2026
IEEE
ICEIB

An Initial Analysis of Improvement Measures (IMs) for CCE Industry's Female Labour Participation in Taiwan

Han-Wei Lai , Zheng-Yun Zhuang , Huang-Hsing Pan and Han-Tsung Liou

Department of Civil Engineering, National Kaohsiung University of Science and Technology (NKUST), Kaohsiung, Taiwan (ROC)

Presented by : Mr. Han-Wei Lai

April 24-26

Contents

Gender Inequality in Employment in the Engineering Industry

- The engineering industry has long been a male-dominated field.Women often face the following challenges:
  - ① **Low labour participation**
  - ② **Unfriendly workplace culture**
  - ③ **Limited promotion opportunities**
  - ④ **Pressure from work-family balance**

Official statistics in Taiwan also continue to show structural gaps in women's labour participation and wage treatment.

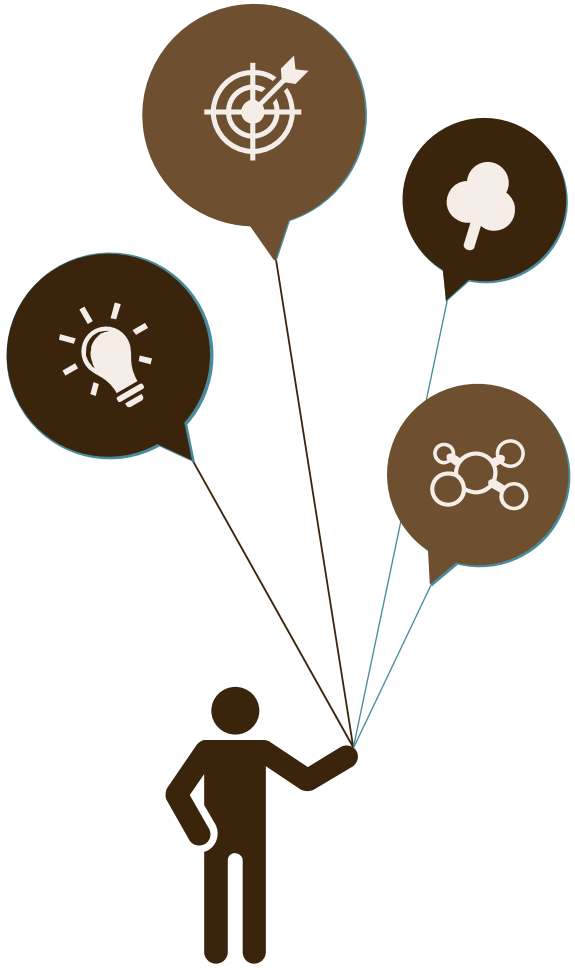
Previous Studies Have Rarely Compared Group Perspectives on Improvement Measures

- Existing studies mainly focus on:
  - ① **Women's workplace difficulties**
  - ② **Barriers to retention**
  - ③ **Overall gender differences in perceptions of workplace issues**

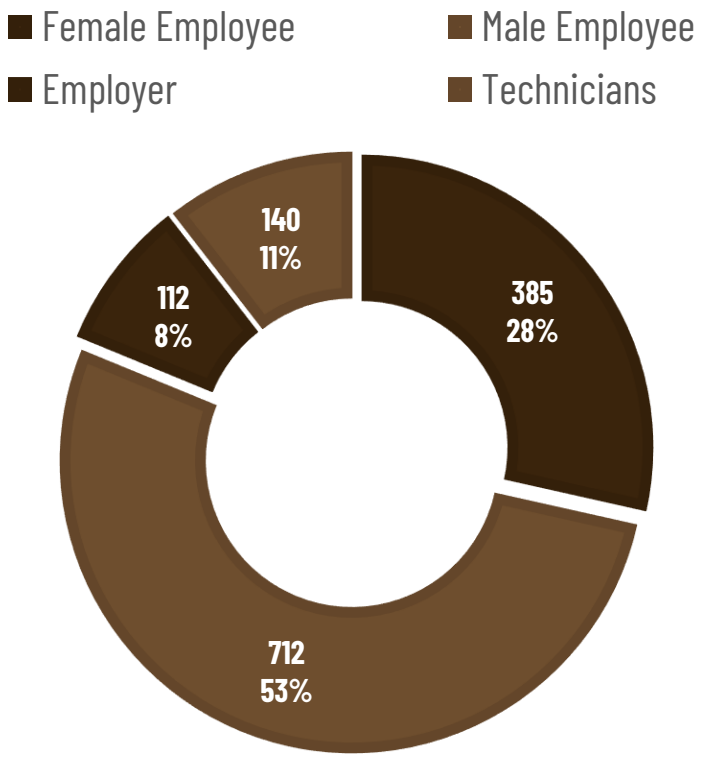
- However, fewer studies directly examine:
  - ① **Which improvement measures are most effective in increasing women's willingness to enter the industry**
  - ② **The differences and similarities among four stakeholder groups: female employees, male employees, employers, and specialists**

Introduction - Research Objectives

- To analyze differences in the evaluations of seven improvement measures across four stakeholder groups
- To compare female employees with the other three groups
- To examine the structural similarity of group opinions
- To provide empirical evidence for policy-making and human resource decisions in the industry



Introduction – Data structure



問卷 / 實地訪查 / 公會 / 社群 / 郵寄

1,351

Effective number of samples

Female Employee	385（28.5%）
Male Employee	712（52.8%）
Employer	112（8.3%）
Technicians	140（10.4%）

4 Categories

of related persons

7 items

Improvement measures (IMs)

- **IM1** Automated / modularized construction
- **IM2** Stable dedicated team
- **IM3** Sound management system
- **IM4** Stronger legal protection
- **IM5** Better salary conditions
- **IM6** In-service training incentives
- **IM7** Additional bonuses / incentives

Introduction - Seven improvement measures

IM1 Adopting automated facilities and modulization technologies during construction

IM2 Establishing a stable and dedicated construction team and avoiding staff turnover

IM3 Improving the management/control system of the CCE company

IM4 Amending the labor law further to enhance employment security for women

IM5 Raising or regulating the salary or pay for women

IM6 Encouraging in-service training by remuneration or awards

IM7 Giving additional bonuses or incentives

Analysis process

1) Unified seven improvement measures（ IM1–IM7 ）

2) Comparison of women vs men / employers / professional engineers

3) Significance comparison for each question

4) Examining the overall structure using Wilcoxon, KS, and correlation matrices

Methods - Research methods

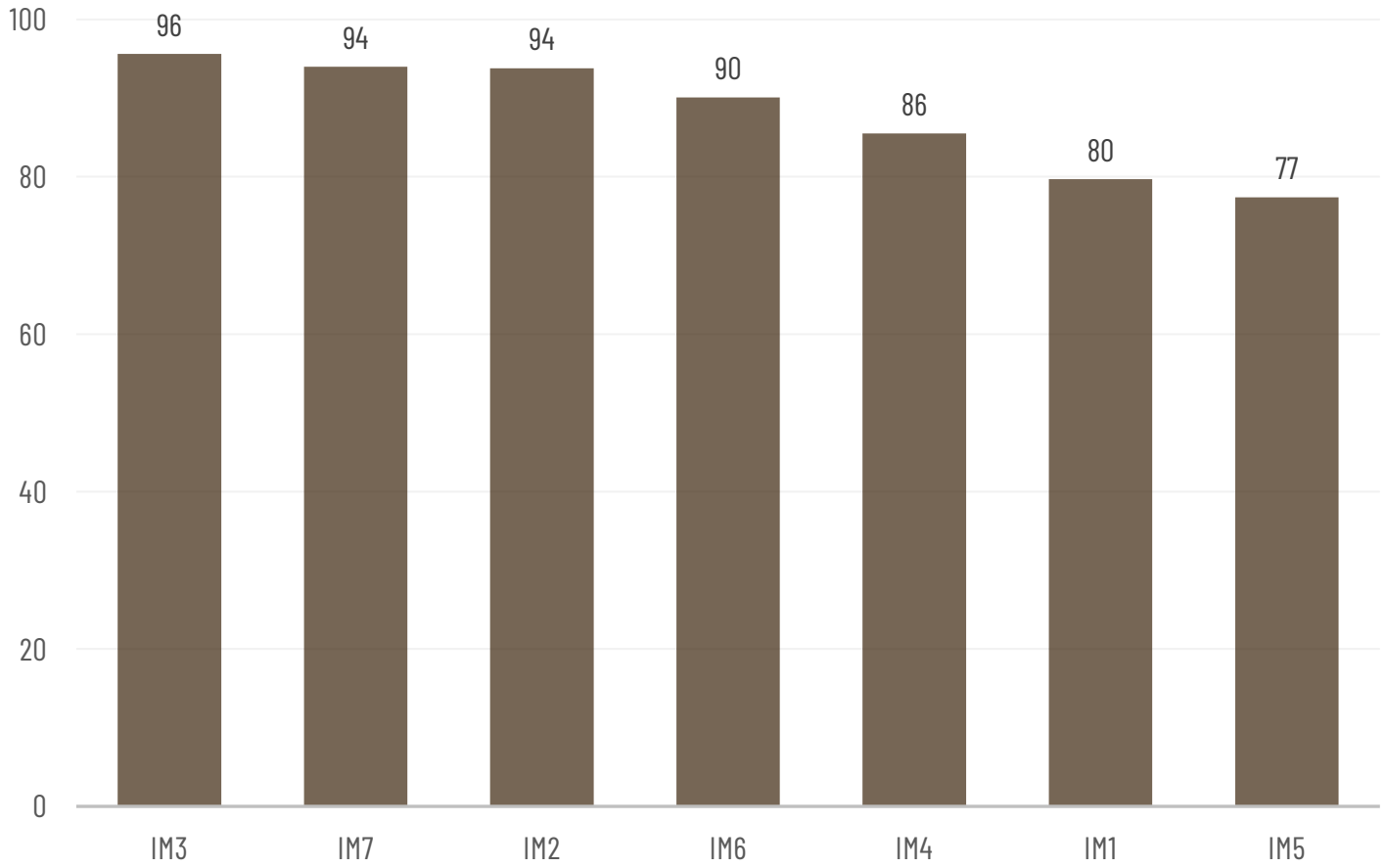
First level: Question-by-question difference analysis

- Compare the proportion of “Yes” responses for IM1–IM7 across the four groups
- Using female employees as the baseline, conduct pairwise comparisons:
  - ① **Female vs. Male**
  - ② **Female vs. Employers**
  - ③ **Female vs. Professional Engineers**

Second layer: Overall structural analysis

- Wilcoxon Test
- Kolmogorov–Smirnov (KS) Test
- Correlation Matrix Heatmap
- SCM-related structural analysis

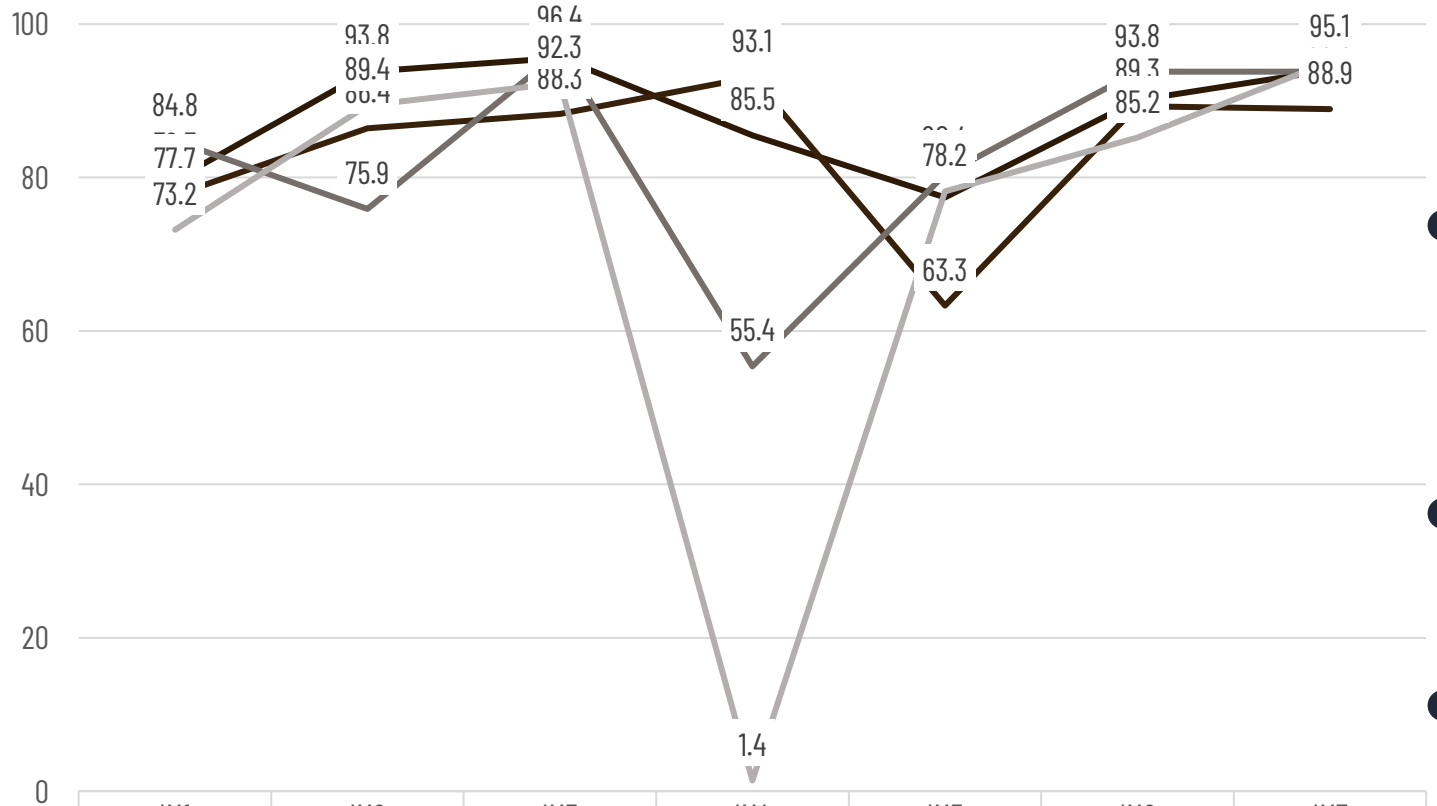
Results - Overall Attitudes of Female Employees toward Improvement Measures



Female employees' support rates across the seven IMs

- Top 3: IM3, IM7, IM2
- All seven IMs exceed 77%
- Women value system, team stability, and incentives together

Results - Comparison of Support Rates Across Four Groups



	IM1	IM2	IM3	IM4	IM5	IM6	IM7
Female Employee	79.7	93.8	95.6	85.5	77.4	90.1	94
Male Employee	77.7	86.4	88.3	93.1	63.3	89.3	88.9
Employer	84.8	75.9	96.4	55.4	80.4	93.8	93.8
Technicians	73.2	89.4	92.3	1.4	78.2	85.2	95.1

Interpretation

- All four groups show support for most improvement measures; however, their support structures differ
- IM4 (Regulations / Protection) exhibits the most significant variation among groups
- The ranking patterns between female and male employees are relatively inconsistent

Results - Item-by-Item Difference Analysis

Comparison between Female Employees and Other Groups

	Females vs. Males	Females vs. Employers	Females vs.Technicians
IM1	×	×	×
IM2	***p-value <0.001	***p-value <0.001	*p-value <0.05
IM3	***p-value <0.001	×	×
IM4	***p-value <0.001	***p-value <0.001	***p-value <0.001
IM5	***p-value <0.001	×	×
IM6	×	×	×
IM7	**p-value <0.01	×	×

Females vs. Males

5 / 7

Females vs. Employers

2 / 7

Females vs. Technicians

2 / 7

Female employees are structurally closer to employers and specialists than to male employees.

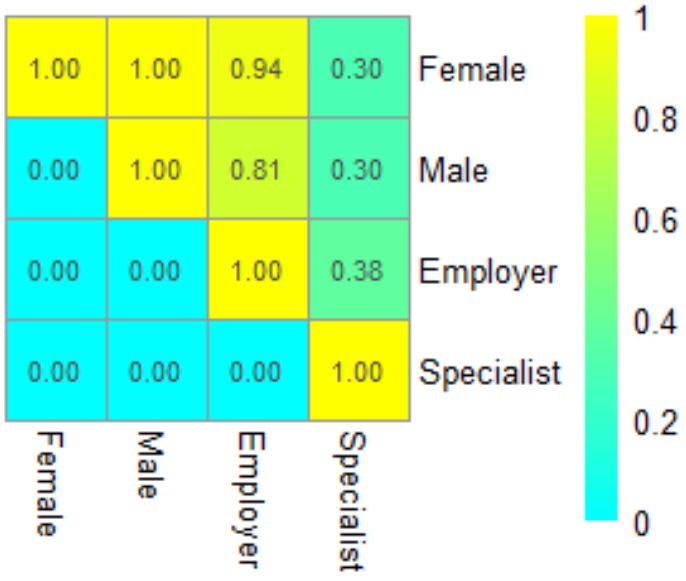
Results - Key Divergent IMs

Key Divergent IMs: IM2 and IM4

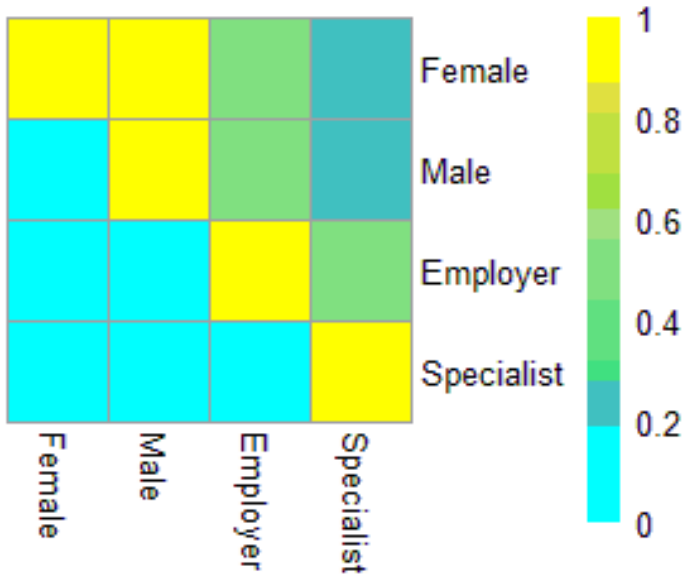
- **IM2 :** Establishing a stable and dedicated construction team and avoiding staff turnover.
- **IM4 :** Amending the labor law further to enhance employment security for women.

Both significantly distinguish female employees from **[Employers]** and **[Technicians]** .

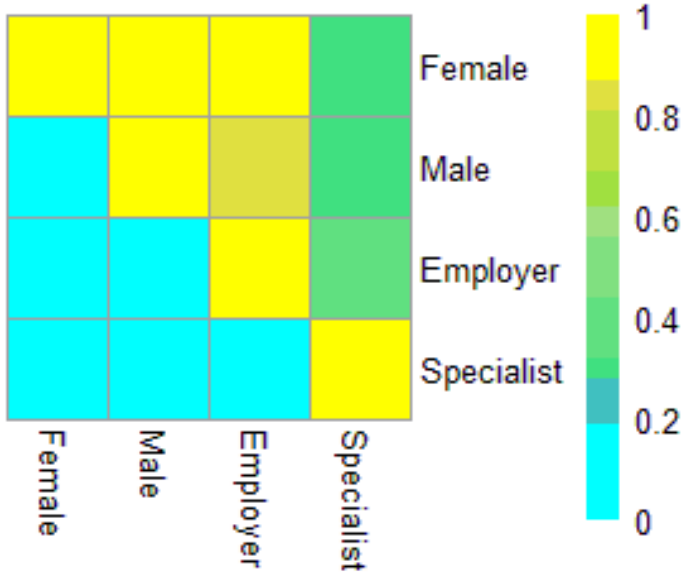
Results - Structural Similarity Across Groups



Correlation



KS



Wilcoxon

Results are consistent with the item-wise comparisons: female employees are relatively closer to employers and technicians, while a larger gap exists between female and male employees.

Discussion - Implications

Whose opinions should be consulted when designing improvement measures?

- Male-dominated perspectives may not fully reflect women's actual needs.
- Female employees' views should be treated as core inputs.
- The question is not only whether inequity exists, but how to improve it effectively.

Conclusions

1) Female vs. male employees showed the largest divergence.
2) Female employees were relatively closer to employers and specialists.
3) IM2 and IM4 were the most critical measures

Future Work

1) Extend to different engineering sectors and countries.
2) Develop a more complete decision-support model.
3) Deepen SCM-related cross-group structural analysis.

2026
IEEE
ICEIB

Thank you for your attention.

Han-Wei Lai , Zheng-Yun Zhuang , Huang-Hsing Pan and Han-Tsung Liou

Department of Civil Engineering, National Kaohsiung University of Science and Technology (NKUST), Kaohsiung, Taiwan (ROC)

Presented by : Mr. Han-Wei Lai

April 24-26