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Seminars in International Economics

Who's afraid of automation? Examining determinants of fear of automation in six European countries

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Who's afraid of automation? Examining determinants of fear of automation in six European countries

Prof. Katarzyna Śledziewska
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Audiobook „Gospodarka Cyfrowa”

Who's afraid of automation? Presentation outline

1. Introduction to the fear of automation
2. Factors influencing the fear of automation
3. Measuring the fear of automation: results and analysis
4. Strategies for managing automation in organizations
5. Conclusions and recommendations

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Change often introduces **uncertainty**, and humans naturally **avoid situations** where the outcomes are unclear.

Change often requires a **shift in beliefs or behaviors**, which can cause cognitive dissonance—a state of mental discomfort.

People tend to avoid situations that challenge their existing mindset

New situations often require **learning or adapting to new skills**, and the **fear of not succeeding** can lead people to **avoid change altogether**



Data and methods

- Used data from the **Central European Social Survey**, conducted using the Computer-Assisted Web Interviewing (CAWI) method
- Covered **11,000 individuals** engaged in the workforce from **six EU countries** (Austria, Czechia, Germany, Hungary, Poland, Slovakia) with a random quota sampling procedure reflecting demographic composition by gender, age, and size of residence
- Data collection period: **December 2021 to January 2022**

Survey questions:

- **Technology at work:** Assessed through questions on
 - recent technology experience (complementary, substitutionary, no impact),
 - automation potential of job tasks,
 - job insecurity due to automation,
 - views on automation-induced mass unemployment.
- **Temporal scope:** Questions covered expectations for the next ten years to capture evolving technology impacts.

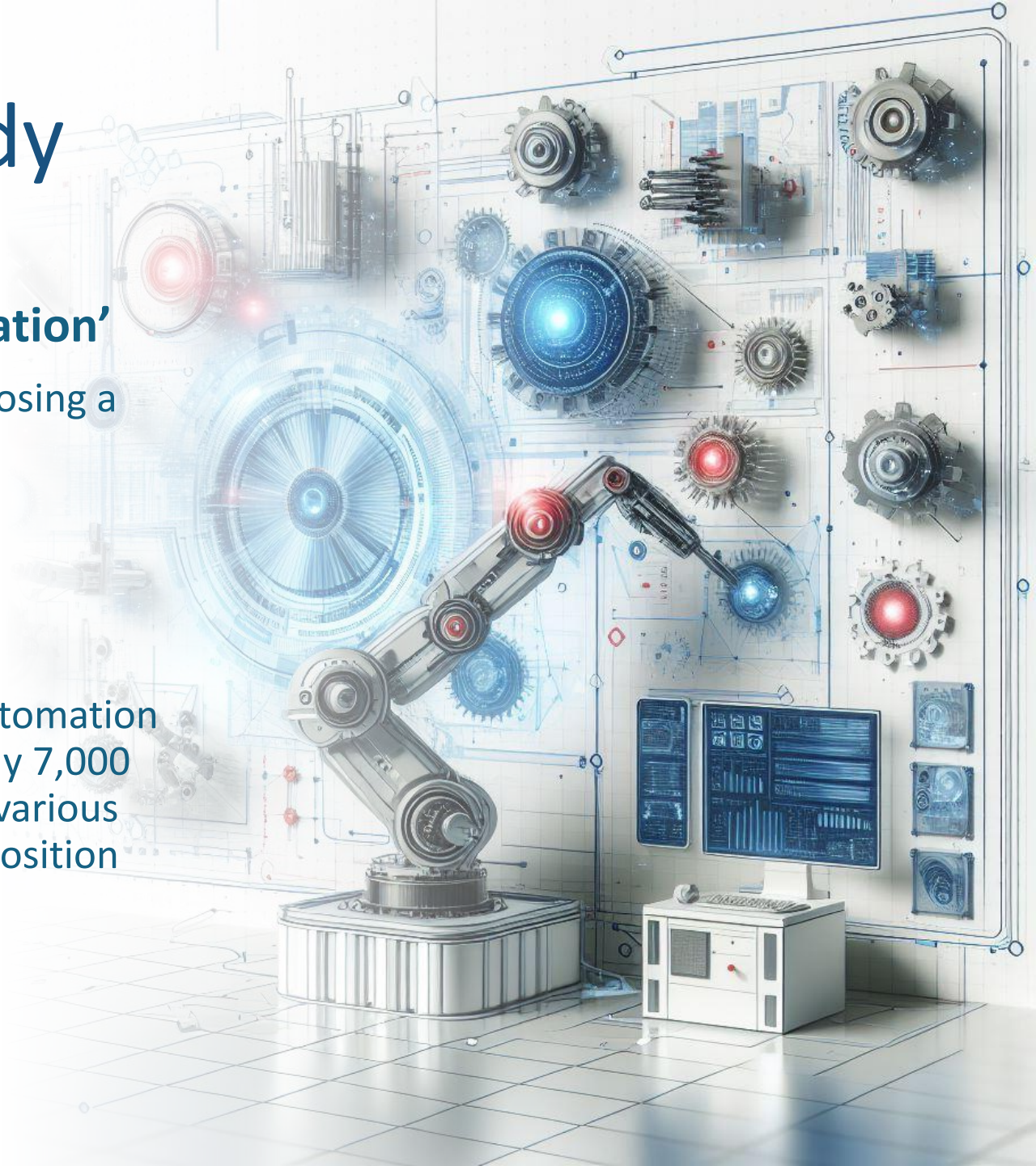
Twofold goals of the study

- **Developing the Concept of 'Fear of Automation'**

We aim to contribute to the existing literature by proposing a novel conceptualization of the "fear of automation."

- **Examining the Determinants of Fear of Automation**

We add to the research on what determines fear of automation by using representative survey data from approximately 7,000 workers across six European countries, analyzing how various factors like exposure to technology and labor market position influence this fear.



Conceptualizing Fear of Automation

Fear vs. Anxiety

(American Psychological Association, 2024; Mayiwar and Björklund, 2023)

- **Fear:** A response to a present, clearly identifiable threat, prompting immediate solutions.
- **Anxiety:** Oriented to a distant and diffuse threat, requiring broader and more adaptable solutions.

Technophobia and Technoparanoia

(McClure, 2017; Agogo, 2018)

- Terms like technophobia (related to computer anxiety) and technoparanoia (fear of job loss due to machines) reflect specific fears associated with technology.

Emerging Definition of Fear of Automation

- Perceived risk of unemployment due to automation effects Innocenti and Golin (2022)
- Response to a perceived threat of job loss because of automation Golin and Rauh (2022)
- Negative perception of how automation will shape the future of work, turning into collective angst Mulas-Granados et al. (2019)

Unified Concept

- Merging technological fear and anxiety into fear of automation, linked with job insecurity concepts in sociology of work.
- Aligned with LeDoux's definition of fear as the conscious awareness of being in harm's way (Mobbs et al., 2019), with specific reference to the risk of job loss due to machines.

From psychological to sociological framework

Fear as a Societal Construct

- Fear is shaped by cultural patterns, interactions, and societal structures (Tudor, 2003)
- Fear serves as a societal integrator, uniting individuals against common threats or recognizing shared predicaments

Significance of Fear in Late Modernity

- Fear has evolved into a significant aspect of social life in late modern societies, often seen as a response to rapid socioeconomic and cultural transformations (Bauman, 2013; Sik, 2020)
- "Liquid fear" - pervasive anxiety experienced by individuals conscious of their vulnerability in a rapidly changing world (Bauman, 2013)

Cultural and Economic Manipulation of Fear

- Fear of automation is exacerbated by "fear entrepreneurs" who benefit from and perpetuate a culture of fear, influencing societal views and behaviors toward technology (Furedi, 2018)
- Prominent discussions and predictions about the "end of work" due to automation (Willcocks, 2020; Rifkin, 1996; Ford, 2016)

Critiques and Reassessments of Technological Fear

- The study by Frey and Osborne (2017) – claims that nearly half of all jobs were at risk, though this methodology faced considerable academic critique for its approach to analyzing job susceptibility to automation.
- Subsequent discussions have suggested that rather than replacing humans outright, technology will more likely complement human work (Autor, Levy, and Murnane, 2003; Daugherty and Wilson, 2018)

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Linking fear to technological change

Technological revolutions are viewed as **direct generators** of objectified fear, particularly the **fear of job displacement** by intelligent machines (Furedi, 2018).

This fear is intensified by **rapid technological advancements** and the perceived **loss of control over these changes**.



Linking fear to technological change

A hot topic in the media, often focusing on risks, fears, and anxieties.

- reports and news with predictions about job losses.



Government
Office for Science

Future Risks of Frontier AI



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Robots Are Stealing Our Jobs

<https://www.entrepreneur.com/science-technology/robots-are-stealing-our-jobs/33246>

Why Robots Won't Steal Your Job

<https://hbr.org/2021/03/why-robots-wont-steal-your-job>

ARTIFICIAL INTELLIGENCE IS COMING TO STEAL YOUR HIGH PAYING JOB, EXPERTS WARN

<https://futurism.com/the-byte/artificial-intelligence-steal-job>

AI Should Augment Human Intelligence, Not Replace It

Source:
<https://hbr.org/2021/03/ai-should-augment-human-intelligence-not-replace-it>

•IBM 7,800 jobs at the company could be replaced by generative AI in the medium term.

•BT Group – plans to slash the firm's headcount by 55,000, using tech including AI to automate up to 10,000 jobs within seven years.

considers a scenario in which increased automation disrupts the UK's workforce, leading to increased unemployment and poverty by 2030

Navigating automation and job creation

Acemoglu and Restrepo (2019)

- The future of work does not signify the **end of employment for people**, but it also **does not guarantee** that technological changes **will always be beneficial for workers**.
- If **automation** remains the primary source of productivity **growth**, the **role of human labor** in production may **diminish**.
- **Crucial** for further wage growth will be the **creation of new tasks** and technologies that enhance the intensity of human work in production processes.



Who is vulnerable to automation?



Individuals in jobs with automatable tasks

(Arntz, Gregory, and Zierahn, 2016; Nedelkoska and Quintini, 2018)



Highly skilled workers in non-routine jobs

(Autor, 2022)



Workers in low and medium-skill jobs

(Acemoglu and Autor, 2011; Autor, Goldin, and Katz, 2020)

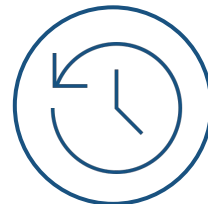


Some studies suggest **women may face greater risks** due to their higher representation in routine jobs (Roberts et al., 2019; Blanas et al.)



Employees in routine jobs

(Osborne and Frey)



Older workers and teenagers in specific job categories

(Nedelkoska and Quintini, 2018)

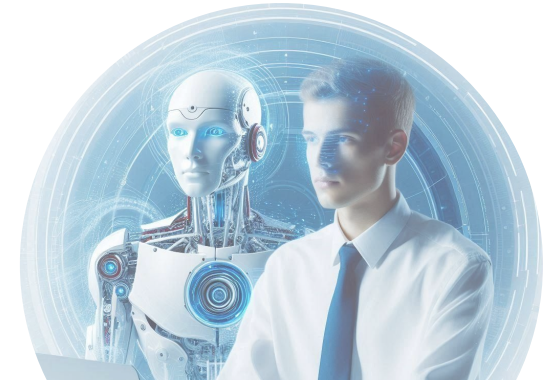
Automation transforms human tasks



Substitution
Machine-only activities



No change
Activities performed
exclusively by humans



Complementarity
Hybrid activities performed jointly
by humans and machines

Humans
complement
AI

AI empowers
people

Complementarity vs. substitutability



Substitution

Machine-only activities

- Routine tasks
- Autonomous decision-making
- Data collection, integration, processing and analysis
- Adherence to procedures and standards



No change

Activities performed exclusively by humans

- Non-routine physical tasks
- Non-routine cognitive tasks
- Collaborate with others
- People management
- Entrepreneurship



Complementarity

Hybrid activities performed jointly by humans and machines

enhancement

People complete the machine

- Customized solutions
- Solving complex problems
- Critical Thinking

AI empowers people

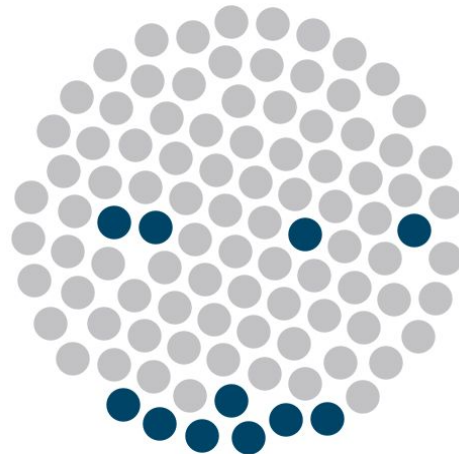
- Strengthening brain power
- Strengthening physical potential

More workers experience complementarity



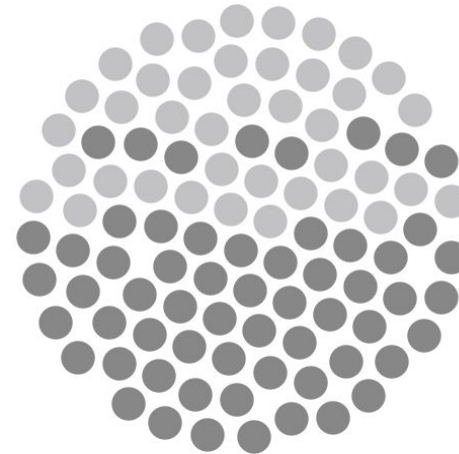
Substitution

11%



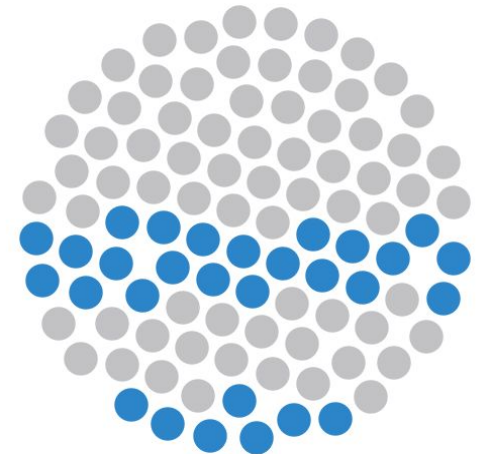
No impact

60%



Complementarity

29%



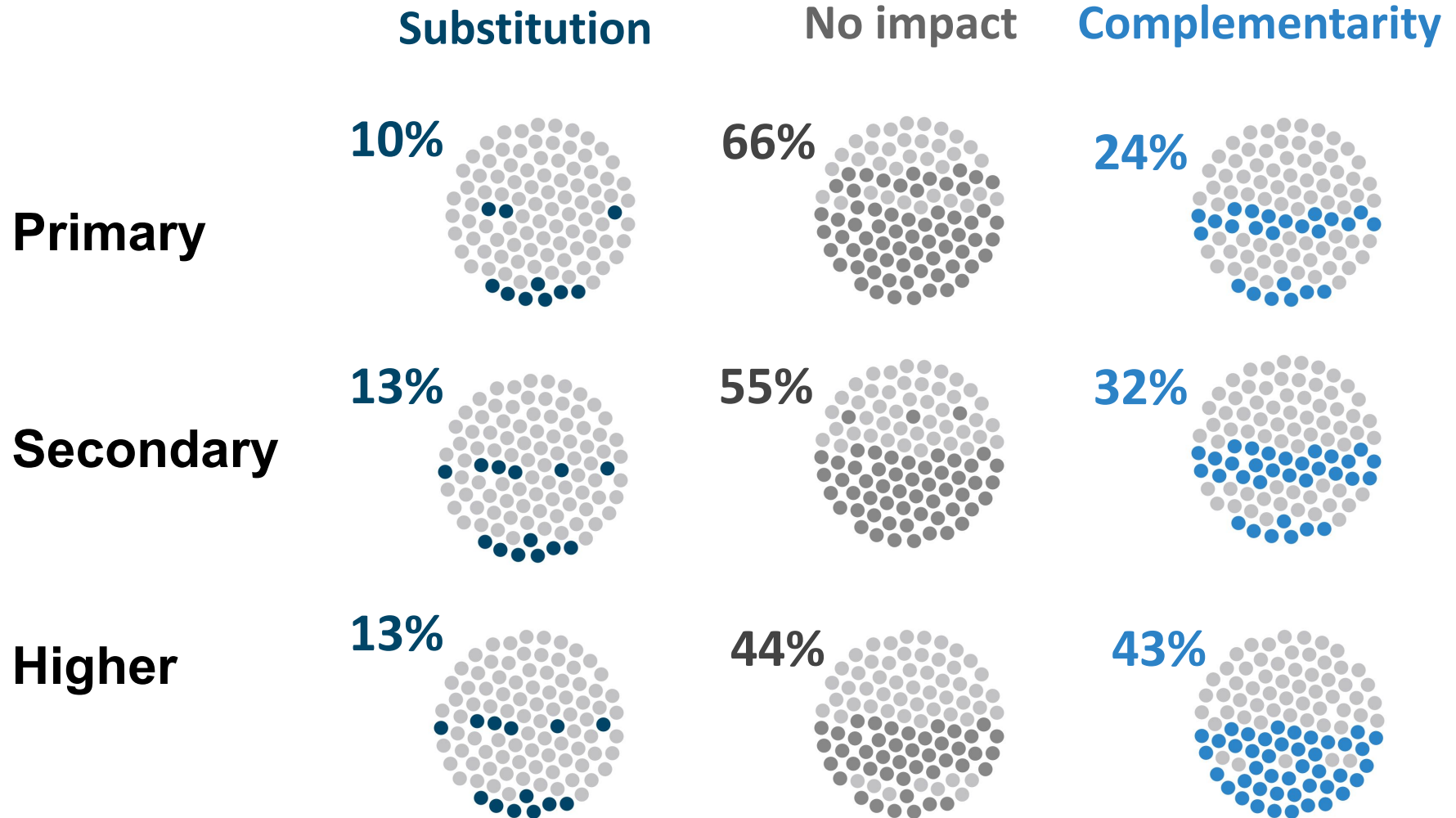
Experience with technology:

I feel that in my current job, new technologies...

The more educated feel that technology will complete their work



Experience with technology:
I feel that in my current job, new technologies...



What determines fear of automation?



Vulnerability linked to less skilled and routine tasks



Influence of technology exposure



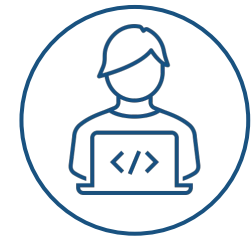
Impact of weaker market position



Demographic factors affecting fear



Education and skill level as buffers



Sense of control reduces fear

Research hypotheses

Fear of automation is higher:

H1: if a worker has already experienced her **tasks** being **substituted** or complemented by the new technologies

H2: the more routine tasks in a given job

H3: the more intense workers' exposition to technology within their sector.

H4: the weaker is position in the labour market as defined by gender, age, education, and income.

H5: the lower is the sense of control over workers lives exhibit a higher fear of automation.



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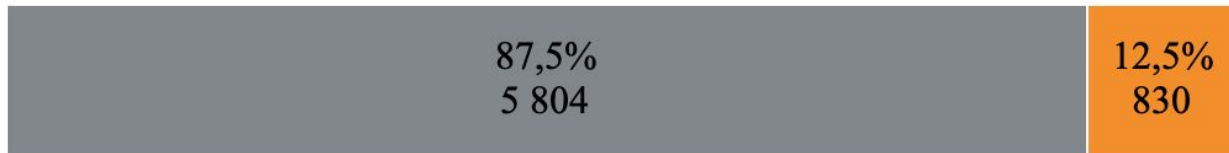
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Description of measures

Variable Name	Description
Fear of Automation	Synthesized from responses to three questions using a 5-point Likert scale; measures concerns about job loss, task automation, and mass unemployment.
Experience with Technology at work	Categorical variable based on whether technology at work is seen as having no impact (answer 1), complementary (answer 2), or substitutionary (answers 3 and 4).
Routine Task Intensity (RTI)	Calculated using a formula from Goos et al. (2014) that compares the intensity of routine, abstract, and manual tasks at work, standardized across countries.
Technology Exposure	Quantified by the number of operational industrial robots per thousand workers in each sector and country, using data from the International Federation of Robotics (IFR) and Eurostat. Measure has been stanarized.
Locus of Control	Variable assessing the perception of personal control over life events. Based on a 7-point scale response to feeling a lack of influence over events in life; higher values indicate a more external locus of control.

Results - descriptive

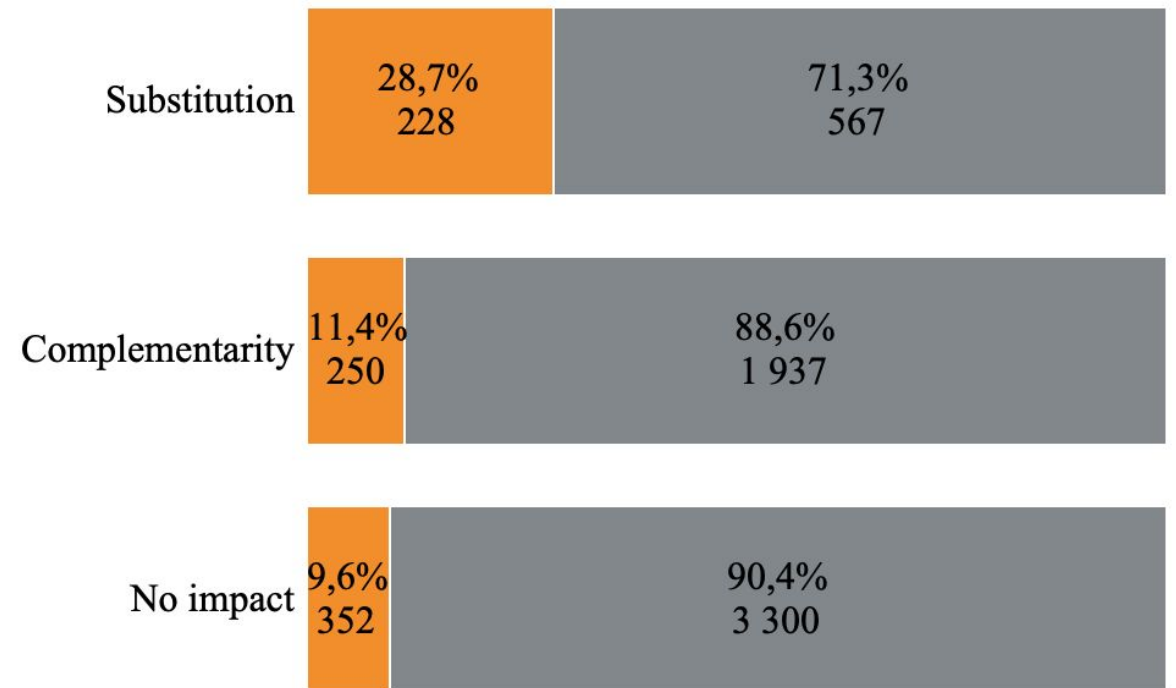
The distribution of the measure of *fear of automation*



Fear of automation

■ No ■ Yes

Fear of automation and the experience with technology at work



Empirical specification

Model Specification:

$$y_{i,o,s,c} = \alpha + \beta_1 Tech_experience_i + \beta_2 RTI_{o,c} + \beta_3 Tech_exposure_{s,c} + \beta_4 X_i + \varepsilon_i$$

- $y_{i,o,s,c}$: Fear of automation for individual i in occupation o , sector s , country c
- $Tech_experience_i$: Individual's experience with technology at work (complementary/substitutionary)
- $RTI_{o,c}$: Routine Task Intensity for occupation o in country c
- $Tech_exposure_{s,c}$: Exposure to technology in sector s of country c
- X_i : Control variables (gender, age, education, wage quintile, locus of control, country fixed effects)

Methodology:

- OLS Regression
- Error Handling: Clustered standard errors by occupation (ISCO 1-digit, 10 clusters) and sector (NACE 1-digit, 21 clusters) to address aggregation discrepancies

Determinants of fear of automation

Table 5. Fear of automation: OLS regression analysis

Experience with tech at work (base = No impact)		
Complementary	0.15***	(0.02)
Substitutionary	0.64***	(0.03)
Routine Task Intensity	0.06***	(0.02)
Technology exposure	0.01**	(0.01)
Gender (base = Male)		
Female	-0.003	(0.02)
Age	-0.01*	(0.01)
Age squared	0.0001	(0.0001)
Education (base = Primary)		
Secondary	-0.12***	(0.02)
Tertiary	-0.20**	(0.06)
Wage quintile (base = 3rd)		
1 st quintile	0.12**	(0.05)
4 th quintile	-0.10**	(0.03)
Locus of control	0.05***	(0.004)
Constant	3.23***	(0.14)
Country FE		Yes
Observations		6,607
R ²		0.14
Adjusted R ²		0.14

Results

- **H1: Supported**
Workers experiencing technology changes in their job tasks, show significantly higher levels of fear of automation.
- **H2: Supported**
An increase in routine tasks correlates with rising fear of automation.
- **H3: Supported**
Greater exposure to digital technologies in the workplace and sector increases fear of automation.
- **H4: Partially supported**
Younger workers, those with lower income, and less education exhibit higher fear levels. Gender shows no significant impact. Education inversely relates to fear. Wage levels show an inverse relationship with fear.
- **H5: Supported**
Higher external locus of control (feeling less influence over events) is associated with increased fear of automation



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Discussion

Main contributions to literature:

- Introduced a new conceptual framework viewing fear of automation as a socially embedded economic phenomenon.
- Validated the significant role of occupational task structure and technology exposure in heightening fear of automation.
- Supported the theories of skill-biased and routine-biased technological impacts, where routine tasks increase fear due to higher automation risks.
- Found that more educated individuals and those with higher control over life events exhibit less fear of automation.

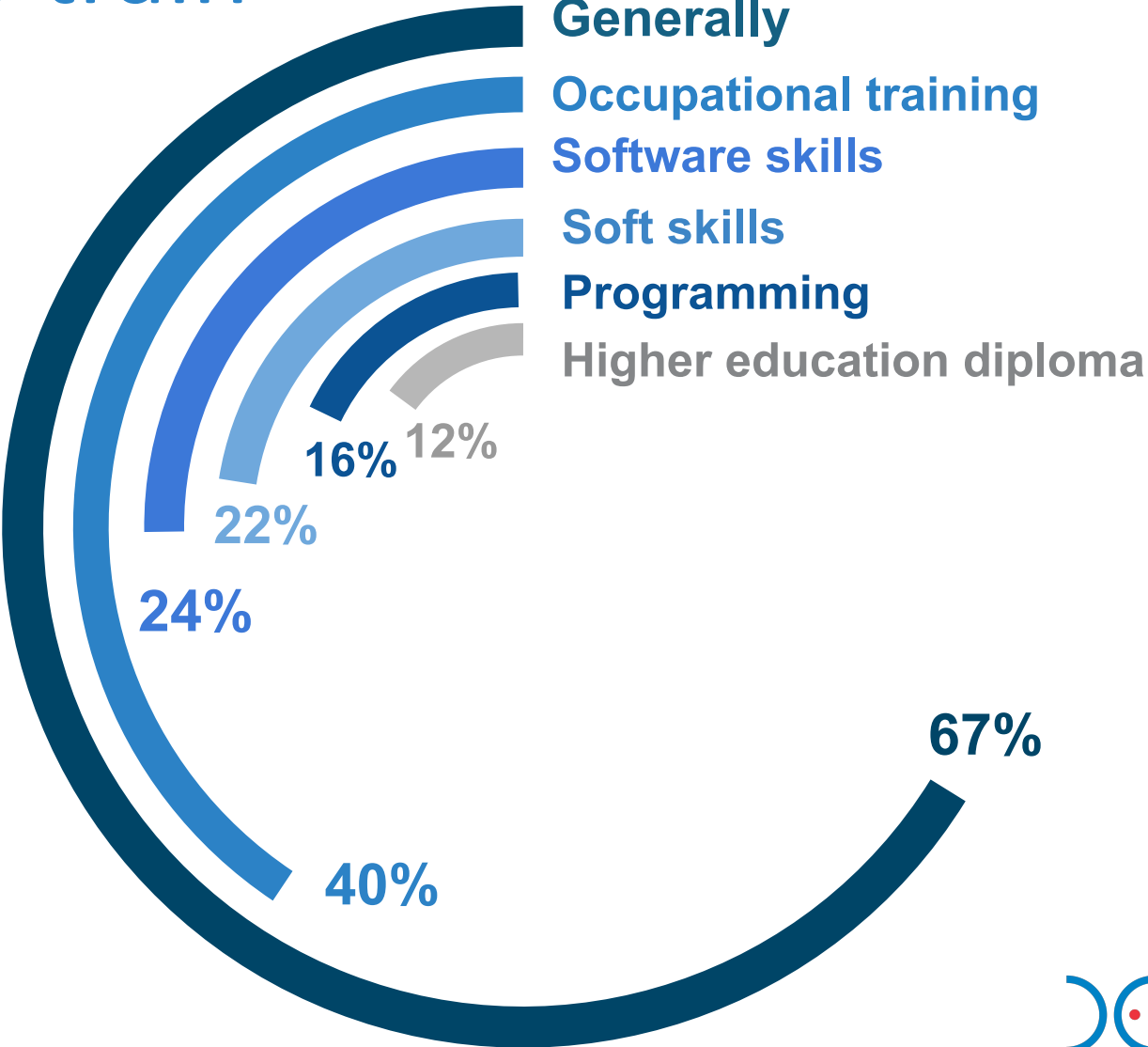
Insights for organizational and policy implementation:

- Understanding fear determinants can help leaders manage digital transformation more effectively.
- Fear can act both as a barrier and a motivator for employees to adapt to technological changes.
- Organizational strategies should address psychological impacts and encourage skill development to mitigate automation fears.

Most respondents declare their willingness to train



Training intentions %

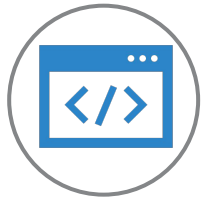


Source: DELab UW study

Trainings: descriptive statistics

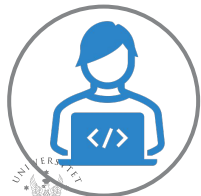


66% of respondents willing to engage in further training.



Most common interests:

- occupational training (**39%**),
- software skills (**24%**).



Interest in programming: **16%**
higher education: **12%**.



Age and Education: Older workers and those with vocational education less willing to train.



Gender: Men more likely to pursue programming and software skills training.



Technology Impact: Workers whose tasks are complemented by technology show highest interest in training.

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Conclusions



Training motivations shaped by fear of job loss, but **fear of technological unemployment can demotivate workers.**



Younger workers and those with higher education more inclined to participate in training.



Vocationally educated and older workers less willing to engage in reskilling.



Organizations need to create supportive environments for lifelong learning to ensure workers adapt to technological changes.

Thank You for Your Attention!



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