MEASURING GENDER BARRIER PERCEPTIONS IN THE SPACE SECTOR IN KOREA

Jung Sun Kim, Ph.D.
Executive Vice President, Dongseo University, Busan, Republic of Korea
Immediate Past President, INWES

June 21, 2024
Technical Presentation at the Committee on the Peaceful Uses of Outer Space (COPUOS)
“..If the space economy is to grow, we will need to attract substantial new talent to the industry. With the majority employed in the industry being scientists and engineers, getting more young people into the science technology, engineering and maths (STEM) fields is essential..”

Global Aerospace (February, 2023)

“..Overall, the number of women in the aerospace industry have fluctuated at around 20 percent for at least 30 years. Only 11 percent of astronauts so far, have been women..”

UN News (October 2021)
A Global Mission

- Increase representation of women in STEM (Gender Balance)
- Diversity & Inclusion in the STEM workplace

Balanced human development in the Space Sector
Paradox 1: Gender Equality & STEM

- Gender Gap in STEM has persisted → Leads to gender gap in Space sector

- Not enough women in R&D* in STEM Worldwide:
  - 31.2% for World
  - 33.2% for North America and Western Europe
  - 26.7% for East Asia and the Pacific

  *based on Headcounts in R&D from UNESCO Institute for Statistics (2020 data), downloaded October 2023

- Share of women in STEM workforce (2015-2023) remains to be less than 30% (WEF, Global Gender Gap Report 2023)

- Bias and gender stereotypes are driving women away from STEM careers → under-representation of women in STEM

- But, as societies become wealthier and more gender equal, women are less likely to obtain STEM degrees → the gender equality paradox
Paradox 2: STEM & Gender Barriers

- Science, Technology, Engineering & Mathematics are **rational** fields.

- Are scientists, technologists, engineers & mathematicians rational?
  - Environment surrounding scientists and engineers are not gender barrier proof.

- Why do Gender Biases exist in STEM (Space)?

- Do the Scientists and Engineers (in Space sectors) perceive the barriers?

---

**Gender gaps will fully close in 131 years at the current rate, according to the WEF Global Gender Gap report 2023.**
To resolve the paradox: Numbers

- Gender imbalance reflects a systemic talent-management problem.
- Women in STEM is a policy issue worldwide since early 2000
  - UNESCO (1999 World Conference on Science → 2004 Mainstreaming gender issue as top priority identified in International Consultation in S&T Priorities and Information)
- Numbers measured can serve as “evidence based statistics” for policy & decision making
  - UNESCO STEM and Gender Advancement (SAGA) Project: Gender parity through data building
  - Sex–disaggregated indicators can visualize gender disparities

An important consideration for the Space sector
AN EFFORT OF THE KOREAN GOVERNMENT TO RESOLVE THE GENDER GAP IN STEM (& SPACE)
## The HDI indices for the Republic of Korea (ROK): 1990-2022*

(HDI=1: highest human development)

<table>
<thead>
<tr>
<th>Year</th>
<th>HDI value</th>
<th>Life expectancy at birth (years)</th>
<th>Expected year of schooling (year)</th>
<th>Mean years of schooling (year)</th>
<th>Gross National Income per capita (2017 ppp $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.628</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>0.731</td>
<td>71.94</td>
<td>12.95</td>
<td>9.27</td>
<td>12,641</td>
</tr>
<tr>
<td>1995</td>
<td>0.780</td>
<td>73.94</td>
<td>14.27</td>
<td>10.00</td>
<td>18,044</td>
</tr>
<tr>
<td>2000</td>
<td>0.824</td>
<td>76.47</td>
<td>15.54</td>
<td>10.62</td>
<td>22,801</td>
</tr>
<tr>
<td>2005</td>
<td>0.861</td>
<td>78.52</td>
<td>16.36</td>
<td>11.24</td>
<td>28,434</td>
</tr>
<tr>
<td>2010</td>
<td>0.890</td>
<td>80.76</td>
<td>16.79</td>
<td>11.64</td>
<td>34,444</td>
</tr>
<tr>
<td>2015</td>
<td>0.908</td>
<td>82.56</td>
<td>16.57</td>
<td>12.12</td>
<td>38,948</td>
</tr>
<tr>
<td>2020</td>
<td>0.922</td>
<td>83.61</td>
<td>16.38</td>
<td>12.61</td>
<td>42,757</td>
</tr>
<tr>
<td>2022</td>
<td>0.929</td>
<td>84.02</td>
<td>16.51</td>
<td>12.61</td>
<td>46,026</td>
</tr>
</tbody>
</table>

The Change (1990-2022) **

- Korea ranks 19 /193 (Very High Human development)
- HDI: $\Delta$ 27.1%
- Life expectancy: $\Delta$ 12.1 yrs
- Education:
  - EYS $\Delta$ 3.6 yrs
  - MYS $\Delta$ 3.3 yrs
- GNI per capita: $\Delta$ 264.1%

## The Global Gender Gap Indices for ROK: 2023

<table>
<thead>
<tr>
<th>Year Published (Number of participating countries)</th>
<th>GGI</th>
<th>Economic Participation and Opportunity</th>
<th>Education Attainment</th>
<th>Health and Survival</th>
<th>Political Empowerment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rank</td>
<td>Value</td>
<td>Rank</td>
<td>Value</td>
<td>Rank</td>
</tr>
<tr>
<td>2006 (115)</td>
<td>92</td>
<td>0.616</td>
<td>96</td>
<td>0.481</td>
<td>82</td>
</tr>
<tr>
<td>2007 (128)</td>
<td>97</td>
<td>0.641</td>
<td>90</td>
<td>0.580</td>
<td>94</td>
</tr>
<tr>
<td>2008 (130)</td>
<td>108</td>
<td>0.615</td>
<td>110</td>
<td>0.487</td>
<td>99</td>
</tr>
<tr>
<td>2009 (134)</td>
<td>115</td>
<td>0.615</td>
<td>113</td>
<td>0.520</td>
<td>109</td>
</tr>
<tr>
<td>2010 (134)</td>
<td>104</td>
<td>0.634</td>
<td>111</td>
<td>0.520</td>
<td>100</td>
</tr>
<tr>
<td>2011 (135)</td>
<td>107</td>
<td>0.628</td>
<td>117</td>
<td>0.493</td>
<td>97</td>
</tr>
<tr>
<td>2012 (135)</td>
<td>108</td>
<td>0.636</td>
<td>116</td>
<td>0.509</td>
<td>99</td>
</tr>
<tr>
<td>2013 (136)</td>
<td>111</td>
<td>0.635</td>
<td>118</td>
<td>0.504</td>
<td>100</td>
</tr>
<tr>
<td>2014 (142)</td>
<td>117</td>
<td>0.640</td>
<td>124</td>
<td>0.512</td>
<td>103</td>
</tr>
<tr>
<td>2015 (145)</td>
<td>115</td>
<td>0.651</td>
<td>125</td>
<td>0.557</td>
<td>102</td>
</tr>
<tr>
<td>2016 (144)</td>
<td>116</td>
<td>0.649</td>
<td>123</td>
<td>0.537</td>
<td>102</td>
</tr>
<tr>
<td>2017 (144)</td>
<td>118</td>
<td>0.650</td>
<td>121</td>
<td>0.533</td>
<td>105</td>
</tr>
<tr>
<td>2020 (153)</td>
<td>108</td>
<td>0.672</td>
<td>127</td>
<td>0.555</td>
<td>101</td>
</tr>
<tr>
<td>2023 (146)</td>
<td>105</td>
<td>0.680</td>
<td>114</td>
<td>0.597</td>
<td>104</td>
</tr>
</tbody>
</table>

**Changes (’23 - ’06)**: 0.064, 0.116, 0.029, 0.009, 0.102

Despite remarkable economic growth, GGGI shows minimal progress.

HDI & GGGI, how far have we come?

<table>
<thead>
<tr>
<th>INDEX Year</th>
<th>HDI</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Index</td>
<td>Rank</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>0.731</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>0.861</td>
<td>26 / 186</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>0.929</td>
<td>19 / 193</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year published</th>
<th>GGGI</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Index</td>
<td>Rank</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>0.616</td>
<td>92 / 115</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>0.636</td>
<td>108 / 135</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>0.680</td>
<td>105 / 146</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STEM graduates % 2023 (female vs male)</th>
<th>ROK</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall STEM</td>
<td>25.22 vs 74.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering, Manufacturing, Construction</td>
<td>20.05 vs 79.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Science, Mathematics and Statistics</td>
<td>49.20 vs 50.80</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Jumped from poorest → economically powerful
- But, still quite low ranked in gender gap
- Gender gap in STEM improving

https://hdr.undp.org/content/human-development-report-2021-22
Women in STEM vs non-STEM workforce, 2015-2023

Source: 2023-06-25 from the WEF Global Gender Gap Report 2023 (p45)
The GISE Survey:
Measuring perception of Gender Barriers

A collaborative effort between KWSE and INWES
funded by the Korean government

GISE = Gender barrier perceptions In Science & Engineering
The Study was initially organized by KWSE together with the Asia Pacific Regional Network (APNN) of INWES, 2014-2018.

The Study turned Global in 2022 as a collaborative effort between KWSE and INWES, with the support from the Korean Ministry of Science and ICT.
Why Perception of Gender Barrier?

- Gender gap is still vivid in STEM
  - Gender gap varies by nation
  - by fields
  - and by workplace

- Gender perception is perceived differently among nations/regions, by fields, by workplace and by gender

- The numbers have not changed much

- Focusing in the increase of numbers or proportions of women in STEM has not been effective. (Need to Fix the system, not the women)

- Cultural change including awareness of hidden barriers is needed.

Why do so many women who study engineering leave the field? (Susan S. Silbey, Harvard Business Review, 2016)

- Different expectations: hope to use engineering in “some type of humanitarian work”
- Gender Barriers: culture of sexism and stereotypes left unaddressed

- A GISE index can be a “tool for change”
Joint project between INWES/KWSE & KARI supported by the KASA (Korea AeroSpace Administration)

<table>
<thead>
<tr>
<th>Method</th>
<th>Questionnaire from INWES/KWSE modified for Space fields, online Data Analysis* &amp; GISE Index calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents</td>
<td>Professional Women in Men (including graduate students) in the Space sector (affiliated with Research Institute, University, Industry)</td>
</tr>
<tr>
<td>Number of Responses</td>
<td>593 (female 153, male 440)</td>
</tr>
<tr>
<td>Survey period</td>
<td>October 18 ~ December 20, 2023</td>
</tr>
</tbody>
</table>

* Respondents: Professional Women in Men (including graduate students) in the Space sector (affiliated with Research Institute, University, Industry)

Number of Responses: 593 (female 153, male 440)

Survey period: October 18 ~ December 20, 2023

Data Processing (SPSS 25.0)
## The GISE-Space Questionnaire

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>No. of Questions</th>
<th>GISE</th>
<th>GISE-Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Personal Information</td>
<td>7</td>
<td>O</td>
<td>modified</td>
</tr>
<tr>
<td>B</td>
<td>Perception of Gender Barrier</td>
<td>6</td>
<td>O</td>
<td>modified</td>
</tr>
<tr>
<td>C,D</td>
<td>Experience of Gender Barrier (male/female versions)</td>
<td>6</td>
<td>O</td>
<td>modified</td>
</tr>
<tr>
<td>E</td>
<td>Career Outlook and Need for Policy</td>
<td>3</td>
<td>O</td>
<td>modified</td>
</tr>
<tr>
<td>F</td>
<td>Perception of Gender Role Stereotype &amp; Gender Equity</td>
<td>5</td>
<td>O</td>
<td>modified</td>
</tr>
<tr>
<td>G</td>
<td>Perception of Gender Equality for study and research Environment</td>
<td>7</td>
<td>O</td>
<td>modified</td>
</tr>
<tr>
<td>H</td>
<td>Gender Barriers in the Space Sector</td>
<td>5</td>
<td>X</td>
<td>O</td>
</tr>
</tbody>
</table>
1. Gender Gap in GISE-Space responses

### B. Gender Barrier Perception (GBP)

<table>
<thead>
<tr>
<th>Gender</th>
<th>GBP 1</th>
<th>GBP 2</th>
<th>GBP 3</th>
<th>GBP 4</th>
<th>GBP 5</th>
<th>GBP 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>2.37</td>
<td>2.17</td>
<td>1.82</td>
<td>2.28</td>
<td>2.27</td>
<td>1.57</td>
</tr>
<tr>
<td>Men</td>
<td>2.16</td>
<td>1.54</td>
<td>1.82</td>
<td>2.28</td>
<td>2.27</td>
<td>1.57</td>
</tr>
</tbody>
</table>

### C/D. Gender Barrier Experience (GBE)

<table>
<thead>
<tr>
<th>Gender</th>
<th>GBE 1</th>
<th>GBE 2</th>
<th>GBE 3</th>
<th>GBE 4</th>
<th>GBE 5</th>
<th>GBE 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>2.31</td>
<td>2.35</td>
<td>2.57</td>
<td>2.57</td>
<td>2.36</td>
<td>2.33</td>
</tr>
<tr>
<td>Men</td>
<td>1.34</td>
<td>1.37</td>
<td>1.56</td>
<td>1.58</td>
<td>1.49</td>
<td>1.35</td>
</tr>
</tbody>
</table>

### E. Career Outlook and Need for Policy

<table>
<thead>
<tr>
<th>Gender</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>2.65</td>
<td>4.17</td>
<td>3.94</td>
</tr>
<tr>
<td>Men</td>
<td>2.78</td>
<td>2.47</td>
<td>2.94</td>
</tr>
</tbody>
</table>

### F. Perception of Gender Role Stereotype & Gender Equity

<table>
<thead>
<tr>
<th>Gender</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>4.07</td>
<td>3.51</td>
<td>3.04</td>
<td>4.15</td>
<td>2.08</td>
</tr>
<tr>
<td>Men</td>
<td>4.46</td>
<td>3.53</td>
<td>3.04</td>
<td>4.15</td>
<td>2.08</td>
</tr>
</tbody>
</table>

### G. Perception of Gender Equality for study and research Environment

<table>
<thead>
<tr>
<th>Gender</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G6</th>
<th>G7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>2.73</td>
<td>2.83</td>
<td>2.65</td>
<td>2.73</td>
<td>2.9</td>
<td>2.97</td>
<td>3.43</td>
</tr>
<tr>
<td>Men</td>
<td>1.87</td>
<td>1.65</td>
<td>1.58</td>
<td>1.63</td>
<td>1.65</td>
<td>1.65</td>
<td>3.63</td>
</tr>
</tbody>
</table>

### H. Gender Barriers in the Space Sector

<table>
<thead>
<tr>
<th>Gender</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>2.43</td>
<td>2.13</td>
<td>2.65</td>
<td>1.72</td>
<td>2.11</td>
</tr>
<tr>
<td>Men</td>
<td>2.27</td>
<td>2.63</td>
<td>1.72</td>
<td>1.74</td>
<td>2.17</td>
</tr>
</tbody>
</table>
1. Gender Gap in GISE-Space responses

- Women perceived higher gender barriers (higher scores) than men overall.
- A statistically significant difference in responses (p<0.001) was observed between men and women in all questions except: F5, H1 and H4.
- No significant difference was observed for F5 (p>0.05) and H4 (p>0.05).
It is crucial to have strong policy support to solve gender inequality in the STEM field. It is equally difficult for a woman to get a job in the STEM field than for a man with the same qualifications and level.

Primary breadwinners (who take care of financial obligations) of households should be men. I believe gender equality will be fully achieved only if women are given equal opportunities as men.

Girls and boys are equally encouraged to choose their majors in STEM during their education period. Being promoted or becoming a tenured professor or a principal investigator is equally difficult for female scientists than for male.

Women in STEM receive equal work distribution and work appraisal compared to their male counterparts of the same qualifications and level. It is equally difficult for a woman to get a job in the STEM field than for a man with the same qualifications and level.

It is appropriate to introduce a quota system or affirmative action plan to solve gender inequality in the STEM field. My family, parents, or friends overall support my Space career.

In order to maintain the order and peace of a family, the husband should have a greater power and authority than the wife. Women in STEM are born to have a way of caring children that men are not capable of in the same way.

Women in STEM being disadvantaged in accessing research equipment or information because they are female.

The strictness, objectiveness and importance of the research outcome are equally respected regardless of the sex of the person in charge.

Women receive the same social evaluation and respect to men as scientists or engineers (by their colleagues, professor, funding donors, academic association, scientific society etc).

Women in STEM being in trouble or leaving work due to her marriage, pregnancy or child care have the same effect on scientists/engineers regardless of their sex for their study, research or project performance.

Women in STEM being sexually harassed (linguistical or physical) or treated unfairly by their colleagues, professor, funding donors, academic association, scientific society etc.

Female students in STEM receive equally fair assessments and appraisal compared to their male counterparts of the same qualifications and level for their work, task or project results.

The applicant with female sex is unfairly treated regardless of the sex of the person in charge of the administrative or budget process of the research project.

Female students in STEM are intimidated in the laboratory or in classes because they are female.

My career in the Space field has been developing/advancing smoothly.

It is inappropriate to introduce a quota system or affirmative action plan to solve gender inequality in the STEM field.
### 2. STEM vs Space GISE: Women

<table>
<thead>
<tr>
<th>Classifications</th>
<th>Question</th>
<th>ST vs SP</th>
<th>Gap (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B. Perception of Gender Barriers</strong></td>
<td>Girls and boys are equally encouraged to choose their majors in STEM during their education period.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Female students in STEM receive equally fair assessments and appraisal compared to their male counterparts of the same qualifications and level for their work, task or project results.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Women in STEM receive equal work distribution and work appraisal compared to men of the same qualifications and level.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>It is equally difficult for a woman to get a job in the STEM field than for a man with the same qualifications.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Being promoted or becoming a tenured professor or a principal investigator is equally</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>It is crucial to have strong policy support to solve gender inequality in the STEM field.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Primary breadwinners (who take care of financial obligations) of households should be men.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Women are in trouble or leaving work due to her marriage, pregnancy or child care.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Women in STEM being in trouble or leaving work due to her marriage, pregnancy or child care have the same effect on scientists/engineers regardless of their sex for their study, research or project performance, pregnancy or child care.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td><strong>C&amp;D. Experience of Gender Barriers</strong></td>
<td>I believe things will turn out fine in the future career for women in STEM</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>It is crucial to have strong policy support to solve gender inequality in the STEM field.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>It is appropriate to introduce a quota system or affirmative action plan to solve gender inequality in the STEM field.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td><strong>E. Career Outlook &amp; Need for Policy to Overcome Gender Barriers</strong></td>
<td>I believe things will turn out fine in the future career for women in STEM</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>It is crucial to have strong policy support to solve gender inequality in the STEM field.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>It is appropriate to introduce a quota system or affirmative action plan to solve gender inequality in the STEM field.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td><strong>F. Perception of Gender Role Stereotype &amp; Gender Equity</strong></td>
<td>In a relative sense, men are rational while women are emotional and thus, they ought to complement each other by doing what is appropriate for their sex.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Women are equally granted or entrusted equal role for their research or project at the same qualifications.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>It is equally difficult for a woman to get a job in the STEM field than for a man with the same qualifications.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Being promoted or becoming a tenured professor or a principal investigator is equally</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>It is appropriate to introduce a quota system or affirmative action plan to solve gender inequality in the STEM field.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td><strong>G. Equity for Women in Science &amp; Engineering Research Environment</strong></td>
<td>Women receive the same social evaluation and respect to men as scientists or engineers (by their colleagues, professor, funding donors, academic association, scientific society etc)</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Marriage, pregnancy or child care have the same effect on scientists/engineers regardless of their sex for their study, research or project performance.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Women in STEM being sexually harassed (linguistical or physical) or treated unfairly by their senior classmate, lab-mate or professor (in university laboratory or project group, etc).</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Women in STEM being disadvantaged in accessing research equipment or information because they are female.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>Women in STEM being in trouble or leaving work due to her marriage, pregnancy or child care have the same effect on scientists/engineers regardless of their sex for their study, research or project performance, pregnancy or child care.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td><strong>H. Gender Barriers in Space Sector</strong></td>
<td>My career in the Space field has been developing/advancing smoothly</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>I am recognized by my peers as a leader in the space field.</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>I personally have not been affected by gender barriers in the Space fields</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>My family, parents or friends overall supports my Space career</td>
<td>Space</td>
<td>STEM</td>
</tr>
<tr>
<td></td>
<td>My current colleague, boss or professor supports my Space career as he/she supports others in the space fields</td>
<td>Space</td>
<td>STEM</td>
</tr>
</tbody>
</table>

Overall, Career Outlook and Need for Policy scores are significantly higher for Space Women than STEM Women but for Gender Barrier “Experience”, scores are significantly lower.

* p<0.05, ** p<0.01, *** p<0.001 (vs Korean STEM responses)
Overall, Perception of Gender Barrier scores are not significantly different between men in STEM and Space (No significant difference at all between Korean men in STEM and Space)
## 3. Age Group Difference

<table>
<thead>
<tr>
<th>Age Group</th>
<th>No. of Resp</th>
<th>Score</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>Scheffe's</th>
</tr>
</thead>
<tbody>
<tr>
<td>20s</td>
<td>164</td>
<td>2.98</td>
<td>1.537</td>
<td>7.436</td>
<td>0.000</td>
<td>***</td>
</tr>
<tr>
<td>30s</td>
<td>183</td>
<td>2.84</td>
<td>1.548</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40s</td>
<td>153</td>
<td>3.39</td>
<td>1.329</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50s &amp; above</td>
<td>93</td>
<td>3.56</td>
<td>1.220</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E2 E3 Score</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>Scheffe's</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.79</td>
<td>1.542</td>
<td>5.50</td>
<td>0.001</td>
<td>***</td>
</tr>
<tr>
<td>2.54</td>
<td>1.547</td>
<td>3.07</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>3.07</td>
<td>1.389</td>
<td>3.17</td>
<td>0.008</td>
<td></td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, *** p<0.001

**E2** It is crucial to have strong policy support to solve gender inequality in the STEM field.

**E3** It is appropriate to introduce a quota system or affirmative action plan to solve gender inequality in the STEM field.

Overall, Age Group did not have a significant effect in responses. However, for E2 and E3 (the need for strong policy and quota system for Space sector) a significantly higher score was observed for those in the 30s and 40s.
Next Step...The GISE index

2022 GISE Index Study

Factor analysis
- To reduce large number of variables into fewer numbers of factors.
- To identify the key questions in the GISE survey
- Consider both absolute responses (both genders) and comparative responses (women vs men)

Composite indicators
- OECD Good practice guide on metrics
- Comparison to SAGA metrics and GII

Factor 1: regional differences in how women perceive gender roles, gender in STEM and experiences. (only response from women)
Factor 2: responses from women to responses to men per region. If responses are in agreement, index is 0, positive differences indicate men do not perceive barriers women do.

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>GISE INDEX</th>
<th>Factor 1 (Absolute) Index</th>
<th>Factor 2 (Comparative) Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>India</td>
<td>0.16</td>
<td>0.14</td>
<td>0.16</td>
</tr>
<tr>
<td>Taiwan</td>
<td>0.42</td>
<td>0.45</td>
<td>0.32</td>
</tr>
<tr>
<td>Japan</td>
<td>0.70</td>
<td>0.72</td>
<td>0.56</td>
</tr>
<tr>
<td>European Union</td>
<td>0.73</td>
<td>0.95</td>
<td>0.33</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>0.81</td>
<td>0.79</td>
<td>0.70</td>
</tr>
<tr>
<td>South Korea</td>
<td>0.87</td>
<td>0.65</td>
<td>1.00</td>
</tr>
<tr>
<td>South America</td>
<td>1.00</td>
<td>1.00</td>
<td>0.83</td>
</tr>
</tbody>
</table>

*Results of 2022 GISE Report on women in STEM

*Index of 1.00 means low perception of gender barriers and 0.00 means highest perception of gender barriers
Summary

- A KASA funded GISE-Space project has been initiated to measure the perception of gender barriers in the Space sector in ROK
- The GISE of INWES/KWSE was modified to suit the Space sector study
- Statistically significant gender gap was observed in the overall GISE-Space responses in the ROK
- Women in Space revealed stronger need for policy development compared to women in STEM in ROK
- However, there was less gender barrier “experiences” in the Space sector compared to STEM in ROK
- No significant difference was observed in responses between men in Space sector and men in STEM in ROK
- Age group did not correlate to the gender barrier responses in ROK
The study shows that a significant gender gap exists in the perception of gender barriers in the space sector in ROK.

Science and engineering together with gender equality are vital agendas for advancing the Space industry.

The difference in gender barrier perceptions between men and women could be a “barrier” in advancing the Space sector.

The GISE study can provide evidence for policy development for balancing the human resources in space industry.

GISE can provide comparative indices through International collaborative projects.

Revealing “numbers” can bring “culture change” through policy making for gender parity in the Space sector.

Conclusion
Future work

- **July, 2024**: GISE index evaluation
- **August, 2024**: GISE-Space ROK Report published
- **2025~**: Expansion of GISE-Space to an international collaborative study
Thank you!

“building a better future worldwide through the full participation of women in girls in STEM (the Space Sector)”
INWES is a global network of organizations of women in STEM, with Organizational Members, Corporate Members, University Members, and Individual Members, all together representing about 250,000 women from all six continents of the world.

INWES is an Official NGO partner of consultative status with UNESCO & has Consultative status with the UN Economic and Social Council

www.inwes.org

“To build a better future worldwide through full and effective participation of women and girls in all aspects of STEM”
A2.
The Association of Korean Woman Scientists and Engineers (KWSE)

Established in 1993
as the first formal organization
of women in STEM in Korea, INWES member since 2002

250 women in STEM, mostly contingent employees (1993)

2,197 members, mostly leaders in Korean STEM institutions (2024)

www.kwse.or.kr
A3. The GISE Project

- Survey based on past KWSE questionnaires
- GISE index developed to act as an indicator of the progress in gender equality in STEM
- Questionnaires translated in 7 languages: Chinese (Traditional Mandarin), English, French, Japanese, Korean, Portuguese, and Spanish
- Significant difference in gender barrier perceptions revealed between women and men
- Multiple dissemination, particularly in Africa, to raise visibility
- Open access policy set up for GISE data to INWES members and partners
- Funded by the Korean Ministry of Science and ICT & Korea AeroSpace Administration
- More details found in https://www.inwes.org/gise/