusions. Firstly, the vacuum cracking equipment system is an effective waste conversion technology, capable of reducing carbon emissions and achieving energy recovery. Therefore, it has the potential to reduce environmental impact and, at the same time, enhance resource utilization efficiency. Secondly, in terms of sustainable development goals, this technology can be an effective means to promote the development of a circular economy.

### Recommendations of the Study

Here are suggestions for future research:

It is recommended that future researchers delve into the challenges faced by supply chain management in practical applications, particularly addressing issues related to promoting raw material markets and the roles of operators.

Provide recommendations for future supply chain system managers to ensure the sustainable operation of the system. This includes regularly monitoring technological advancements, conducting cost-benefit analyses, formulating corresponding policy support, and actively participating in social engagement strategies. These suggestions contribute to a deeper understanding of the challenges and opportunities of the vacuum cracking equipment system in practical applications. They also provide valuable guidance for future research and implementation.

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# An In-Depth Analysis of Tariq Malik's Impact on Global Business, Innovation, and Sustainability: A Rigorous Examination.

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## Abstract

Over the course of his academic career, Dr. Tariq Malik has published several papers on a variety of topics in the discipline of global business, innovation, and technology. Globalization, biotechnology, corporate governance, technological uncertainty, allied social capital, institutional barriers, knowledge transfer, innovation, entrepreneurship, defense investment, capitalist diversity, family business succession, negotiation styles, society, and other broad topics - the connection between nature and technology, the Belt and Road Initiative, intergenerational succession, clinical trial programs, the spread of K-pop music, legal and cultural emergencies, etc. In this article, we have categorized and commented on these articles in detail, including the content of the research, the direction of the topic, the research methodology, and the citation of theories. He also made expectations for his future research and possible contributions..

**Keywords:** Innovation Research, Corporate Governance, Supply Chain Management, Sustainable Development, Knowledge Diffusion

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## Introduction

**Brief overview of Tariq Malik's body of work**

Dr. Malik's academic research focuses on innovation, but his research also covers global trade, and sustainability, just to name a few. Granted to his prolific output during his academic career, he has exerted a certain influence in the academic circle. In this article, we intend to make a collation of his published literature to outline the full picture of his research, which we believe is also conducive to the follow-up research of future researchers, as we hope to see that Dr. Malik can play a greater role in related research fields in the future.

**Importance of the selected paper in the context of Malik's research**

From 2006 to 2023, Dr. Malik has published a total of research papers in both peer-reviewed journals and international conferences. The papers focus on a variety of topics that cover the global areas of business, innovation, and technology. To be more specific, those topics include globalization, biotechnology, corporate governance, technological uncertainty, allied social capital, institutional barriers, knowledge transfer, innovation, entrepreneurship, defense investment, capitalist diversity, family business succession, negotiation styles, society, and other broad topics - the connection between nature and technology, the Belt and Road Initiative, intergenerational succession, clinical trial programs, the spread of K-pop music, legal and cultural emergencies, etc.

From the perspective of management, the abundant categories mentioned above clearly demonstrate that Dr. Malik has expanded his research to different disciplines. On top of that, he has presented his research results in important journals and international seminars. It is sufficient to say that Dr. Malik’s works, given the increasing complexity of the management issue that we face nowadays, are a clear example of tackling new problems with past research experiences that we are looking forward to learning from.

The following is a brief overview of Dr. Malik’s extensive work, which can be broadly summarized as follows, according to the nature of his writings:

**Title and publication details**

The following is a rough classification of Malik's papers and the title of the article:

1. Globalization and Business Governance:

In this area, Malik published a paper in 2006 titled “Paradoxical dimensions of globalization in the biotechnology firms' network systems” at the IEEE International Conference on Management of Innovation and Technology. (Malik, 2006) and then in 2007, another paper, “An Analysis of Global Business Governance Structure and Prospects for Deglobalisation” came out (Malik, 2007a).

2. Biotechnology and Innovation:

In this area, in 2011 Malik published an article entitled “Real Option as a Strategic Technology Uncertainty Reduction Mechanism: Inter-firm Investment Strategy by Pharmaceuticals” which is presented in Technology Analysis & Strategic Management (Malik, 2011). In 2012, he published an article titled “Disparate Association Between Alliance Social Capital and the Global Pharmaceutical Firm's Performance”, which was published in International Business Review (Malik, 2012). Another paper entitled, “Complexities of scope and scale in claims: issues in vertical knowledge flow in cancer Biotechnology" was published in Int. J. Healthcare Technology and Management in 2013 (Malik, 2013a.). In the same year, he published another article entitled "Institutional Barriers in the Diffusion of High Technology: A Case of Biotechnological Innovation from a Chinese University". The article was published in the Journal of Chinese Entrepreneurship (Malik, 2013b).

3. Knowledge Transfer and University-Industry Relations:

In this area, Malik published an article in 2013 titled "National Institutional Differences and Cross-Border University-Industry Knowledge Transfer" in Research Policy (Malik, 2013c). He published an article entitled Positive Effects of opinion-count on job satisfaction of team members in business enterprises. The article was published in the Journal of Communication Management. Also, in the same year another article came out as "Resource-Dependent Influence on the International Entrepreneurial University's Premature NPD Termination". This paper was presented at the International Symposium at the 73rd Annual Meeting of the Academy of Management (Malikk, 2013e).

4. Defense and Science/Technology Transformation:

In this field, Malik published an article in 2017 titled "Defense Investment and the Transformation of National Science and Technology". The article was published in the journal Technological Forecasting & Social Change (Malik, 2017a). Another article titled, "Varieties of Capitalism, Innovation Performance and the Transformation of Science into Exported Products" was also published in" the journal Technological Forecasting & Social Change (Malik, 2017b).

5. Entrepreneurship and Family Business:

In this field, Malik published an article in 2017 titled "Founder's Apprehension in Small Family Business Succession in Thailand" on Sage Open (Malik, 2019a). In 2020 another article titled "Contextual Bricolage and the Founder's Apprehension in the inter-generational Succession of Small Family Businesses" was published in Management Revue: Socio-Economic Studies in a journal (Malik, 2020b).

6. International Relations and Negotiation:

In this field, Malik also published a paper in 2019 titled "Sino-Russian negotiation styles: A cross-cultural analysis of situated patterns". The article was published in the Asian Journal of Comparative Politics (Malik, 2019b).

7. Belt and Road Initiative:

In this area, Malik published an article titled "The Belt and Road Initiative (BRI) Project Legitimization: The Rhetor's Innovation and the US Response". The article was published in the Asian Journal of Comparative Politics (Malik, 2020a).

8. Clinical Trials and Health Management:

In this area, Malik published a 2020 paper titled "Culturally Imprinted Anxiety and the Itinerary of Clinical Trial Projects for its Management". The article was published in the journal Cross-Cultural Research (Malik, 2020c).

9. Sustainability and Environment:

In this field, in 2020, Malik published a paper titled “Science and Sustainability Dilemma: Greenland and CO2”. This paper was presented at The International Conference on Sustainability Management (Malik, 2020e).

10. Media and Consumer Behavior:

In this field, Malik published an article titled “Concrete Narrative and Media Ranking Effect on Consumer Satisfaction of DiDi Services in China”. The paper was published in the journal Digital Economy and Sustainable Development (Malik, 2023a).

11. Innovation and Technology Management:

In this area, in 2023, Malik published a paper titled Construal Levels and Innovation Project Time Estimations in Mental Health Management Intervention: Visual versus Acoustic. The article is published in the journal Current Psychology (Malik, 2023b).

12. Social Change and Cultural Factors:

In this field, in 2023, Malik published an article titled “Institutionally Manifested Mortalities Religiosity Mitigates Suicides; Uncertainty Intolerance Eclipses” in the book, The Palgrave Handbook of Global Social Change, edited by Baikady et al. (Malik, 2023c). Another article entitled “Tension and transition between technical and conformance devices in Sino-foreign university alliances towards innovativeness” was published in the International Journal of Chinese Education (Malik, 2023g).

13. International Business and Cultural Moderation:

In this field, Malik & Huo co-published a paper in 2022 titled “National Culture Moderates the Link Between Work Stress and Depression”. The article was published in the journal Cross-Cultural Research (Malik & Huo, 2022).

14. Miscellaneous Topics:

Malik has several studies that fall outside the scope of the above, so we have included them in the Miscellaneous Topics. In 2023, Malik wrote a paper that can be listed as a miscellaneous topic, entitled: “Science and sequestration for sustainability: more green space; more carbon-free earth” in the journal Digital Economy and Sustainable Development (Malik, 2023f). A year before, Malik wrote an article, also on a miscellaneous topic, entitled “Military-civilian partner selection for mental health management: An analysis of organizational and technological legitimacy” which was published in the journal Ethics, Medicine and Public Health (Malik, 2022). In 2023, he wrote an article entitled Legal and Cultural Contingencies in the Foreign Portfolio versus Foreign Direct Investment Decisions Across Countries, which was published in the Journal of The Knowledge Economy (Malik, 2023e).

15. Collaborative Research and Joint Publications:

Malik has also conducted several joint research projects with several peers, and in 2021 he and Choi co-published an article entitled: “Social Media Versus Personal Experience in the Consumer's Apprehension of imported food, security, and safety dilemma”. This article was published in the journal Sage Open (Malik & Choi, 2021). He co-published an article with Huo in 2019, entitled ‘Entrepreneurial State vs

Liberal Market: Chinese Comparative Advantage in the Transformation of National Science to Technology Artefacts". This article was published in the journal Chinese Management Studies (Malik & Huo, 2019a). In 2016, Malik and Yun co-authored an article titled "Operational complexity of foreign innovation projects and the inter-organizational alliance in the biopharmaceutical industry in China". This article was published in the journal Technology Analysis & Strategic Management (Malik & Yun, 2016). In 2013, he co-published an article with Zhao entitled: "Sino-Foreign University Collaboration and its Implications: An Analysis of the Development of Chinese University's Reputation". This article was published at the Annual Conference of the Academy of Innovation & Entrepreneurship at Oxford University (Malik &Zhao, 2013).

16. Quantitative Analysis and Modeling:

Malik has done a lot of research in this area. In 2022, he co-authored an article titled "The Impact of Climate Change on Agricultural Total Factor Productivity: A Cross-Country Panel Data Analysis, which was published in The Agriculture Issue (Xiang, et al., 2022). In 2020, he co-authored an article entitled: "The impact of population pressure on global fertilizer use intensity, 1970–2011: An analysis of policy-induced mediation". This article was published in the journal Technological Forecasting & Social Change (Xiang, et al., 2020).

17. Media and Innovation Perception:

In this area, in 2021 Malik co-authored an article titled "The Role of Media Coverage in the Audience's Legitimacy Judgment about Disruptive Innovation: An Empirical Study of DiDi in China" in the journal Technology Analysis & Strategic Management (Yu et al., 2021).

18. Sports Sponsorship and Brand Trust:

This field is an important research topic in marketing, and in 2019, Malik co-authored an article entitled: "The negative spillover effect in sports sponsorship: An experiment examining the impact of team performance on sponsor's brand trust". The article was published in the International Journal of Sports Marketing and Sponsorship (Yuan et al., 2019).

**The main objective of these papers**

As can be seen from the analysis in the previous section, Dr. Malik's research covers a wide range of disciplines, yet all are rooted in management science. He attempts to use the philosophy of management to explain the various phenomena that may be encountered in this world, and to make in-depth interpretations from the perspective of management. Therefore, he chose different topics to conduct research and made incisive analyses based on management theories one by one. At the same time, he also adopts different research methodologies in an attempt to convince the reader of his rigorous research process.

We can also safely say that Dr. Malik is an expert in management science who applies his knowledge to various phenomena in the world today, including social problems, political problems, environmental problems, international systems, and scientific and technological developments, just to name a few. He adopts the classical theories of management and also the research methods of management science so that everyone can see his research in management in these papers, and also let everyone see the infinite possibilities of management, which can play a great role in solving the problems faced by today's society.

**Key findings and contributions**

The findings and contributions of Dr. Malik are detailed in each of these articles, and what we want to express here is to synthesize his scholarly contributions and findings in these 50 papers with a thorough understanding of his works.

Academically, Dr. Malik's articles all originate from a management perspective, so he has developed many new areas for management research. For example, in the field of innovation research, he discussed the development of technology and the diffusion of science and technology. On the phenomenon of social change, he analyzes cultural factors. In terms of business management, his research topics cover from large enterprises to small and medium-sized enterprises. On the topic of public health, he does management analysis on the topic of clinical medical trials. In terms of the current international situation, he conducts research on the Belt and Road Initiative promoted by China. All of these demonstrate not only his expertise but also his enthusiasm for doing academic management research, and he also tries to do further research from the perspective of a management scholar.

## Literature Review

**Overview of Tariq Malik's research themes and areas of interest**

We have categorized his articles in the previous chapter, and here we will analyze them further based on a few important categories.

If we categorize it into several key domains, we can roughly divide his article into 1. Globalization and Governance; 2. Technology and Innovation Strategy; 3. Institutional Factors in Knowledge Transfer; 4. Innovation Performance and Varieties of Capitalism; 5. Belt and Road Initiative and International Business; 6. Science, Sustainability, and Cultural Contingencies. As shown in Figure 1.

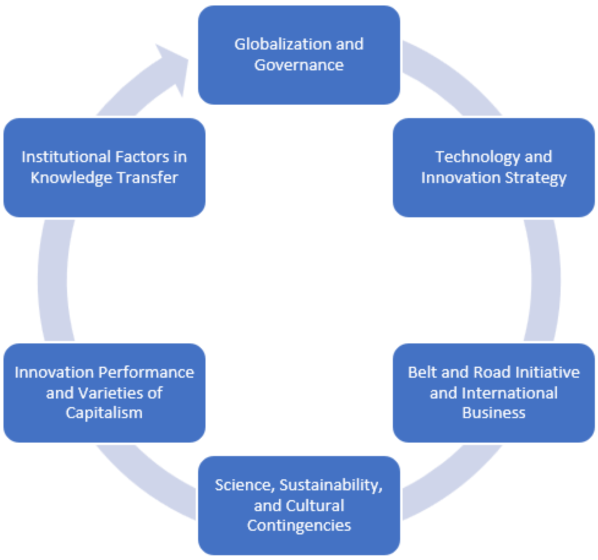


**Figure 1** Main classifications of Malik's papers

In the area of globalization and governance, he discusses the ambivalence of globalization in biotech company network systems (Malik, 2006); global business governance structures and deglobalization prospects are also discussed (Malik, 2007a); as well as stable institutions and new technologies, while comparing the biotechnological systems of China and India (Malik, 2007b). It ranges from China to India and even analyzes the trends of globalization and deglobalization.

In terms of technology and innovation strategy, he uses physical options as a strategic technology uncertainty reduction mechanism and discusses the investment strategy using pharmaceutical companies as an example (Malik, 2011). He uses the different associations between allied social capital and the performance of global pharmaceutical companies to conduct an empirical analysis to derive more credible results on the complexity of claim scope and scale (Malik, 2012). In addition to his case studies on the problem of vertical knowledge flow in cancer biotechnology (Malik, 2013a), he also uses the example of biotechnology innovation in Chinese universities to study institutional barriers to high-tech diffusion (Malik, 2013b).

In the study of knowledge dissemination, he uses national institutional differences and cross-border universities to illustrate industry and knowledge transfer (Malik, 2013c). Opinion counts are used to illustrate the positive impact of team members' job satisfaction (Malik, 2013d). One of his works discusses the impact of the premature termination of NPD in international entrepreneurship universities from the perspective of resource dependence (Malik, 2013e). Finally, the issue of national defense investment and the transformation of national science and technology was discussed (Malik, 2017a).

On innovation performance and the plurality of capitalism, Dr. Malik uses a panel analysis approach to illustrate the diversity of capitalism, the performance of innovation, and the transformation of science into export products (Malik, 2017b). A study concerning business founders about the succession of small family businesses in Thailand for the succession of small and medium-sized enterprises was conducted (Malik, 2019a). At the same time, the negotiation style of China and Russia is analyzed from the perspective of negotiation mode, and the cross-cultural perspective of situational mode. (Malik, 2019b)

On the Belt and Road Initiative and international business, Dr. Mallik discussed the legitimization of the Belt and Road Initiative (BRI), illustrated by the rhetorical innovation and the U.S. response (Malik, 2020a). He also addresses the context patchwork and founders' concerns in the succession of small family businesses from generation to generation (Malik, 2020b). The anxiety of cultural stigma and the itinerary of the clinical trial project of its management are discussed in detail (Malik, T. H. 2020c).

In the area of science, sustainability, and cultural contingencies, Dr. Malik wrote an article on legal and cultural contingencies in foreign investment portfolios and cross-border direct investment decisions (Malik, 2023e). He also showed his concern for the protection of the earth's environment, discussed the isolation of science from sustainable development, and looked forward to the emergence of more green spaces, and a more carbon-free planet (Malik, 2023f). In addition, he discussed the tension and transformation between innovative technologies and consistent means of Chinese and foreign university alliances (Malik,2023g).

**Comparison with other relevant literature in the field**

In the upcoming generation, there remain two questions that scholars are concerned about, and we wish to get answers from Dr. Malik's research. The first one is Safely Chain Management, and the second is Sustainable Management. Although we have not seen any of the 50 articles so far that he has written much on these two topics, we still expect to see more of his articles on these two topics shortly.

1. Supply Chain Management

In the upcoming generation, there remain two questions that scholars are concerned about, and we wish to get answers from Dr. Malik's research. The first one is Safely Chain Management, and the second is Sustainable Management. Although we have not seen any of the 50 articles so far that he has written much on these two topics, we still expect to see more of his articles on these two topics shortly.

2. Sustainable Management

Sustainable management is a common issue for everyone in the future. Sustainable management is not only a business strategy, but also a manifestation of values and ethics. Within the framework of sustainable management, businesses and organizations focus not only on short-term profits, but also on the impact on the environment, the interests of the community, and the well-being of employees. This management approach encourages innovation and promotes technologies that reduce resource waste and energy consumption, while emphasizing social responsibility and fair trade. It emphasizes the collaboration of suppliers, consumers, governments, and NGOs to achieve sustainability goals and build shared values. Sustainable management also involves transparency and reporting, enabling organizations to disclose their environmental, social and economic performance to stakeholders. This transparency helps build trust, improve the social image of the business, and attract more consumers and investors.

Sustainable management is also a philosophy of operational and organizational management that aims to ensure that the needs of the present are met without compromising the ability of future generations to meet their needs. This management approach emphasizes environmental, social and economic balance and pursues sustainable development in the long term. The above demands have been touched upon by Malik in his past articles.

## Methodology

**Brief description of the research methods employed in the selected paper**

Over these 50 papers, we have seen that Dr. Malik skillfully uses a variety of different management research methods, both qualitative and quantitative.

Using in-depth interviews for qualitative research, he successfully conducted a qualitative study on how to pass on his business to the next generation as an entrepreneur in a small to medium-sized Thai enterprise. This is a very inner world, and it is not easy for us to use quantitative data to see the changes in this inner thought, so only with the help of in-depth interview techniques can we see the essence of the problem, and this article made full use of the skills of qualitative research, and also obtained good results.

In other studies, it is common to see the quantitative analysis model being used in management science, and he makes extensive use of questionnaire analysis techniques to obtain accurate mathematical models but does not adhere to the framework of mathematical models only. Therefore, from his thesis, it can be seen that he emphasizes the inner mental world discovered by management, and he attaches importance to the influence of the inner world on the phenomena of the external world and believes that a model is just a tool we use, and the results seen by the model must ultimately be carried out by our own will to produce benefits.

Nevertheless, we can still see that he has a good grasp of quantitative research tools, and he also uses economic databases for panel data analysis to provide a clear interpretation of social change from the perspective of overall economics.

**Evaluation of the appropriateness and effectiveness of the methodology**

From his research, we can see that his research is all well-founded. Regardless of the research methodology, his article has sufficient data to support his conclusions, which is in line with the spirit of the management research paper, which is to explain your findings through data. This is also the reason why the Malik article is very readable.

## Contributions to the Field

**Discussion of the paper's significance in advancing knowledge in the field**

The 50 research papers published by Dr. Malik were all empirical research. Therefore, its reference value is extremely high. More importantly, each of his papers has a very strong theoretical support, which makes his articles not only have a modern sense, but also be in line with the past theories of management, and give full play to the application value of management academics.

**Potential implications for future research and practical applications**

Based on our understanding of the work and the aim of the journal, we expect that we will be able to add to the following research areas in the future:

1. From the perspective of organizational innovation, supply chain management is fundamentally transformed. The traditional supply chain theory comes from the concept of enterprise management is mostly the same, spanning from the scope of production, sales, human resources, R&D, and financial management, which are mostly inseparable. However, with the increasing complexity of supply chain management, the supply chain itself has become a very large organization, so it is possible to analyze the supply chain organization with a systematic concept where the supply chain organization can be innovated and reformed so that the management of the supply chain can be more efficient.

2. Research on sustainable development from the perspective of systems innovation. Since sustainable development is an important aspect of today's social science disciplines, and from a systemic point of view, what kind of ways should systems from large and small promote sustainable development, this is what we expect the authors to make to contribute to this field.

## Limitations

### Identification and discussion of any limitations in the selected paper

It is precisely because the field of his 50 papers involve many fields that his influence has reached a very broad aspect, but it is precisely because the scope of the papers is too broad that the articles in some fields will make people feel unfinished. In the area of sustainability, for example, there exist only two articles at the moment, which is an area that could be strengthened. In addition, although there are wonderful articles on social changes and technological innovations, we still look forward to more work in the future.

### Suggestions for overcoming or addressing these limitations

These developments will take time and more collaborators will be needed to get involved in cross-cutting research. In previous research, it was rare to see the co-authorship of Malik with other scholars, which also limited his paper output, and we hope that in the future there will be more opportunities coming for extensive collaborations between Dr. Malik with scholars in different fields. In that way, the expertise of Dr. Malik could be comprehensively combined with ideas from other disciplines, possibly making yet another greater contribution to this academic society.

## Conclusion and Recommendations

### Summary of key points discussed in the review

In the AI generation, we are fortunate to see that Malik has written so many books with his wisdom, which are all independently based on the theories of the field of management. Therefore, he opened the door for us to study management. Let the backward students in the field of management see the frontier of management. His article deserves careful reading by management researchers.

### Suggestions for further research inspired by the paper under review

In the AI generation, we are fortunate to see that Dr. Malik has written so many books with his wisdom, which are all independently based on the theories of the field of management science. Therefore, he opened the door for us to study management. Let the backward students in the field of management see the frontier of management. His article deserves careful reading by management researchers.

**Table 1** Further categorization of Malik's articles in recent years

| No. | Category | Example |
|---|---|---|
| 1 | Defense Investment and High Technology Exploitation | Defence Investment and the Transformation of National Science and Technology: A Perspective on the Exploitation of High Technology Technological Forecasting & Social Change (Malik, 2017a). |
| 2 | Varieties of Capitalism, Innovation Performance, and Science Transformation | Varieties of capitalism, innovation performance and the transformation of science into exported products: A panel analysis (Malik, 2017b). |
| 3 | Cross-Cultural Analysis and Negotiation Styles | Sino-Russian negotiation styles: A cross-cultural analysis of situated patterns (Malik, 2019b). |
| 4 | Society-Nature-Technology Nexus and Institutional Causes | . Society-Nature-Technology (SNT) Nexus: Institutional Causes and Cures of National Morbidities (Malik, 2019c). |
| 5 | Belt and Road Initiative (BRI) Project and Innovation Response | The Belt and Road Initiative (BRI) Project Legitimisation: The Rhetor's Innovation and the US Response (Malik, 2020a). |
| 6 | K-Pop Music Diffusion and Visual Technology | K-Pop Music Diffusion in Korea and East Asia: Convergence of Visual Technology and Concrete Narratives (Malik, 2023d). |
| 7 | Legal and Cultural Contingencies in Foreign Investment Decisions | Legal and Cultural Contingencies in the Foreign Portfolio Versus Foreign Direct Investment Decisions Across Countries: An Institutional Fit Perspective (Malik, 2023e). |

**Possible avenues for future exploration in the same research domain**

We look forward to seeing Dr. Malik focus on the correlation between the following topics in the future, as shown in Figure 2.

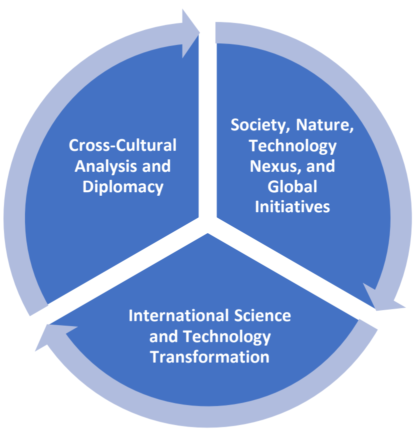


**Figure 2** We look forward to future research on the linkage

**Concluding remarks on the overall quality and significance of Tariq Malik's selected paper**

Malik's articles are published in leading international journals, so the quality of his articles is recognized by rigorous peer review. This paper will not be commented on here. Only from the perspective of management can we briefly comment on his contribution to the article. It is recommended that readers read the original article from the journal where the article is cited so that they can get more inspiration.

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## Author Guidelines

**For Paper Submission and Manuscript Preparation**

**General Instructions**

The Journal of Supply Chain and Sustainability Research (SCSR) accepts research papers, academic articles, and review articles written in Standard British or American English, not a mixture. Poorly written English may result in rejection or return of the submission for language editing. The articles must fall within the aim and scope of the journal, that is, science, social science, technology, management, and related issues (see about Journal).

Please note that papers in these areas in order to be published in the SCSR journal Research or academic papers must be 15-20 pages in length inclusive of references, tables, graphs, charts, and figures.

**For research papers**, the author is advised to include all elements of the structure below:

- **Title** of paper must be clear, concise, and informative, all-in uppercase within three typeset lines.
- **Abstract** (150-250 words) Abstracts must include sufficient information for readers to judge the nature and significance of the topic, the adequacy of the investigative strategy, the research results and conclusions. The abstract should summarize the major results of the work and not merely list topics to be discussed. It is an outline or brief summary of your paper in a well-developed paragraph, should be exact in wording, and understandable to a wide audience.
- **Keywords** (3-5)**,** immediately after the abstract**,** keywords are for indexing purposes, and should be different from the title.
- **Introduction** This section provides necessary background of the paper and a brief review the existing knowledge, and importance of the problem.
- **Objectives**
- **Literature Review, Conceptual Framework (**Discussion of the research work of others in the field or topic area and how your work will enhance and contribute to the field. Citation of work by others should follow APA (7th edition) style e.g.

Example: Maslow (1970) asserts that……; ……………. (Maslow, 1970)
Wang and Pettit (2021).............; .................. (Wang & Pettit, 2021)
Hisrich et al. (2020)…………….;…………… (Hisrich et al., 2020)

Novack et al. (2018)…………….; …………… (Novack et al., 2018)

- **Research Methodology** This section indicates clear research objectives, conceptual framework(s) (if any), research question(s), hypotheses, population and sample, research instruments, and the data collection process. This section provides clear steps used in conducting your research. It means all procedures need to be described in sufficient detail to allow someone to replicate it.
- **Results and Discussion** This section covers the analysis of the data. It should include statistics in tables, charts, graphs, or pictures analyzed against hypotheses or in answering the research question(s) in quantitative research, or descriptive analyses of categories in qualitative research. **Results** is purely descriptive. **Discussion** describes and interprets the findings, placing them in a bigger context, relating them to other work(s) and issues outlined in the Introduction.
- **Research Benefits**
- **Conclusion and Recommendations** This section summarizes your study's key findings and implications. It should not be long and repetitive, but capture the essence of the study discussed in all previous sections. It should briefly cover the limitations of your research and suggested future direction for further research.

**For academic articles, we** recommend the structure below:

1. **Introduction**
2. **Discussion**
   **2.1 subheading**
   **2.2 subheading**
3. **Conclusion**

The author is advised to follow a logical, understandable point of argument. Break your main argument into sub-headings and present them in an outline at the end of the Introduction.

- **References List** all the sources you have cited in the body of your research. It states the author/s of the source, the material's year of publication, the name or title of the source material, as well as its electronic retrieval information, including the date it was accessed, if these were gathered from the Internet (Research articles, academic articles, reports, academic conferences, references, no later than the last 5 years and Books, unlimited years of reference)

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Authors are welcome to submit their manuscripts.

All submissions will be given an initial check by our editorial team, within **6-8 weeks after submission date** you will be notified of the initial check result on thaiJo system. Only the article which passes the initial check will proceed to the review process (6 -8 weeks). The author will be kept informed of the current status of their paper.

**Articles being currently considered for publication by other journals will not be accepted by The Journal of Supply Chain and Sustainability Research (SCSR). If the author withdraws or sending a manuscript to other journals any time after the manuscript has been sent to peer review till the final decision, the Journal will charge the author a penalty fee for its time and resources spent. The authors must always pay the page charge even if the withdrawal is permitted.**

**Specific Instructions:**

- **Format** The preferred format for the text and tables of a manuscript are MS Word DOC and PDF.
- **Paper size** Manuscripts must be typed double-spaced on A4 size paper, a single column format.
- **Margins** Use a 1-inch margin on all sides of each page-left, right, top, and bottom.
- **Spacing** Double space lines throughout the paper including appendices, footnotes. Exceptions: Triple or quadruple spacing can be done around equations. Single or one-and-a-half spacing can be done in tables or figures. Indent the first line of every paragraph a standard Tab key space (½ inch).
- **Font Size and Type**. Browallia New font (20 pts. bold for title; 14 pts. for author(s) and affiliation; 16 pts. bold for headings and 16 pts. bold subheadings; and 14 pts. for text)
- **Titles** should be no more than three typeset lines.
- **Headings** should be in bold type, in 16 point Browallia New font. First-level headings should be aligned to the left with initial caps. One line space should separate headings from the preceding text.
- ***Subheadings*** Italicize the subheadings in the bold type, single-spaced; in 16 point Browallia New font.

**SUB-HEADING ONE** Bold, Left, UPPERCASE HEADING

**Sub-heading Two** Bold, Left, Capitalize Each Word

**Sub-heading Three** Indented, bold, Capitalize Each Word

- Tables, Graphs, Charts, and Figures in 12-point Browallia New font, Bold
- **References** The Journal uses American Psychological Association (APA) style ($7^{th}$ edition).
  - Include only those sources you have cited in your paper.
  - Position the first line of each reference flush left, with subsequent lines wrapping with a ½-inch (hanging) indent.
  - Organize the list in alphabetical order according to the first letter beginning each entry. Usually, the author's last name is the first piece of information in each entry. Use initials for the author's first/middle names.
- Use the following format for your reference list:

Cokins, G., Pohlen, T., & Klammer, T. (2018). *Supply Chain Costing and Performance Management* ($2^{nd}$ ed). New Jersey : Wiley.

Hisrich, R. D., Peter, M. P., & Shepherd, D. A. (2020). *Entrepreneurship* ($11^{th}$ ed). New York : McGraw- Hill.

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- **Tables and Figures**
    - Line drawings should be of high resolution and high contrast. For color or grayscale photographs (halftones), use a minimum of 300 dpi (.JPG).
    - Provide captions to figures
    - Use the table function of Microsoft Word.
    - Figure and tables should be placed as close as possible to where they are mentioned in the text
- **Page Numbering**: Number all pages of the paper, beginning with the title page. The number is in the bottom right corner (1 inch from right and ½ inch from the bottom page edges).

**Publication Charge**

**Publication Charge**

The process of payment will be required to enable an effective and efficient screening process. Fee payment will be due at registration, will be **150 USD for both Thai and international authors. This fee is non-refundable.**

**Remark: The fee shall be in effect from October 1, 2026 onward.**

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1. The manuscript must not have been published or submitted elsewhere for consideration. (A brief explanation will be necessary to clarify this matter.)
2. The submitted file is in **Microsoft Word** and **PDF** document file with a single column format.
3. Where available, URLs for the references must be provided.
4. Research or academic papers must be 15-20 pages in length inclusive of references, tables, graphs, charts, and figures.
5. The text must be double-spaced; (a 14-point font Browallia New; italics rather than underlining except for URL addresses); and all illustrations, figures, and

tables must be placed within the text at the appropriate points, rather than at the end.

6. The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.
7. Attached to all submitted articles must be a **150-250 words abstract**, **Keywords** (3-5) and a statement containing the author's present academic or nonacademic position and an address where he or she may be contacted by the editors or interested readers. Authors should place their names on the cover page, but the name should not appear on headers or elsewhere in the body of the article. Full contact details for the corresponding author, including email, mailing address and telephone numbers should also be provided. As the Journal of Supply Chain and Sustainability Research (SCSR) is a peer reviewed journal, the author must be follow the instructions about Ensuring a Blind Review.
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