

Towards Collaborative Business Models for Interorganizational Federated Machine Learning

Milena Zahn, 07.11.2022, Final Presentation Guided Research

Chair of Software Engineering for Business Information Systems (sebis)
Faculty of Informatics
Technische Universität München
www.matthes.in.tum.de

Outline



Motivation

- Federated Machine Learning
- Collaborative Business Models

Research Approach

- Research Questions
- Research Design

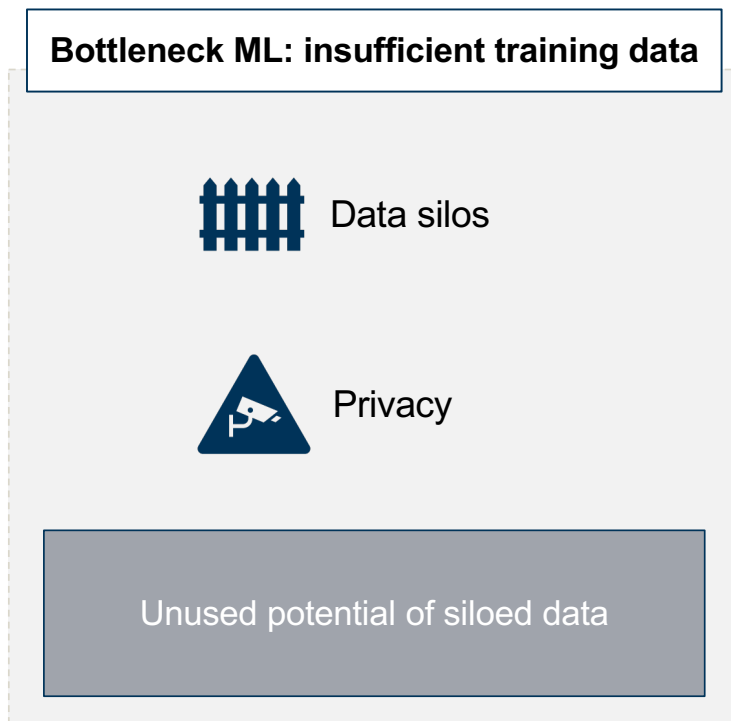
Results

- Collaborative Business Models for FedML
 - Challenges
 - Aspects
- Foundations for Governance
 - Roles
 - Lifecycle

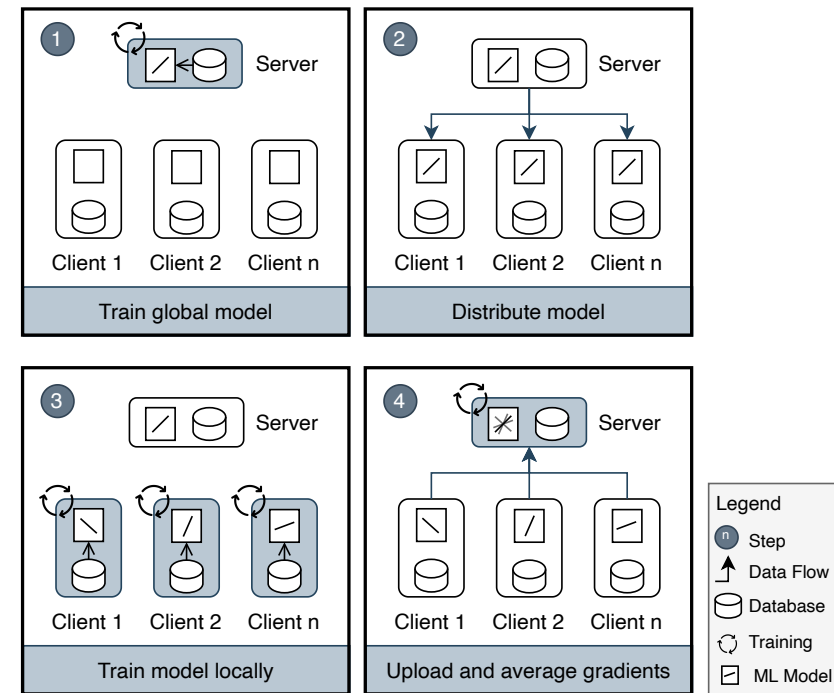
Limitations and Future Work

Motivation

Federated Machine Learning



Federated Machine Learning



[Ya19] Yang, Q., et.al.: Federated Machine Learning: Concept and Applications

[Lo21] Lo, S., et. al.: A Systematic Literature Review on Federated Machine Learning: From a Software Engineering Perspective

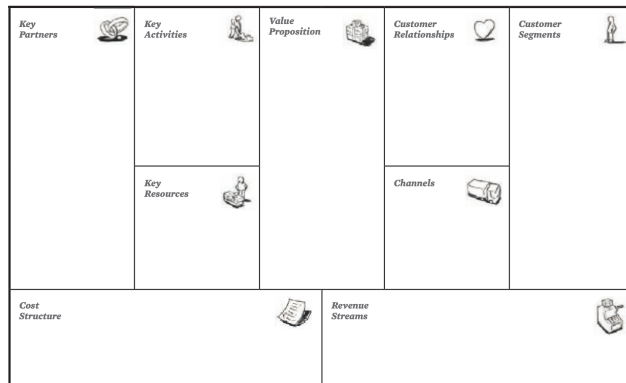
Motivation

Collaborative Business Models



Collaborative Business Models

Business Model Canvas¹



→ Several approaches for collaborative projects in specific areas

Observation

- Challenging especially when multiple companies are involved²
- Alliance failure rates are high, leaving much revenue at risk and value unrealized³
- Complex to operationalize³



Conclusion

- Align with operational governance
- Suggest attributes that support successful implementation⁴

¹ [Os10] Osterwalder, A., Pigneur, Y.: *Business Model Generation: A Handbook For Visionaries, Game Changers, and Challengers*

² [Pa21] Pauna, T., et al.: *Challenges for implementing collaborative practices in industrial engineering projects*

³ [Ma19] de Man, A., Luvison, D.: *Collaborative business models: Aligning and operationalizing alliances*

⁴ [Cu21] Curtis, S.: *Business model patterns in the sharing economy*

Research Approach

Research Questions and Methodology

Research Title

Towards Collaborative Business Models for Interorganizational Federated Machine Learning

Research Methodology

RQ1

What are governance-related challenges of interorganizational Federated Machine Learning in distinction to prevailing collaborative Business Models?



RQ2

What are aspects of interorganizational Federated Machine Learning Business Models, and which attributes could be used to extend the Business Models Canvas by Osterwalder?



RQ3

What are the foundations of governing Machine Learning processes, and how can they be derived to interorganizational Federated Machine Learning?

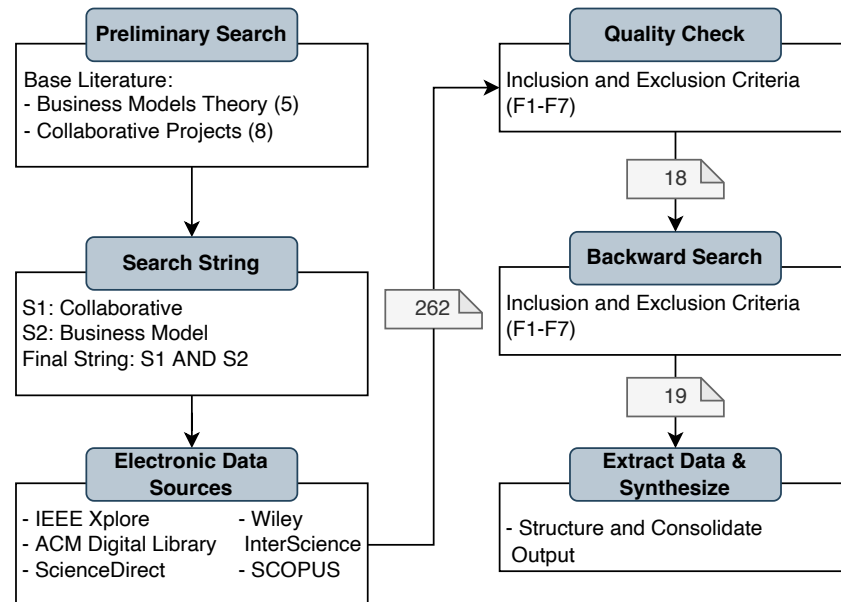


Research Approach

Research Methodology



Systematic Literature Review



S1 Collaborative: collaborati* OR federated OR interorganization* OR inter-organization* OR intercompany OR cross-company OR multi-party OR cross-industr* OR multi-institution* OR shared OR sharing OR alliance OR networked

S2 Business Model: "business model*" OR "model canvas" OR "business value model*"

Semi-structured Interviews

Interview Guide

- General Introduction
- Motivation for FedML Projects
- Challenges in FedML Projects
- Implementation Collaborative Business Models
- Outlook

Interviews

Interview ID	Position	Organization	Duration
E1	AI Business Developer	Large German software enterprise	52
E2	AI Project Lead and AI Developer	Large German software enterprise	44
E3	Principal Data Scientist (4)	Large German software enterprise	45
E4	Applied Researcher	Medium-sized innovation company	35
E5	Scientific Researcher	Research institute for software development	59

[K15] Kitchenham, B.: Evidence-Based Software Engineering and Systematic Reviews

[Ch10] Chen, L., Babar, M., Zhang, H.: Towards an Evidence-Based Understanding of Electronic Data Sources

Collaborative Business Models for FedML

Challenges



RQ1 What are governance-related challenges of interorganizational Federated Machine Learning in distinction to prevailing Collaborative Business Models?

Results



For references: see [report](#)

Collaborative Business Models for FedML

Aspects



RQ2 What are aspects of interorganizational Federated Machine Learning Business Models, and which attributes could be used to extend the Business Models Canvas by Osterwalder?

Artefact

Guiding questions

- Basics
- General Business Models¹
- Collaborative Federated Machine Learning
 - Collaboration Management
 - Co-Creation Management
 - Co-Creation Practices
 - FedML Product



¹ [Os10] Osterwalder, A., Pigneur, Y.: Business Model Generation: A Handbook For Visionaries, Game Changers, and Challengers

Collaborative Business Models for FedML

Aspects | Collaborative Federated Machine Learning



RQ2 What are aspects of interorganizational Federated Machine Learning Business Models, and which attributes could be used to extend the Business Models Canvas by Osterwalder?

Collaboration Management

Collaboration Structure

- *Negotiation Mechanisms*
- *Decision-Making*

Participant Management

- *Formation*
- *Change Management*
- *Transparency*

Infrastructure

- *Communication Management*
- *Collaboration Platform*

Co-Creation Management

Distribution of Attribution

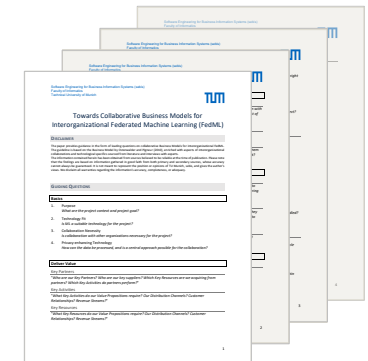
- *Ownership*
- *Responsibility*
- *Accountability*

Distribution of Revenue and Costs

- *Incentivization*
- *Collaboration Costs*

Intellectual Property

- *Intellectual Property Management*



Collaborative Business Models for FedML

Aspects for the Business Model Canvas



RQ2 What are aspects of interorganizational Federated Machine Learning Business Models, and which attributes could be used to extend the Business Models Canvas by Osterwalder?

Aspects to extend the Business Model Canvas¹

- Collaboration Management
- Co-Creation Management

Key Partners Who are our key partners? Who are our key suppliers? Which key resources are we acquiring from partners? Which key activities do partners perform?	Key Activities What key activities do our value propositions require? Our distribution channels? Customer relationships? Revenue streams?	Value Proposition What value do we deliver to the customer? Which one of our customer's problems are we helping to solve? Which customer needs are we satisfying? What bundles of products and services are we offering to each customer segment?	Customer Relationships What type of relationship does each of our customer segments expect us to establish and maintain with them? [...]	Customer Segments For whom are we creating value? Who are our most important customers?
	Key Resources What key activities do our value propositions require? Our distribution channels? Customer relationships? Revenue streams?		Channels Through which channels do our customer segments want to be reached? How are we reaching them now? How are our channels integrated? [...]	
Cost Structure What are the most important costs inherent in our business model? Which key resources are most expensive? Which key activities are most expensive?		Revenue Streams For what value are our customers really willing to pay? for what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each revenue stream contribute to overall revenues?		
Collaboration Management Is the collaboration structured with a dominant partner or with equal participants? How is the collaboration formed with the participants? How transparent are the participants inside and outside the collaboration?		Co-Creation Management How are revenue and costs distributed? How are ownership/ responsibility/ accountability distributed? How is intellectual property managed throughout the project participants?		

¹[Os10] Osterwalder, A., Pigneur, Y.: *Business Model Generation: A Handbook For Visionaries, Game Changers, and Challengers*

Collaborative Business Models for FedML

Foundations for Governance

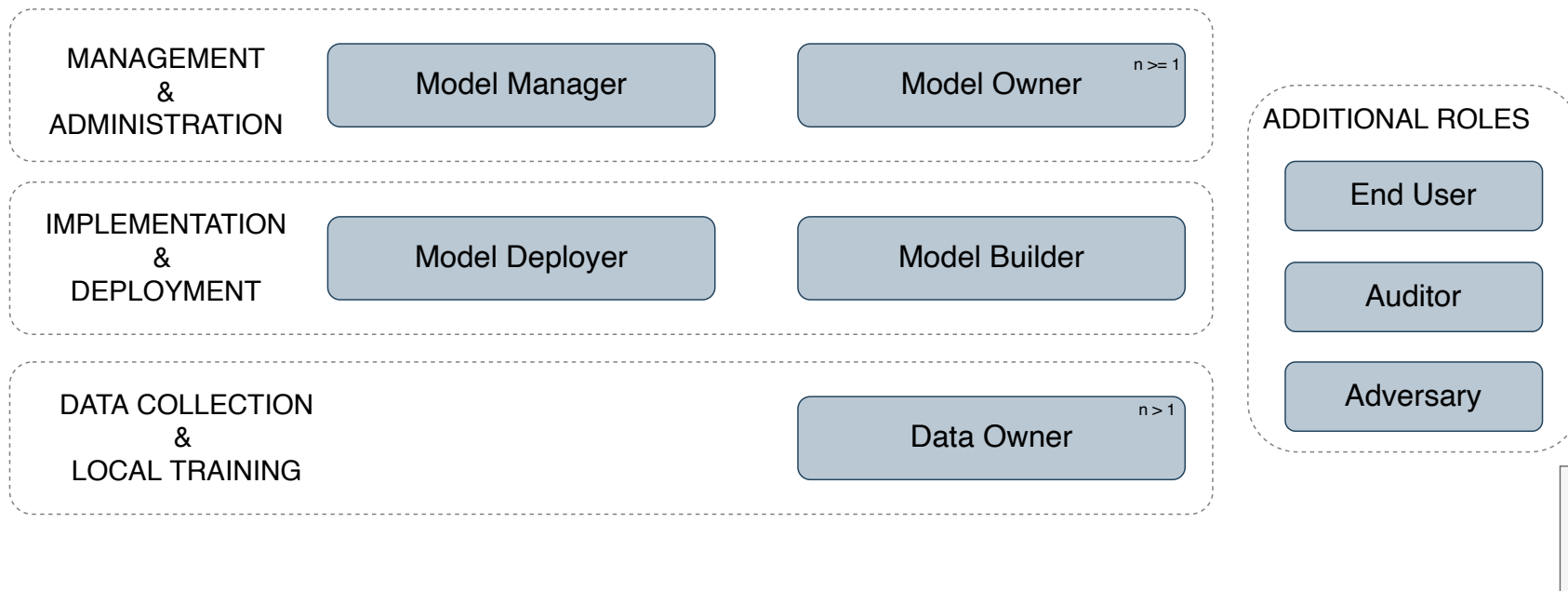


RQ3

What are the foundations of governing Machine Learning processes, and how can they be derived to interorganizational Federated Machine Learning?

Results: Roles

Overview of derived, high-level Federated Machine Learning roles



Collaborative Business Models for FedML

Foundations for Governance

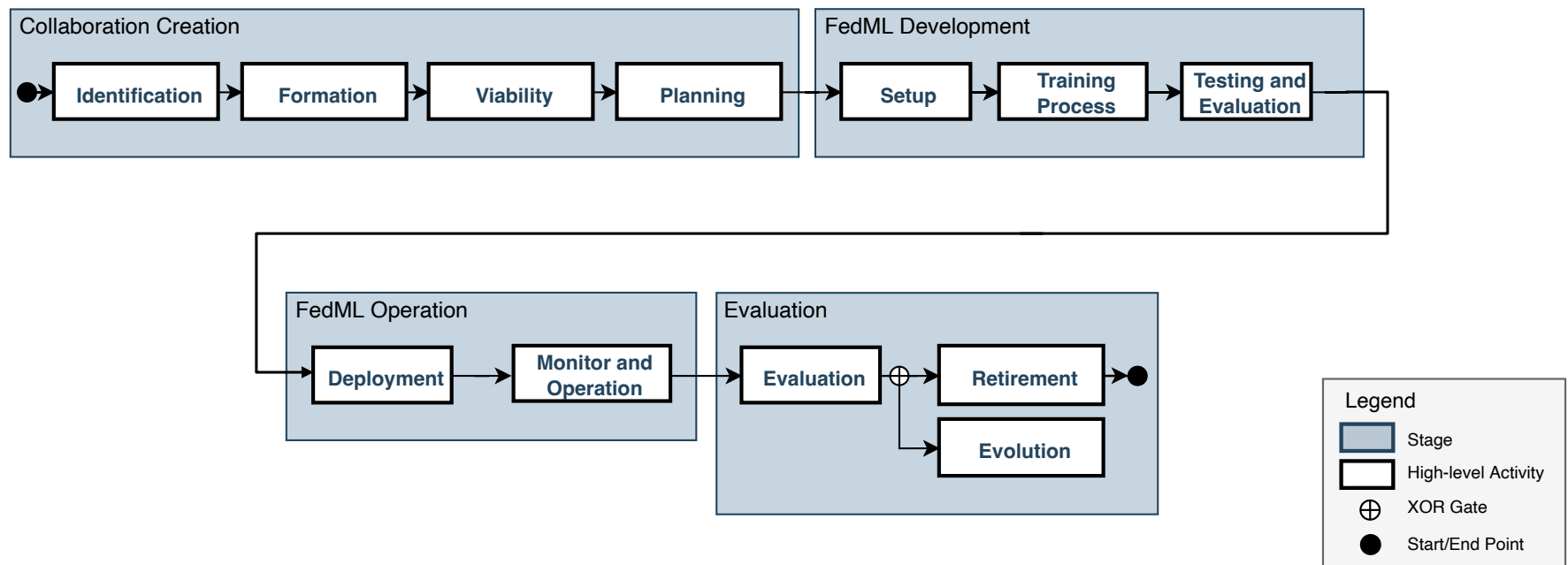


RQ3

What are the foundations of governing Machine Learning processes, and how can they be derived to interorganizational Federated Machine Learning?

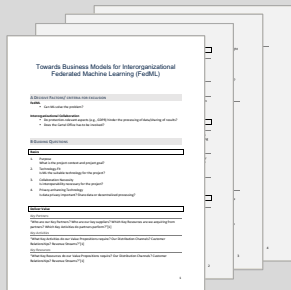
Results: Lifecycle

Overview of the high-level Federated Machine Learning lifecycle without iterations



Limitations and Future Work

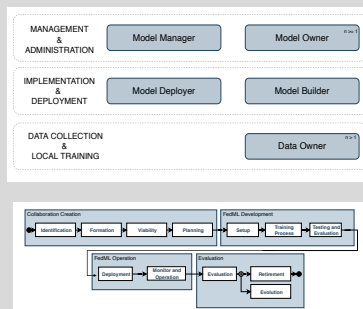
Aspects for Business Model



- Validation through interviews
 - Could be biased and might have led to one-sided results
 - No completed projects of practice

→ More interview partner

Roles and Lifecycle



- No validation
- Adopted from existing ML literature

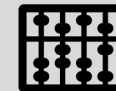
→ More detailed analysis/modelling

→ Workshop

Future Work



Validation with real-world applications



Process modelling



Data protection laws and regulations



Task-Technology fit



Milena Zahn

Technische Universität München
Faculty of Informatics
Chair of Software Engineering for Business
Information Systems

Boltzmannstraße 3
85748 Garching bei München

Tel +49.89.289. 17132
Fax +49.89.289.17136

matthes@in.tum.de
www.matthes.in.tum.de

