



34th Annual **INCOSE**
international symposium
hybrid event
Dublin, Ireland
July 2 - 6, 2024



Experiences from five age cohorts of female systems engineers

The importance of being Björn

Agenda

- Introduction
- Background Sweden
- Survey
- International perspective
- Conclusions and future work



Introduction



Background Saab Group

- Engineering-dense company within defense industry
- High level of education among the engineers
- High proportion of men – especially for technical leaders

Underwater Systems



Fighter Systems



Command and Control

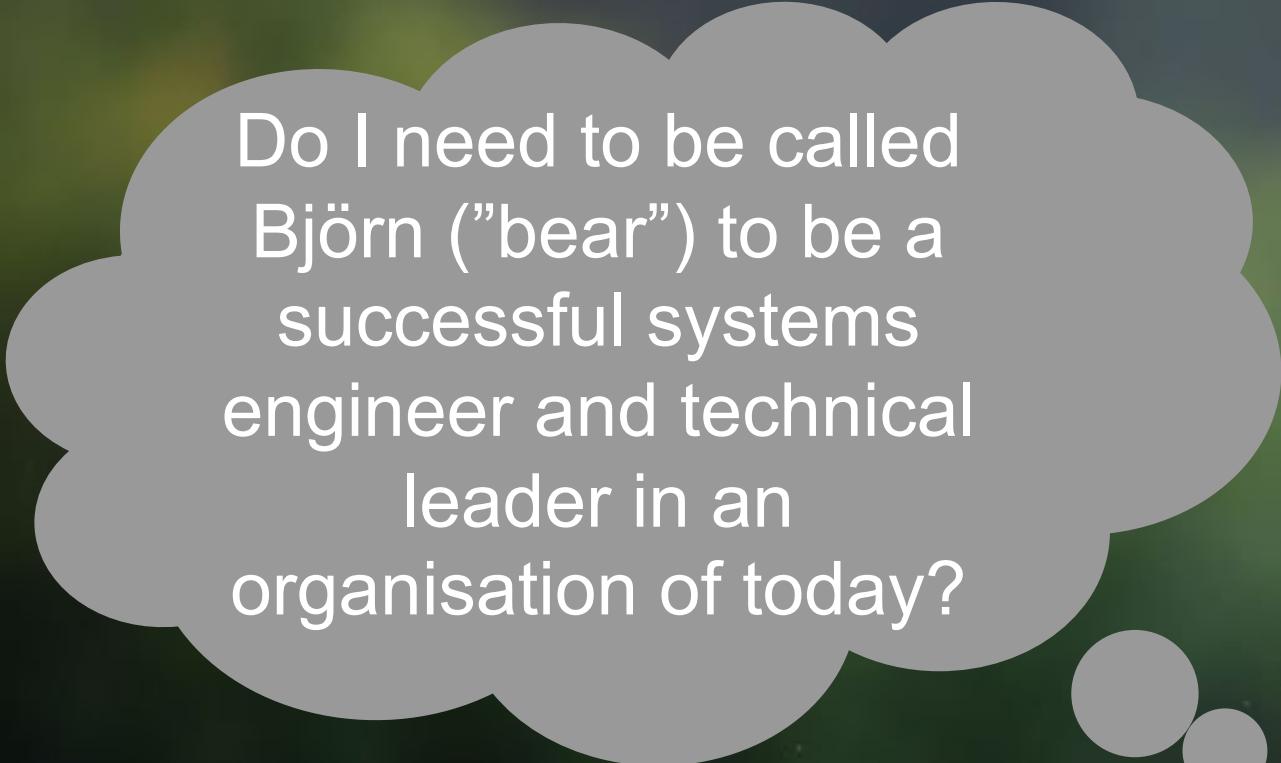


Sensors

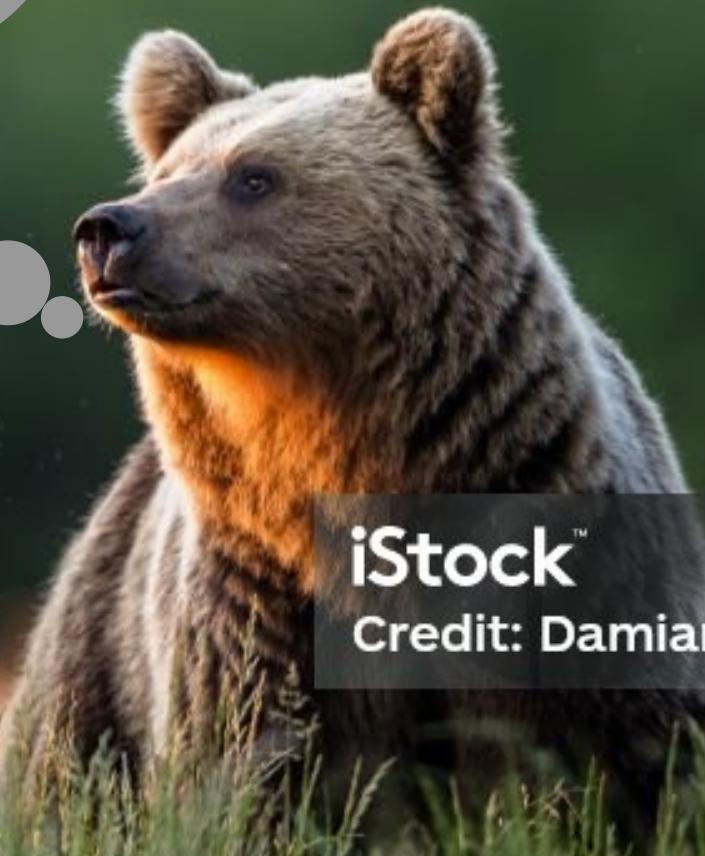


Advanced Weapon Systems





Do I need to be called
Björn ("bear") to be a
successful systems
engineer and technical
leader in an
organisation of today?



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Credit: DamianKuzdak

Goals for the work

- Raise the voices of female systems engineers over the last five decades
- To reflect on the situation of today and in the past



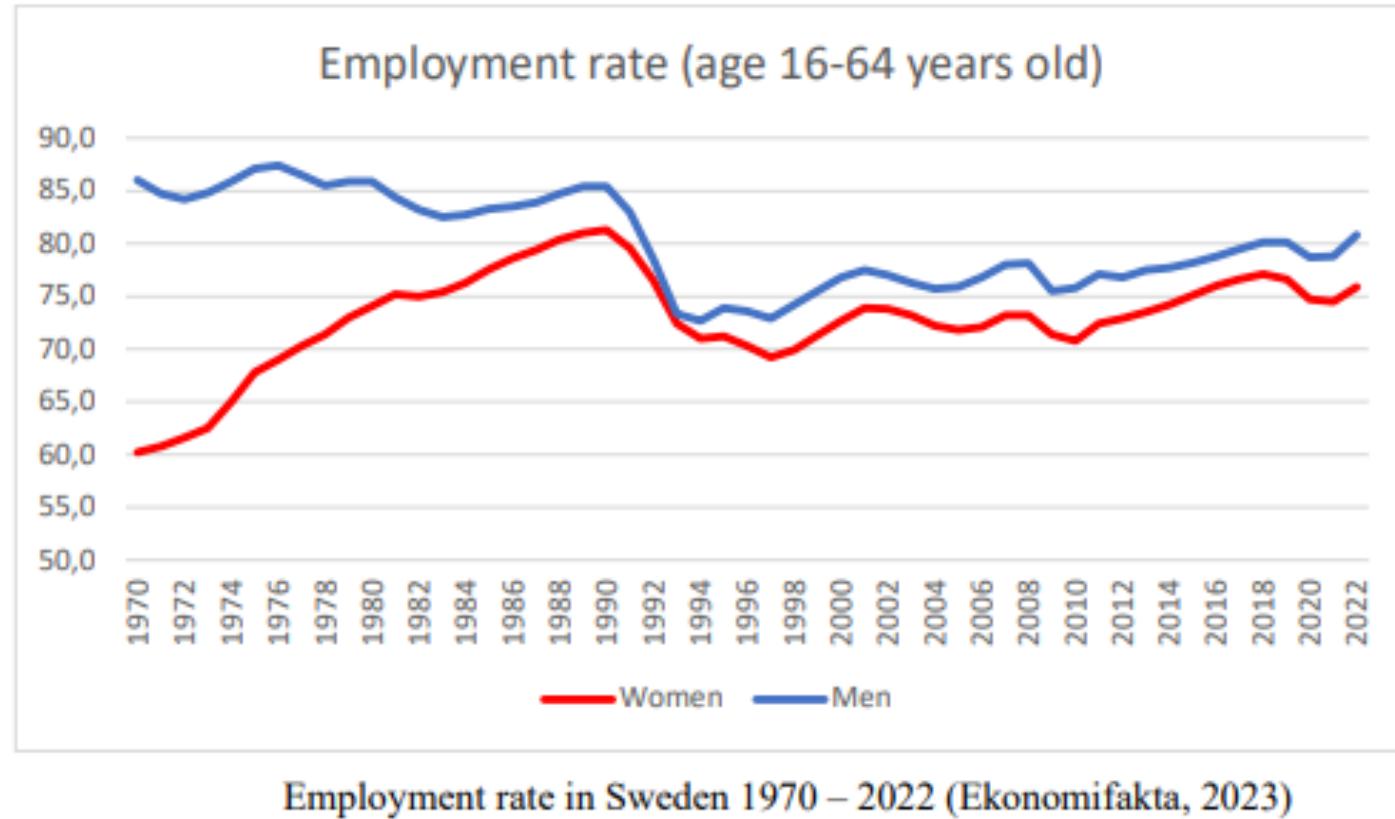
Background Sweden

2-6 July 2024



Swedish employment rate from 70s until now

- **Major labour shortage** in Sweden during the late 60s and early 70s
- **Women** were seen as **unused labour**
- **Gender roles** were questioned and a **frequent topic of discussion**



Employment rate in Sweden 1970 – 2022 (Ekonomifakta, 2023)

Reforms in Swedish society

1971: Abolishment of joint taxation



1986: Financial compensation for 360 days



1989: Financial compensation for 450 days

1995: Reserved "father month"



2002: Reserved second "father month" and financial compensation for 480 days



2016: Reserved third "father month"



2024: More flexibility. Parental leave transfer Double days

70s

80s

90s

00s

10s

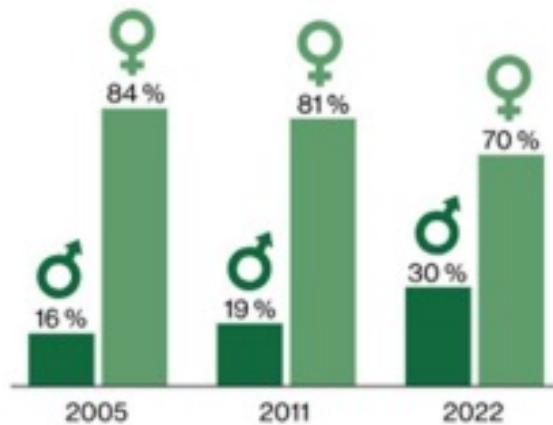
20s

1974: Financial compensation for parental leave (180 days)
1978: Campaign to encourage men to be home



Major expansion of childcare and preschool facilities was needed to handle this transformation.
Also possibility for women to enter higher education to learn a profession.

Parental leave men vs women



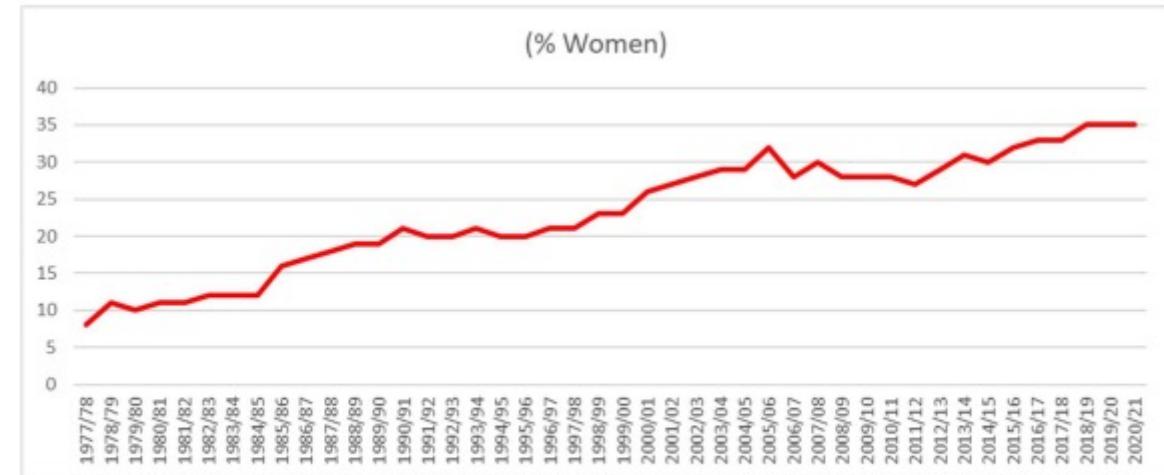
Swedish childcare and school system

Age (years)	Childcare/school system	Cost
1-5	Voluntary Preschool (kindergarten)	Highly subsidised
6	Compulsory reception class	Free
6-13	Leisure-time centers	Highly subsidised
7-16	Compulsory primary school (grade 1-9)	Free
~16-19	Upper secondary school	Free
>20	University, college, higher vocational college	Free + Generous study allowances and loans

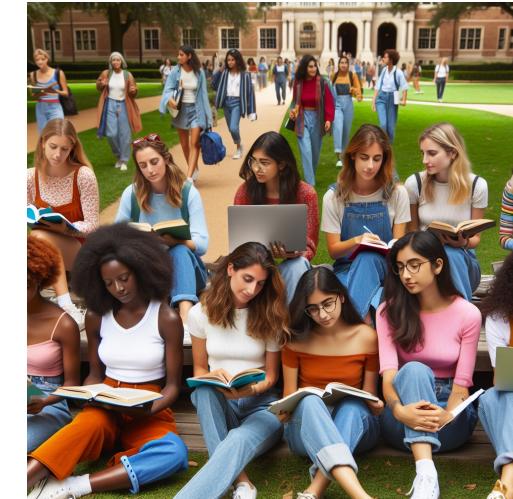


Female proportion at university engineering education

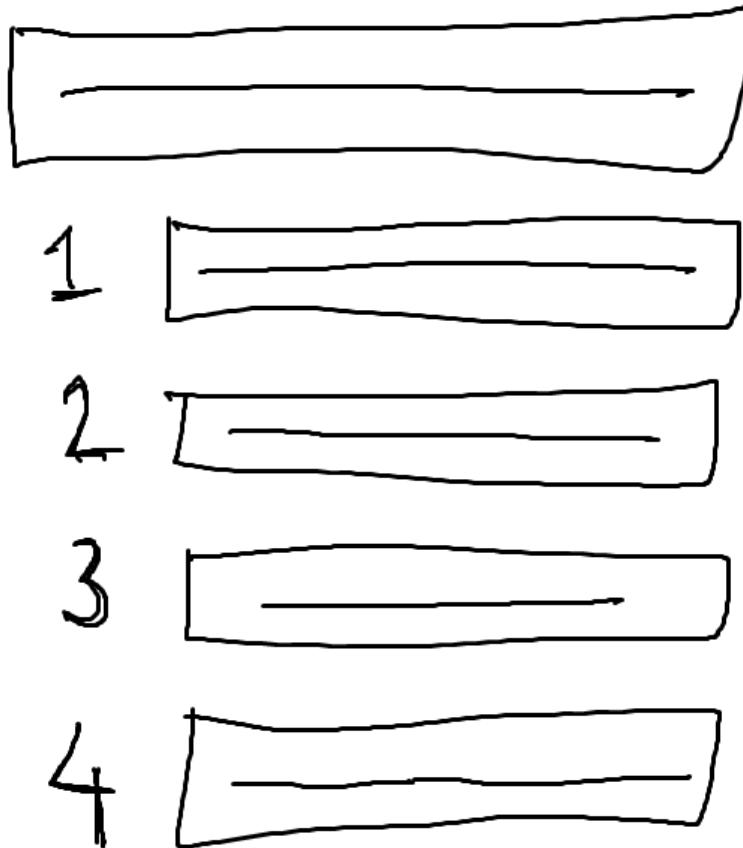
- The engineering discipline in Sweden is **still a male-dominated field**
- **Graduated female engineers within Master of Science in Engineering** has risen from **8% to 35% since the 70s**



Proportion of graduated female engineers of master's degree from 1977/78 to 2020/21 (SCB, 2023).



Survey



Survey structure

- Interviewed 14 females in total
 - 2-3 in each age cohort
 - 20-30 years old up to 60-70 years old
- Personal interview of 1 hour
- Roles today (examples)
 - Head of Design
 - Head of Airworthiness
 - Chief Engineer
 - Systems Engineer



Oldest



Middle



Youngest

Type of questions

- Why engineer?
- Experiences during work life
- Changes in society and how that has effected them during work life
- The young systems engineers
 - What do you see in older female systems engineers?
- The older systems engineers
 - What do you see in younger female systems engineers?



Why engineer?

Oldest age group cohort



"I wanted to prove to myself that I could do something that no one expected of me"

Middle age group cohort



"I had a strong and supportive mother who highlighted the importance of having a higher education to be able to support oneself financially"

Youngest age group cohort



"It sounded cool to be engineer – engineers deal with cool stuff and remains at the forefront"

- Good at **mathematics, science** and high grades at school
- Job opportunities
- Interest in **understanding how things work** and a genuine interest in problem solving
- **Supportive teachers, family, or society** encouraging to study engineering

Conditions in society and early working life

Oldest age group cohort



“Being the only woman, I have to be very rigorous in my job and make no mistakes as I represented the whole female engineering community.”

- **Majority of the household responsibility and no general childcare**
- Often **single female at work**
- **Adapt the male style** to fit in
- Prove themselves worthy and **work extra hard to be respected**

Middle age group cohort



“I had to communicate in a short and concise manner in order to make the men listen to me. But being a woman can be an advantage, you stand out.”

- Quite **unequal society** in the beginning but **improved**
- Appreciated that **the oldest group had paved the way** for them and that the **society** gradually gave them **support** and encouragement to be an engineer
- **Still in minority** and put pressure on themselves to **perform well to be respected**

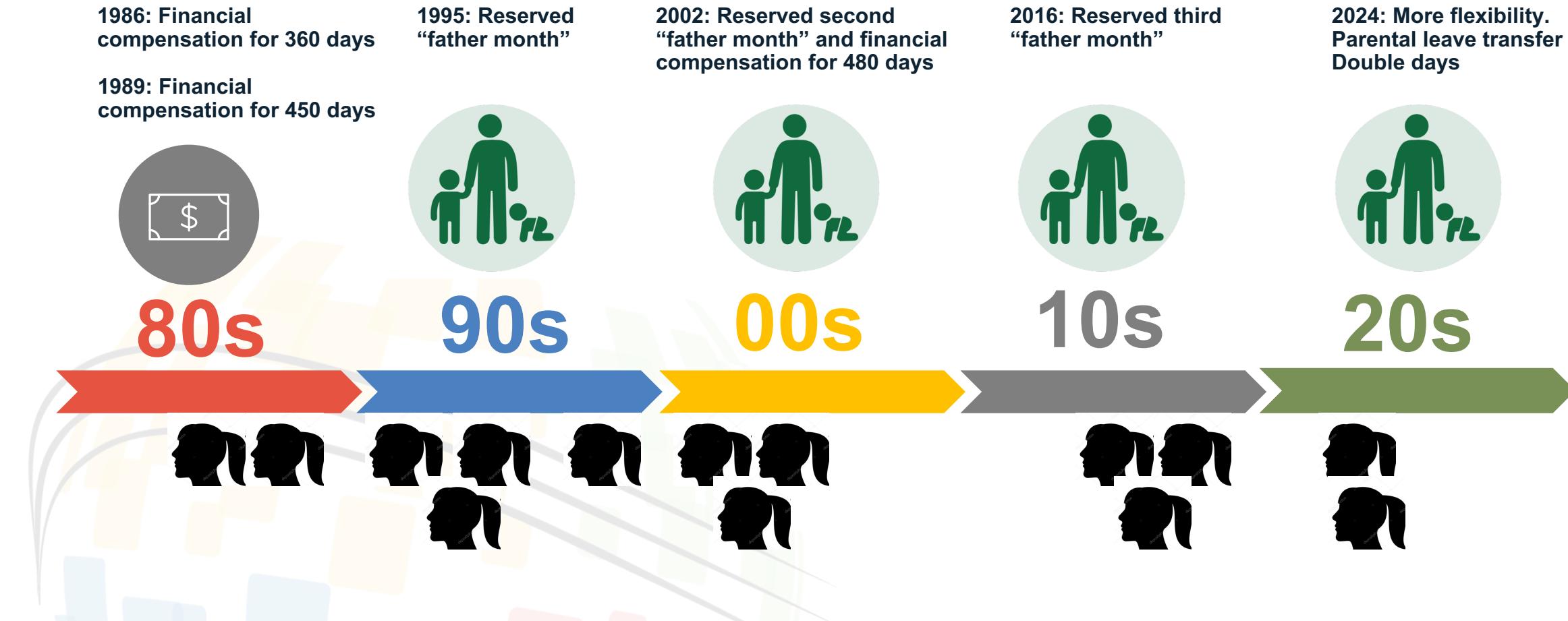
Youngest age group cohort



“I feel respected as an engineer, no matter gender.”

- **Equal conditions** at work and in society
- **Same possibilities** as men
- **Confident** in what they can achieve and see **no obstacle to have a career as an engineer**

Comparison of start in work life and societal reforms



Career opportunities for female systems engineers

Oldest age group cohort



“We need to prove our competence, while a man can be recruited based on his potential skills.”

- Considered **not** to be as **good** or interested **in technology** as men
- Were **not encouraged** to take demanding leadership roles
- Experienced **condescending comments** or being ignored when expressing their views

Middle age group cohort



“To become a technical leader, you must be handpicked, and females rarely are.”

- **Not** the same opportunities to take on **technical leadership** roles
- Women needs to “plant” her **ideas** to a man in order to succeed in her work.

Youngest age group cohort



“The career is performance-based and have nothing to do with gender.”

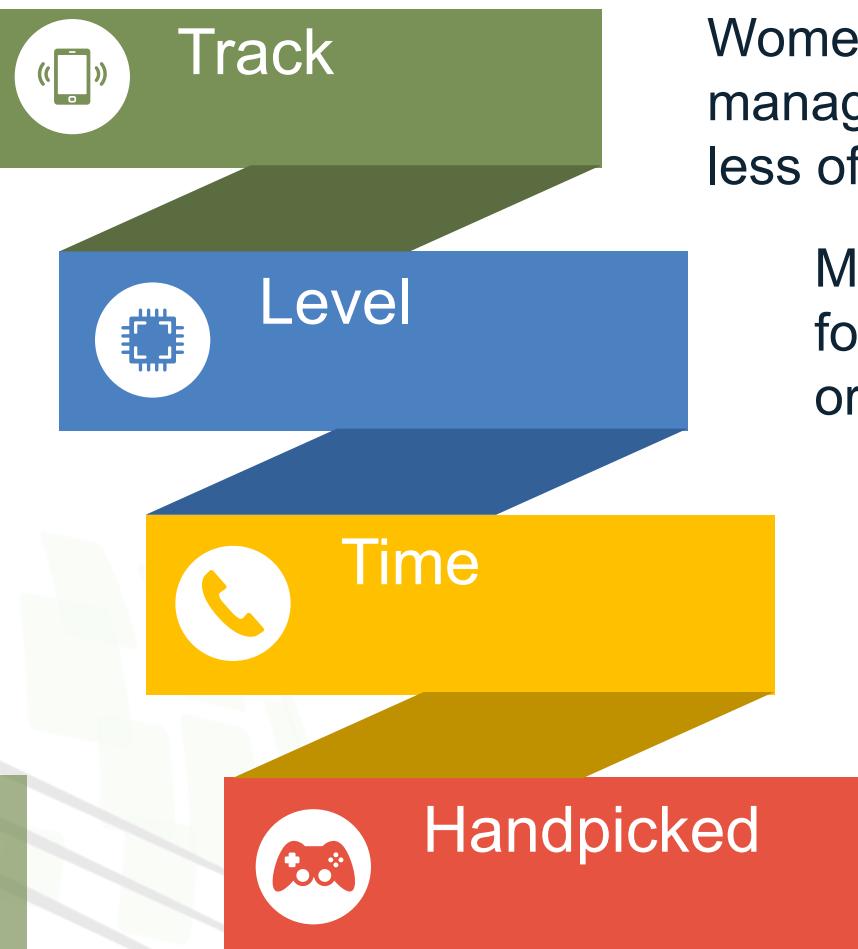
- **Harder** to get trust and **responsibility** in the daily work
- **Unsure** on content of career track **technical leadership**

Career opportunities for female systems engineers

Senior systems engineering training programs seems beneficial to become a technical leader

100%

Current female (3)
Chief Engineers



Women often become project managers and line managers and less often technical leaders

Most female technical leaders are found further down in the organisation

Technical leadership track takes time

The technical leadership roles are instead handpicked

Reflections younger vs older female systems engineers

Oldest age group cohort



“They are more goal-oriented and not afraid to express their opinion.”

Middle age group cohort



“In order for the older to succeed in that environment, they had to adopt a male leadership style.”

Youngest age group cohort



“The ones that remain are those who could handle the pressure.”

- Youngest: **more self-confident** and secure
- A downside: may take **leading roles too soon**, and thus not have time to build up the technical expertise

- Oldest: had to **break the norm** by taking on technical leadership roles
- Youngest: **stand up** for themselves more

- **Oldest:** have been forced to be **strong**, in order to reach what they are today
- **Female role models** crucial to see that it is possible to succeed

International perspective



International perspective

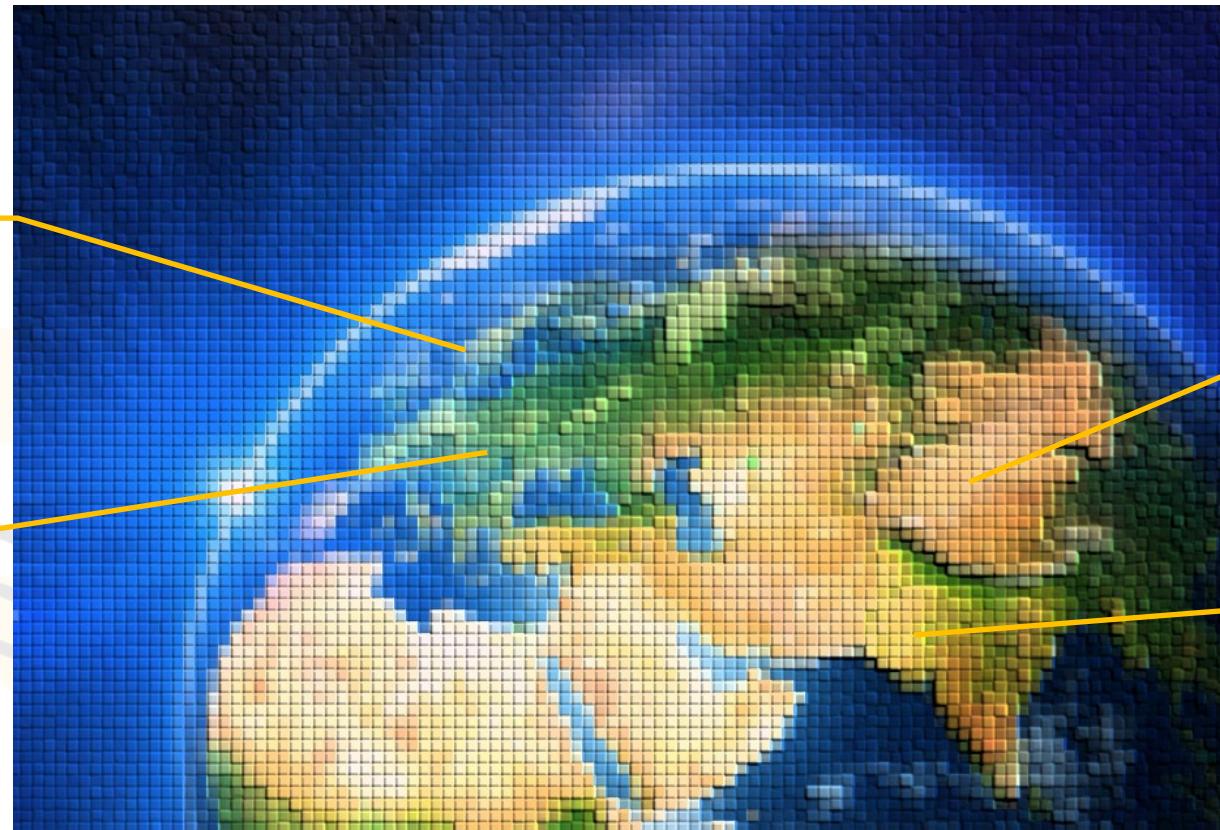
Motivating factors to enrol engineering programs

Role models and encouragement from society and the engineering profession

Engineers in family

Problem-solving skills

Interest in mathematics/science



International perspective

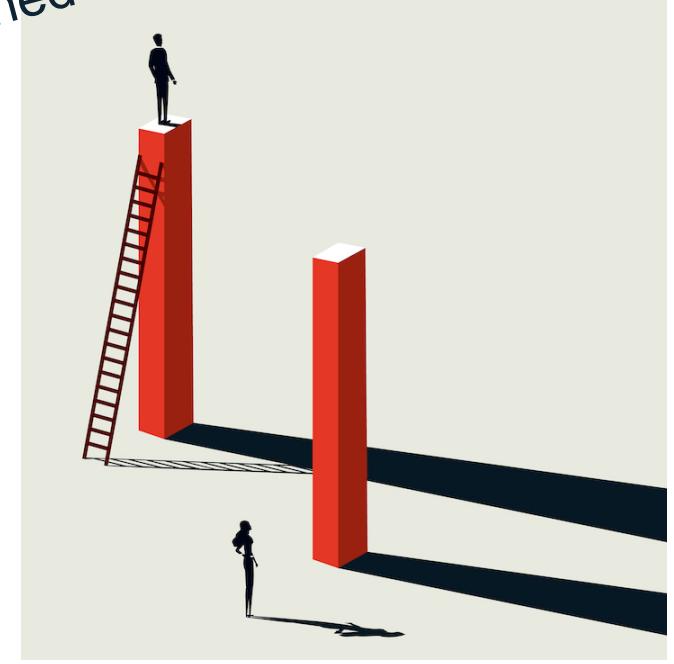
Position and hierarchy within engineering field



Female formal technical leaders in clear minority, traditionally dominated by men



General feeling not being listened to...



Experiences of not having same opportunity to build a technical leadership career as men

International perspective

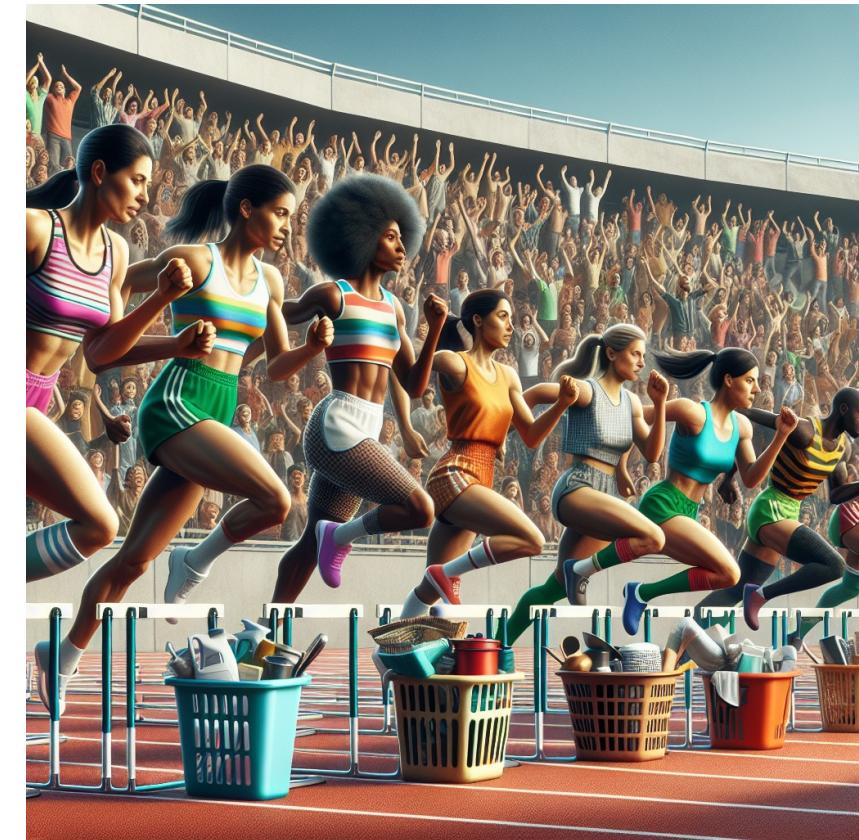
Challenges and important factors

Largest challenges internationally

- Motherhood
- Parental leave
- Continued responsibility for the family
- Access and support for education

Reasons for a successful female engineering career

- Low costs for children day care
- Gentle approach in the engineering organisation towards the female engineers during the "small children" period
- Shared household duties
- Inclusion in technical leadership pipelines for technical career advancement



Conclusions and Future Work



Conclusions

Becoming a female systems engineer is more common nowadays, also becoming a line manager or a project manager, but taking on a **technical leadership role still is rare**

One influence over all age cohorts is some form of **encouragement from society and family to choose engineering**

The youngest female systems engineers **expect equal opportunities** at work and equal workload at home



The older female systems engineers had to **break gender norms** and endeavour to succeed in their career

The **structural changes** in the Swedish society have been crucial to break the gender norm in general

Recommendations for future work

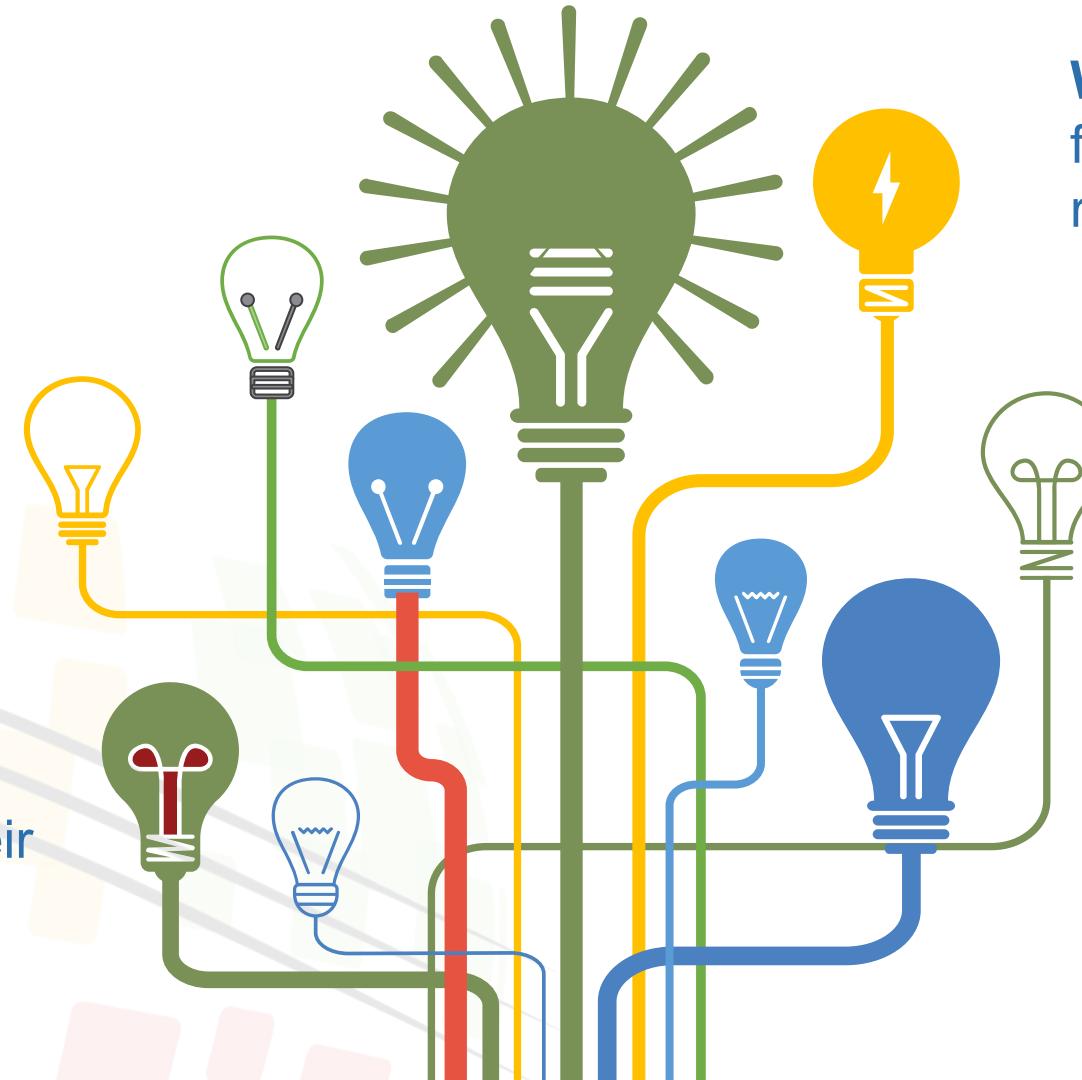
Extend the comparison with similar **international studies** and conditions

Include expectations and realities for **engineering students of today** and their start in work life

Wider group of female engineers and roles

Include **male group** of systems engineers for reference

Study the **effect of new university engineering programs** that attracts a large proportion of women today



Final words

“In order to be a successful systems engineer and technical leader in our organisation, you should just be *yourself!*”



Marianne Johansson.
SEMP & Way of Working
Coordinator
Saab Aeronautics, Sweden



Linda Cederberg
Principal Systems
Engineering Consultant
Combitech AB, Sweden



Johanna Axehill
Product manager
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Questions?





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