ICSEA 2025

BARRIERS AND ENABLERS OF AI ADOPTION IN SOFTWARE TESTING:

A Secondary Study

Katja Karhu, Junior Researcher, LUT University, Finland – katja.karhu@lut.fi
Jussi Kasurinen, Associate Professor, LUT University, Finland – jussi.kasurinen@lut.fi

ICSEA 2025 - Barriers and Enablers of AI Adoption in Software Testing: A Secondary Study

KATJA KARHU

- Doctoral student in LUT University
- M. Sc in Information Technology in 2007 from LUT University
  - M. Sc. Thesis ”Knowledge Transfer in Software Testing Organizations” (original Finnish title: “Tietämyksen välittäminen ohjelmistotestausorganisaatioissa”)
- Professional experience
  - 2024- Junior Researcher (doctoral student) at LUT University
  - 2024 Part-time lecturer of Object-Oriented Programming at LUT University
  - 2022-2024 Software Architect and Product Owner at Procountor
  - 2020-2022 Senior Software Developer at Procountor
  - 2012-2020 Software Developer at Procountor
- What did I actually do:
  - Agile software development of financial management systems with Java
  - Unit testing and integration testing
  - Acted as a Product Owner and Scrum Master

www.linkedin.com/in/katjakarhu

RESEARCH INTERESTS

- AI in software testing
  - How are companies utilizing AI in software testing in practice?
  - How will AI change software testing work in software development?
- Why did I choose this topic?
  - In early 2024 the company I worked in, AI adoption in software testing started to come up in conversations
  - There was a not lot of concrete information available about AI adoption in practice
- Qualitative research methodology
  - Interviews
  - Thematic analysis

BACKGROUND AND MOTIVATION

- We were interested in empirical studies made in a real-world industry context
  - Data collected from testing specialists
  - Excluded e.g. experiments
- Why a literature survey with this specific focus?
  - Research interests!
  - Nguyen at al (2023, 2025) conducted an extensive literature review in 2023, and found that
    - most of the existing studies on AI in software quality assurance are "experimental studies and thus do not take into consideration the industrial context".
    - "how GenAI models deal with real-world software quality issues remains a mystery"
  - We decided to see if the situation had changed, and tried to find all recent (2020 onwards) empirical studies on AI in software testing, with that real-world context

A. Nguyen-Duc et al., “Generative Artificial Intelligence for Software Engineering A Research Agenda,” preprint, Oct. 2023. DOI: 10.48550/arXiv.2310.18648.
A. Nguyen-Duc et al., “Generative Artificial Intelligence for Software Engineering A Research Agenda,” Software: Practice and Experience, pp. 1–38, Jun. 2025. DOI: 10.1002/spe. 70005.

RESEARCH QUESTIONS

- We had to split the reporting of the results into two studies
  - Study 1: Expectations vs Reality – A Secondary Study in AI Adoption in Software Testing
    - RQ1: What kind of studies have been made in the industrial or business context regarding AI adoption in software testing?
    - RQ2: How is AI utilized in software testing in the industry?
  - Study 2: Barriers and Enablers of AI Adoption in Software Testing: A Secondary Study
    - RQ1: What are the issues that prevent or hinder AI adoption in software testing?
    - RQ2: What are the enablers behind successful AI adoption in software testing?

SYSTEMATIC MAPPING STUDY

- We found a total of 17 studies (peer-reviewed, theses, and grey literature) that matched our criteria
  - Google Scholar
  - Scopus
- Data collection was done during October and November 2024
  - Most of the studies(10) were published in 2024
  - Potential limitation: there are most likely newer studies that would fit our criteria
- Since the number of studies was quite small, a detailed qualitative analysis was possible

THEMATIC ANALYSIS

- Reflexive thematic analysis
  - Non-positivist approach: coding is an interpretive practice, where researcher subjectivity is embraced as a resource (Braun and Clarke, 2023)
    - Personal view of AI: a hopeful sceptic
      - A pragmatic approach in analysis - wanted to find the concrete information about AI adoption (actual benefits, actual use cases, barriers and enablers of adoption, etc)
    - Some background knowledge on software testing (from research and in SW development context)
- A theme is a concept that captures important patterned information and insights about the data, related to the research question (Braun and Clarke, 2006)

MAIN THEME: BARRIERS AND ENABLERS

- Barriers and enablers can be related to, for example:
  - Management
  - Processes
  - Human resources
  - Tools
  - Data
  - External barriers and enablers
    - Legislation is an important barrier/enabler that is not mentioned here: there was not enough information about it in the data
- Barriers are not always bad and enablers good

TABLE II. BARRIERS AND ENABLERS PER CATEGORY FROM EARLIER LITERATURE

Category	Barriers	Enablers
Management	Lack of usefulness/produced value [1][20][24][26][27] Requires significant investments [1][27] Risk aversion [1][21][27] Lack of time and resources [1][21][24][25][27]	Marketing AI benefits [1][26] Leadership support [14][16][17][25] Investments in technology [14][16][17][26] Investments in skill development [26] Outsourcing [27] Hiring new employees [27]
Processes	Incompatibility with current processes [1][13][21] Strict IT policies [25] Poor internal communication [25]	Evaluation of current processes [1][28] Change management [25] AI roadmap [27]
Human resources	AI skill gap [1][20][21][24][26][27] Lack of trust in AI [13][21][23]–[25] Resistance to change [1][25]	Personnel training [16][24]–[27] Internal communication [21][25] Collaborative experimentation and research [1] Guidelines for working with AI [20]–[22][25]
Tools	Difficulties in finding and selecting tools [20][24] Lack of transparency [13][21][28] Incompatibility with legacy systems [1][21][26] Poor usability of tools [1] Unreliability (e.g., hallucination and bias) [21][23] Tool pricing [20] Lack of domain knowledge [20]	Explainable AI (XAI) [13][21][28] Monitoring and reviewing [21] Building test automation first [1] AI tool documentation [4] Company's internal AI tools [25] Open-source AI tools [20] Formal screening process for AI tools [25]
Data	Lack of training data [1][13][20][21][23][25]–[28] Data privacy and security issues [24][27]	Purposefully collecting data for training [1][26] Creating training datasets [20][26] Tools for data cleaning and pre-processing [27] Reliable data sources [27] Proper training of AI with high quality data [20][27][28]
External	Lack of reference implementations or standards [1][21]	Education system (e.g., university level) [27] Collaboration with other organizations [27] Certifications [16][21][26]

BARRIERS AND ENABLERS

- Lack of usefulness or produced value was reported in several studies
  - Relates to also to the lack of reference implementations or standards
- AI adoption requires big initial investments
  - Return-of-investment has not yet manifested, because AI adoption is still in it's early stages
- The why adopt AI if benefits are vague and cost is high?
  - Motivations for new technology adoption (Gulzar and Smolander, 2024)
    - Market dynamics, internal imperatives, technological advancement, social influence, economic considerations, operational and strategic improvements
    - AI hype as the reason for adoption?
- Potential enablers
  - Marketing AI benefits -> risk of increasing hype
  - Collaboration with other organizations could help identify and develop AI solutions for testing

BARRIERS AND ENABLERS

- Lack of time and resources
  - Daily work consumes all time and resources, no time for learning
- AI skill gap
  - even though LLMs have made AI more easily accessible, AI adoption still required specialized knowledge
- Lack of trust in AI (also relates to unreliability of AI tools, resistance to change)
  - LLMs are not ideal for tasks that require reliability or determinism
  - Data privacy and security issues
- Potential enablers:
  - Leadership support
  - Investments in skill development
  - Collaborative experimentation and research
  - Personnel training
  - Guidelines

BARRIERS AND ENABLERS

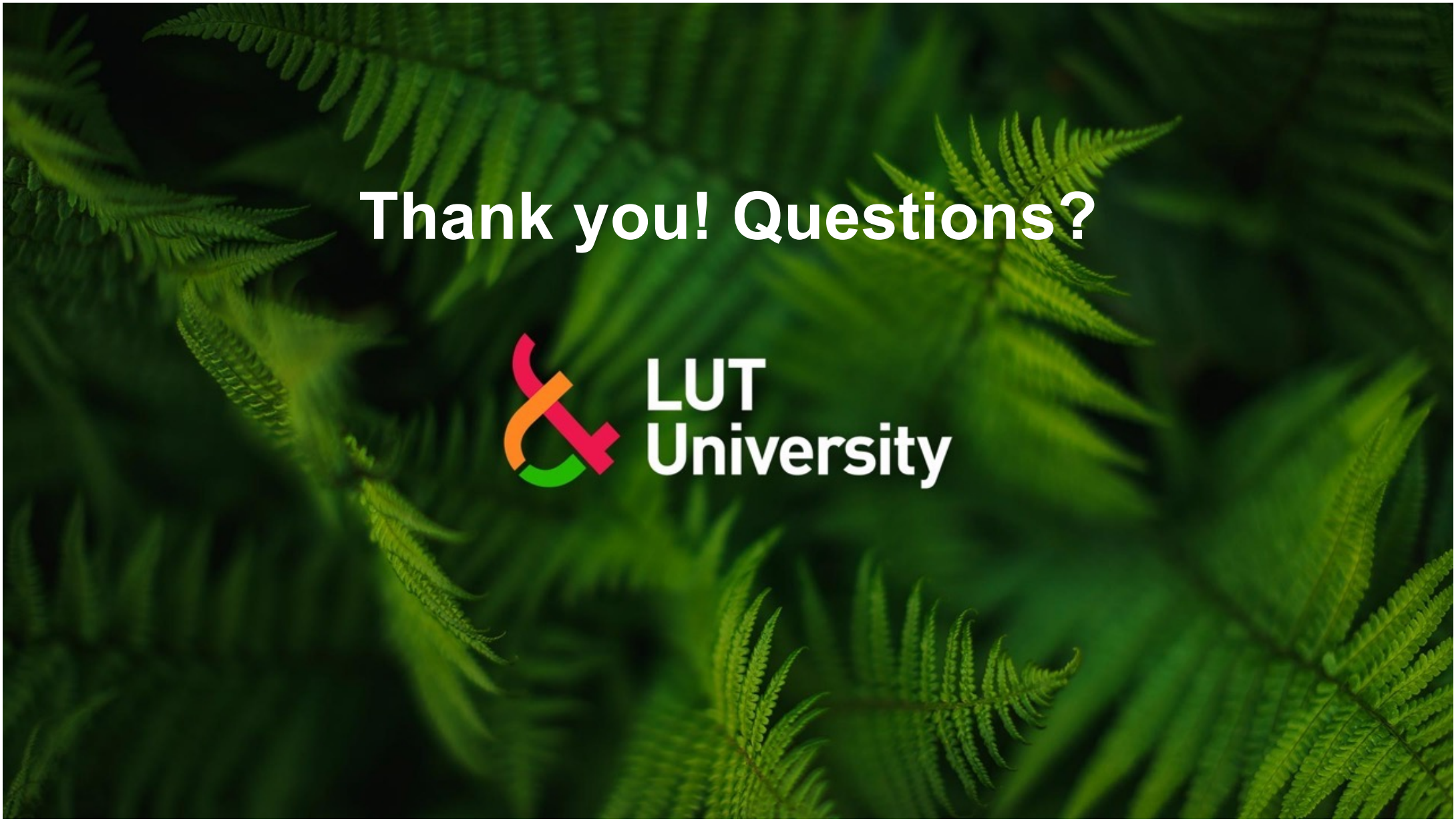
- New tools affect processes
  - Incompatibility with current processes was mentioned as a problem
  - Potential enablers:
    - Evaluation of current processes -> could we do things differently
    - Change management
- Lack of data for training
  - Potential enablers:
    - Purposefully collecting data for training
    - Creating training datasets
    - Tools for data cleaning and pre-processing

SUMMARY

- AI adoption in software testing is not only a technological issue
  - External, managerial, organizational and human issues impact adoption
- AI solutions for software testing exist, but there is a lack of reported success stories
  - It is possible that companies want to keep their success as a secret

NEXT STEPS

- Interview study with companies
  - Companies with no AI adoption in software testing
    - Why not?
  - Companies that have adopted AI in their software testing?
    - Why?
    - How?
      - What use cases?
      - What technologies have been used?
      - What challenges have arisen in the AI adoption process?
- Interviewees
  - Managers
  - Software testing specialists (testers, test automation developers), developers


Thank you! Questions?
LUT
University