Investigating the Establishment of Communities of Practice in Large-Scale Agile Software Development

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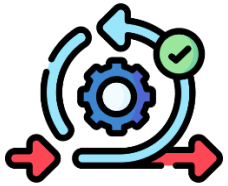
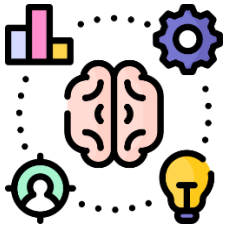
Outline

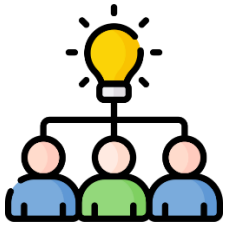
Motivation – Need for Knowledge in Large-Scale Agile Software Development



Due to their success in a small scale, agile methods are becoming more popular in a large-scale organizational context



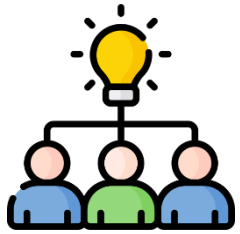
Large-scale software development (LSAD) requires access to an enormous amount of knowledge and expertise to be successful. Good coordination between all involved parties is needed as well.



Communities of Practices (CoPs) help to leverage the tacit knowledge in a multi-team organization. They support scaling agile to a large and distributed organization and improve & influence organization-wide issues.

Bjørnson et. al. (2016), K. Dikert et. al. (2016), Hendriks, P. (1999), Ipe, M. (2003), Kahkonen, T. (2004), Markus, L. M. (2001), Paasivaara et. al. (2014), Šmite, D. Et. al. (2017)

Motivation – Big picture & goal of this thesis



The potential of CoPs to address the need for knowledge in LSAD:

- They can enable cross-organizational knowledge exchange and coordination
- CoPs can support the agile transformation
- They strengthen the autonomy and self-organization of the teams

Only a little research with a focus on:

- Providing an overview of which CoPs currently exist in practice in LSAD
- The establishment of CoPs in large-scale agile development (how/why)
- Providing guidance, especially on topics relevant to practice

Requirements in LSAD:

- Coordination between different teams and roles
- Trustful working environment (including good networking)
- Self-organized teams
- Company-wide knowledge (exchange)
- Challenges for CoPs, since they can also fail

Investigation of the use and establishment of CoPs in LSAD

Kähkönen (2004) Markus, L. M. (2001), Paasivaara et. al. (2014), SAFe 6.0 (2023), Silvia et. Al. (2007), Schwaber et. al. (2020), Uludag et. Al. (2022), 16th State of Agile Report (2023)

Outline

Introduction

Research Methodology

Study results

Differences between classic CoPs and the ones in LSAD

Open research areas

Key findings and outlook

Research Methodology - Research questions

RQ1	What types of CoPs exist in large-scale agile software development?

RQ2	What are the goals and reasons for the establishment of CoPs in that context?

RQ3	How were the CoPs established? Who was involved and how?

RQ4	How do knowledge sharing and governance take place?

RQ5	What research topics in that context would be relevant/interesting for practice?

Research methodology – Problem Identification for Design Science

Environment

M. D. Myers et al. (2007), C.B. Seaman (1999)

Expert/Interview study:

- Semi-structured interviews with interview experts from different roles and organisations
- Goal: Understand the current state of how and what kind of CoPs are established in large-scale agile development and identify relevant research topics in that context

Peffers et al. (2012)

Design Science Research

Hevner et al. (2004), Peffers et al. (2007)

Problem identification

Objectives of a solution

Design and development
Guidance for Future Research in the area of CoPs in large-scale agile development

Evaluation of the Artefact

Communication

Knowledge Base

Literature and related work:

- Large-Scale agile development
- Communities of practices:
  - Different Types
  - Establishment
  - Roles/Stakeholders
  - Challenges
- Related work

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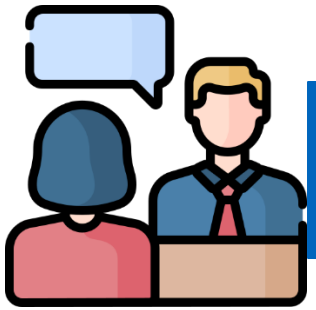
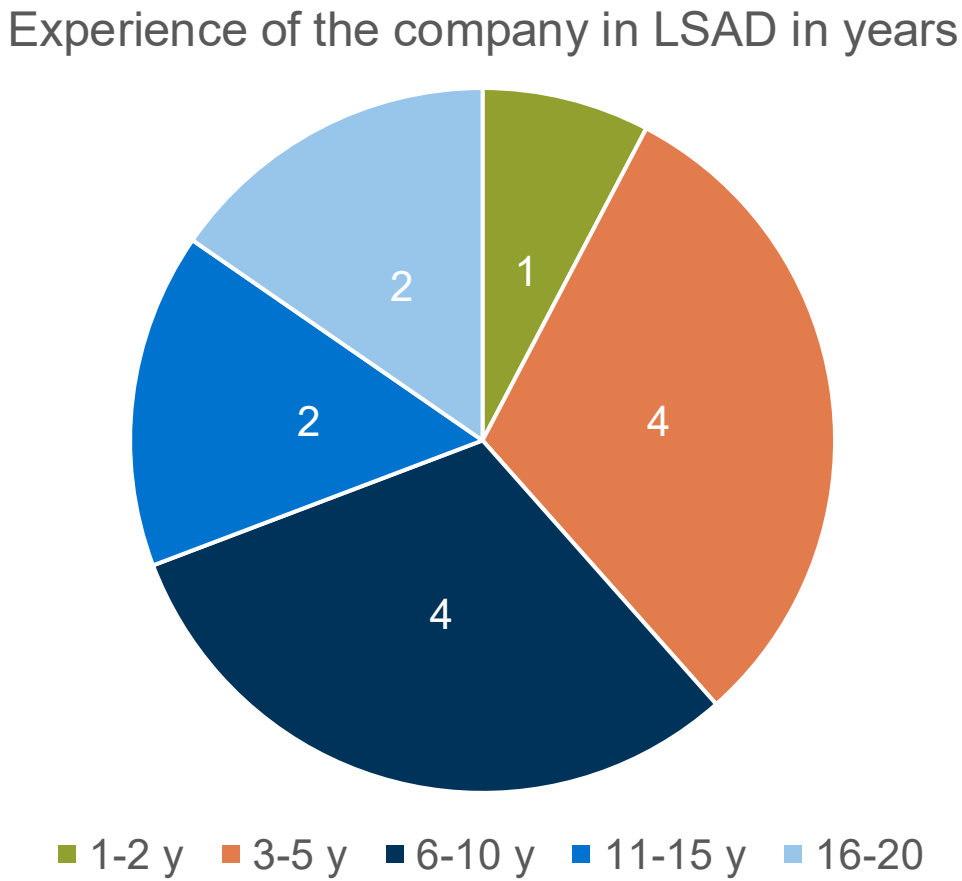
Study results – Organizations of the interviewed experts



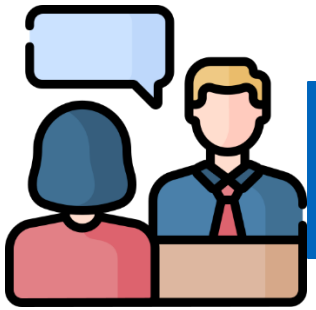
23 interviews with experts from **13 organizations**

Organizations

- Organizations from the sectors of **Automotive, Consulting, Healthcare, Retail (Food, Electronic), Insurance, Medical Devices,** and **Software Development**
- Between **1-6 interviews** per organization (experts out of different working areas)
- 5 companies (38,5%) have **more than 100.000 employees worldwide**
- 4 companies (30,8%) have **less than 10.000 employees worldwide**



Study results – Roles and experience of the experts

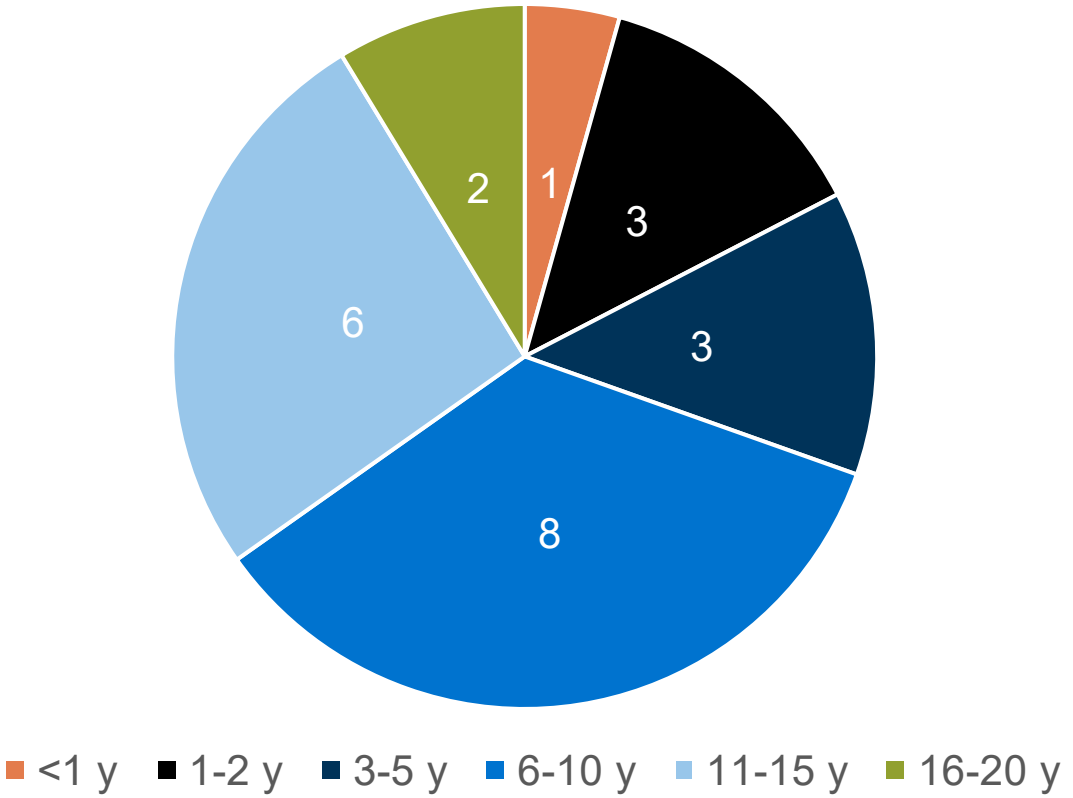


23 interviews with experts from **13 organizations**

Experts

- Experts from different working roles, e.g., **Agile Coach, Manager, Scrum Master**
- Experts with different roles in the CoPs, e.g., **Lead, Member, Moderator**
- 13 experts (56,5%) have **more than 11 years of experience in agile development**
- 8 experts (34,7%) have **more than 11 years of experience in LSAD**

Experience of the experts in LSAD in years



Study results – Types of CoPs in LSAD (RQ1)

Role-based CoPs

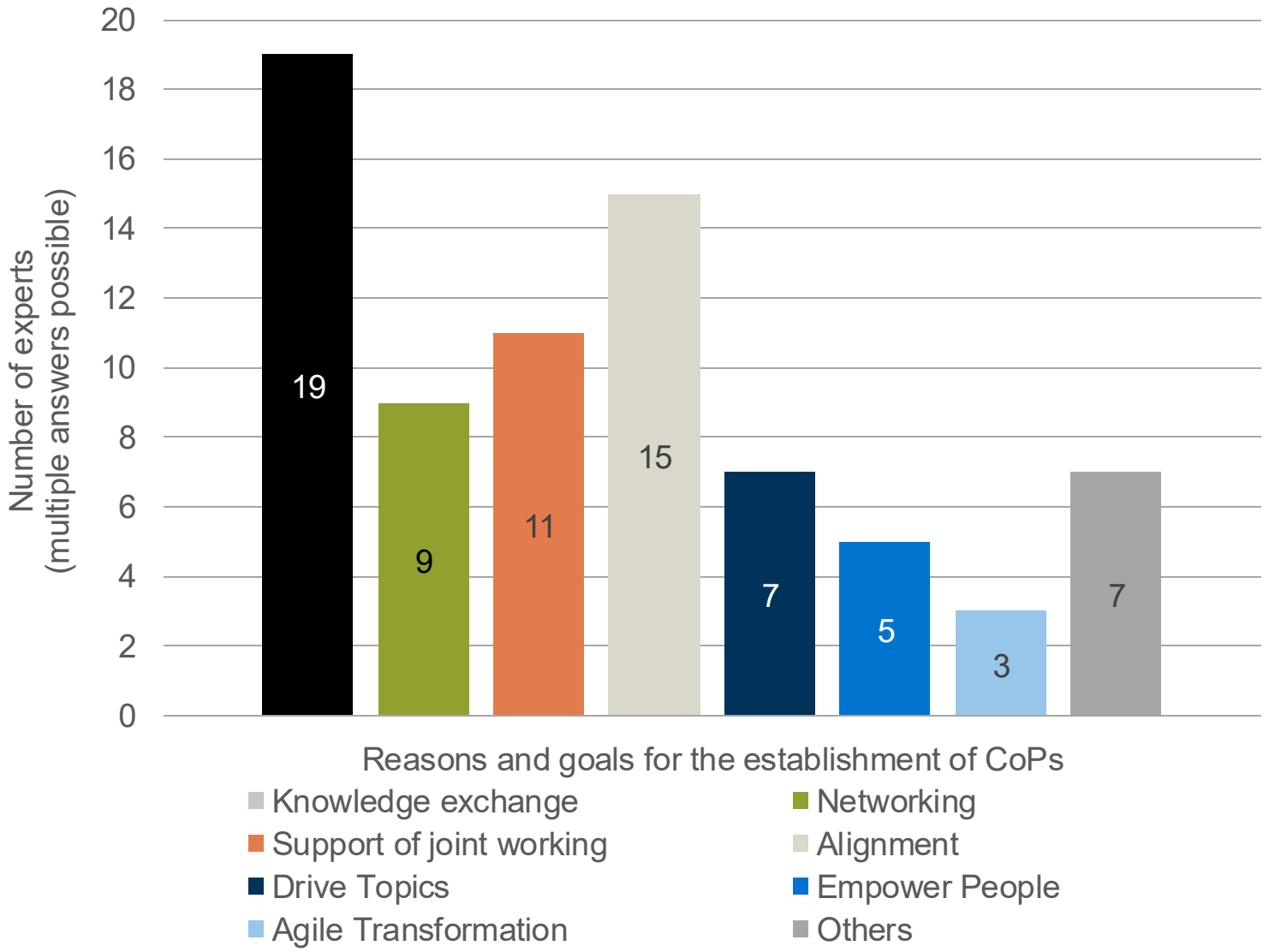
- **16 experts** mentioned role-based communities
- In total, **43** were identified
- The most common ones mentioned by the experts are:
  - **Scrum Master** (34,8%)
  - **Product Owner** (34,8%)
  - **Architects** (17,4%)
- Remark: Some CoPs are created (and mandatory) **for specific roles**, but everybody could join theoretically

Topic-based CoPs

- **21 experts** mentioned topic-based communities
- In total, **48** were identified
- The most common ones mentioned by the experts are:
  - **Agility** (30,4%)
  - **Architecture** (17,4%)
  - **Cloud, Security, and UX** (each 13,0%)
- Remark: The target group of the topic-based CoPs is either **everyone interested** or **multiple roles**

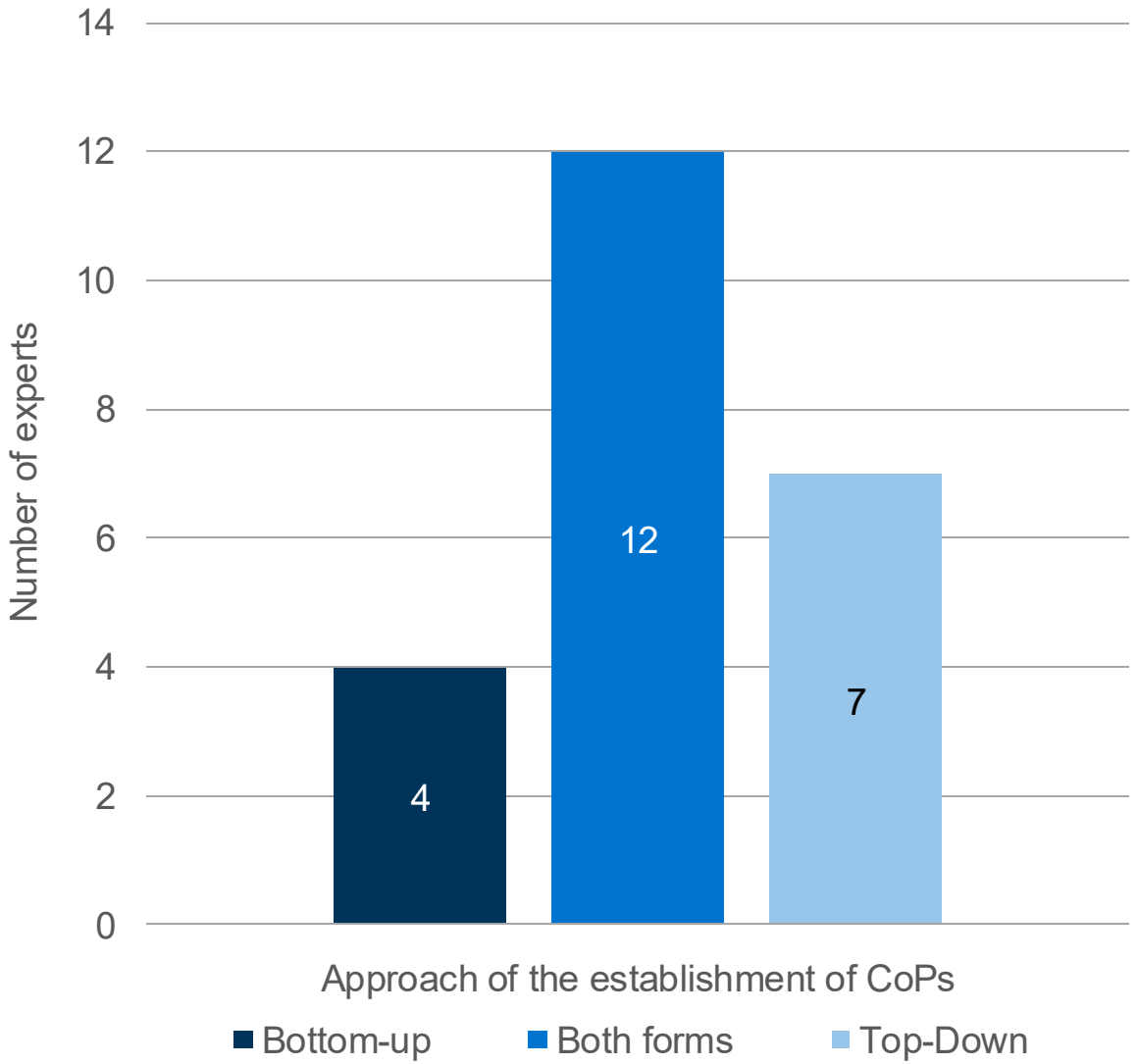
Study results – Goals and reasons for the establishment (RQ2)

- **Knowledge exchange** (82,6%):
  - Share knowledge related to topics or roles
  - Help new employees
- **Alignment of people** (65,2%):
  - **Align roles** in the whole organization, e.g., Scrum Masters
  - “Be on the same page”
  - Train/Introduce new methods to all people
- **Support of joint working** (47,8%):
  - Help **cross-functional areas**
  - Improvement of the **independence and cooperation of the teams** in their daily work, e.g., in case of problems



Study results – Establishment process (RQ3)

- **Top-down** (82,6%)
  - By **management** (and **agile coaches**)
  - E.g., during organizational transformations
  - A mainly successful, if there is a certain need for knowledge exchange, e.g., a company-wide problem
- **Bottom-up** by employees (69,6%)
  - Arises often through informal talks of **employees** and gets bigger over time
  - Can start without the support and permission of the management
- **Further planned CoPs:**
  - Concrete plan (26,1%)
  - Most likely in the future (56,5%)

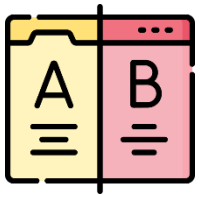


Study results – Changes and reasons for closing CoPs

Changes

- **Format** (30,4%)
  - From presentation to more discussion
  - Adoption of the agenda to a more formal one

- **Frequency** (26,1%)
- **Size and people** (26,1%)



- **Split of CoPs** (26,1%)
  - Topic/Scope was too wide

- **Regular Changes** (47,8%)
  - Based on feedback
  - Needed to keep attendance and participation high

Closing of CoPs

- **Lack of attendance** (56,5%)
  - Lack of interest
  - Time issues (under pressure)

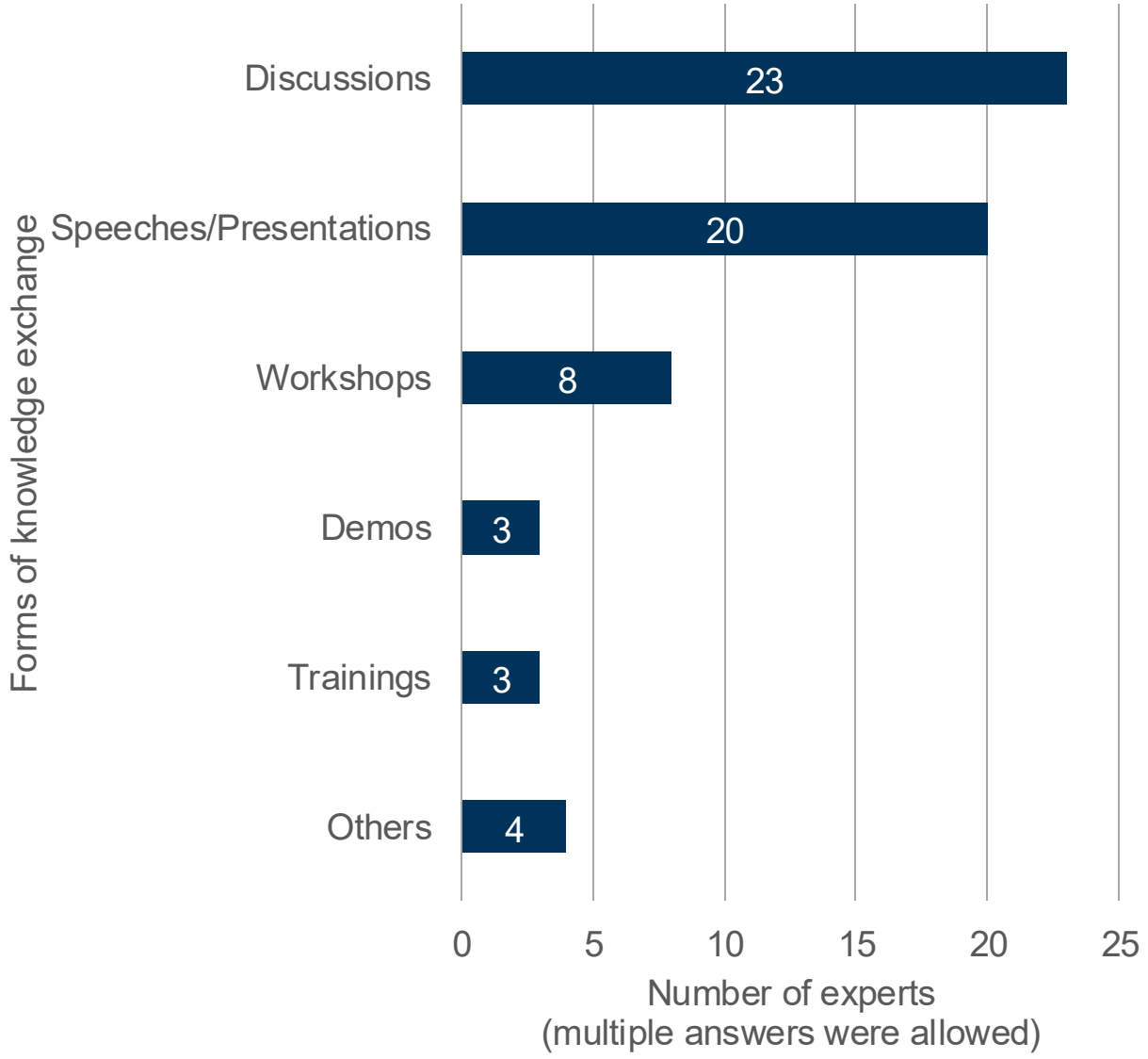
- **No common goal** (47,8%)
  - Different expectations
  - No clear focus on a specific topic

- **Lack of participation** (30.4%)
  - No CoP-Leader
  - One-way communication (Just a few people speak)

- **Achieved Goal** (34,8%)
  - Topic is no longer relevant
  - CoP gets integrated into another one

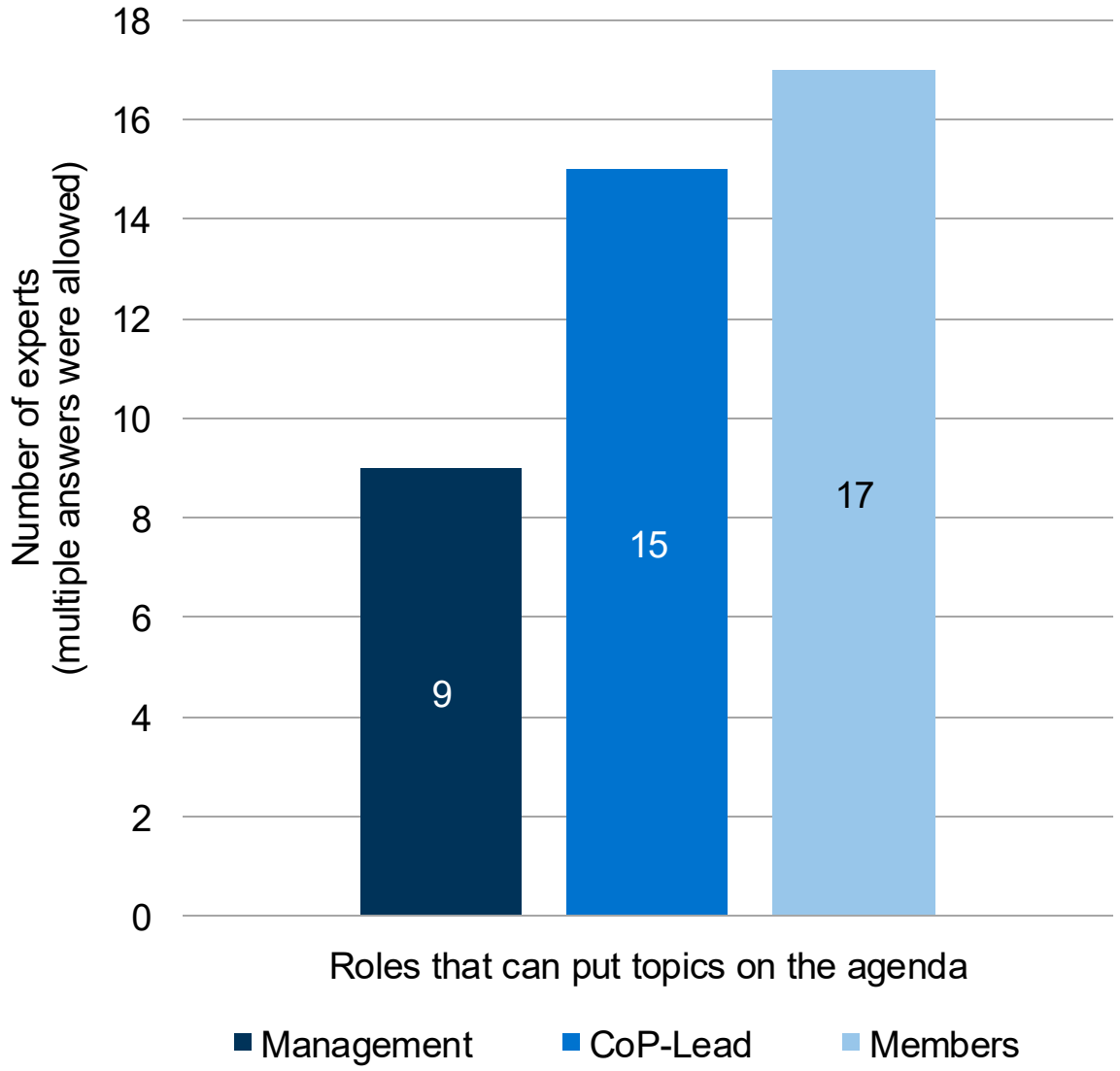
Study results – Knowledge sharing and governance of CoPs (RQ4) 1/2

- **Time & Location:**
  - mainly **1h** meetings (34,8%)
  - Regularly, mainly **weekly** (60,1%)
  - Asynchronous communication via **chat** (91,3%)
  - Mainly **virtual,** followed by hybrid formats
- **Form of knowledge exchange:**
  - **Discussions** (formal or informal) (100%)
  - **Speeches** and **Presentations** (87,0%)
  - **Mixture** suggested
- **Communication & Documentation:**
  - (Public) documentation of the results (73,9%)
  - Communication of the results (56,5%), e.g., via e-mails, newsletters, or company-wide meetings
- **Tools:**
  - **Microsoft Teams** (82,6%)
  - **Wiki/SharePoint** (56,5%)
  - **E-Mail** (52,2%)
  - **Confluence** (47,8%)



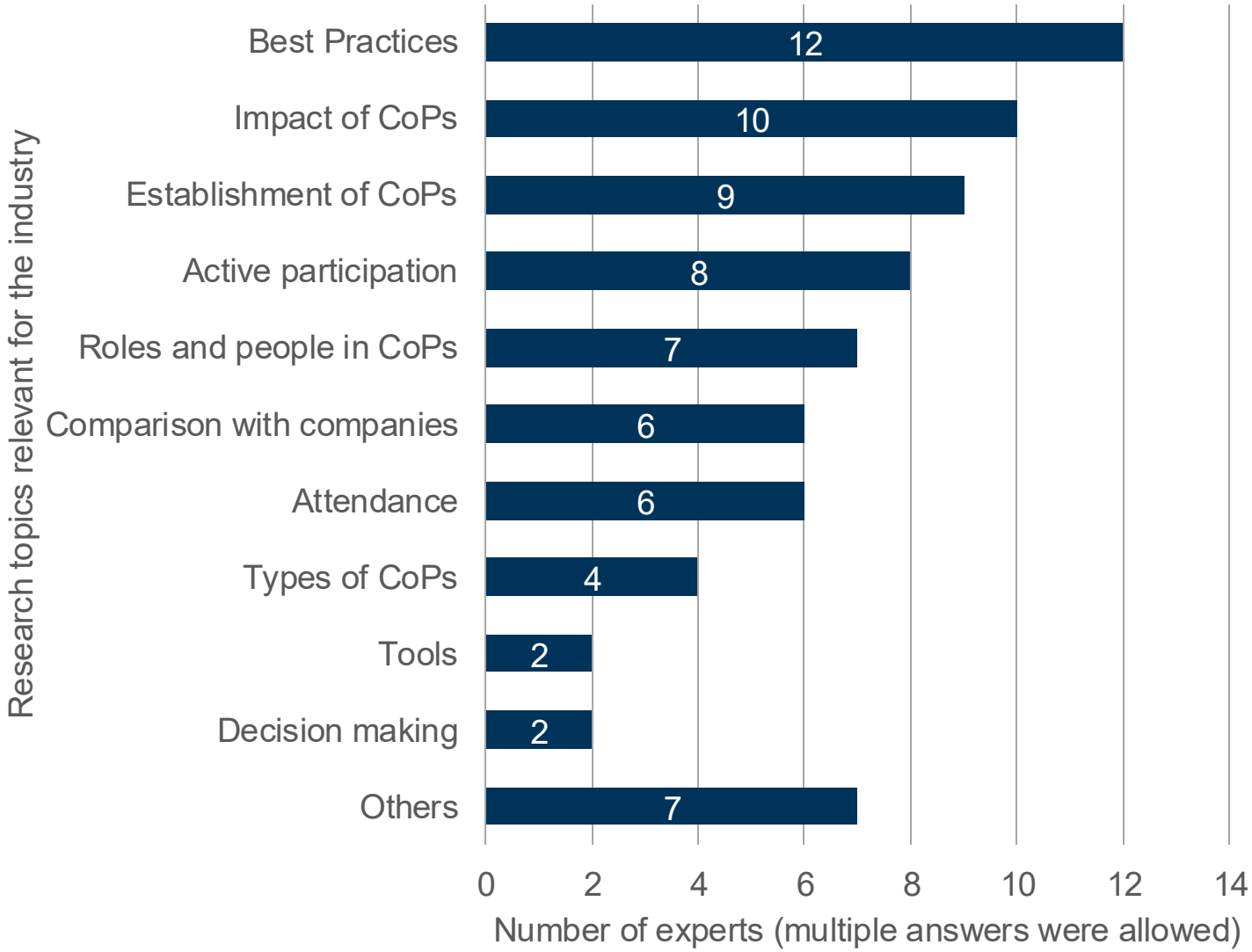
Study results – Knowledge sharing and governance of CoPs (RQ4) 2/2

- **Roles involved:**
  - In CoPs: Leader, participants, speaker moderator
  - Mainly supportive: Management, agile coaches
- **Obligation to attend the CoP:**
  - Mainly **voluntary**
  - In some cases, **partly mandatory** (17,4%)
  - In InsuranceCo1, some are **mandatory**
- **Agenda:**
  - Agenda can be **co-created** or **provided** by management or CoP-Lead
  - In some cases, e.g., informal coffee talks, there is no strict agenda
- **Steering:**
  - delicate topic since teams and people should have autonomy
  - Mainly for organizational stuff like invitations, set-up, moderating, or agenda



Study results – Research area relevant for the industry (RQ5)

- **Best Practices** (52,2%)
  - Do’s and don’ts
  - Aspects for **a successful early phase**
- **Impact of CoPs** (43,5%)
  - What **values** do CoPs create, e.g., revenue versus costs?
  - What happens if there a suddenly no more CoPs in a company?
  - **But:** Unclear how/hard to measure
- **Establishment of CoPs** (39,1%)
  - Concrete **guidelines** based on proven ways or experience
  - **Goal setting**
  - What can foster the **emergence of CoPs**



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Differences between classic CoPs and the ones in LSAD

Open research areas

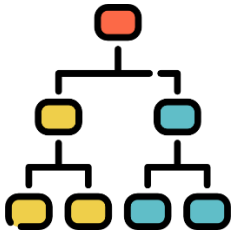
Key findings and outlook

Differences between classic CoPs and the ones in LSAD

Types of CoPs:
Although there are topic- and role-based CoPs in both cases, the most common CoPs in LSAD mainly focus on agile topics or roles, e.g., Scrum Master, Agile Coaches.

Goals and reasons:
While the goal of classic CoPs is mainly networking and knowledge exchange, the experts also mentioned the alignment of people, support of joint working, and driving particular topics as reasons.

Approach and format:
In non-agile organizational contexts, the most common and successful way to establish a CoP is the bottom-up approach. In contrast, the experts indicated that the initiative came mainly from management, which is not in line with agile methodology.



Structure and hierarchy:
While traditional organizations have a more hierarchical structure with central decision-making, CoPs in LSAD aim to enable self-organization and distributed decision-making.

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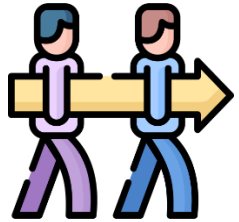
Best practices:
What are best practices for establishing and managing CoPs?

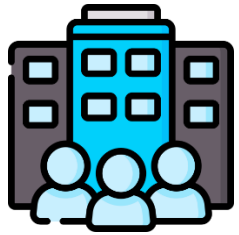
Impact of CoPs:
What is the effect of CoPs on organizational success?



Decision Making:
What decision-making authority should and do CoPs have in LSAD?

Active Participation:
How can active participation be achieved in all phases of a CoP?

Attendance:
How can high attendance be achieved in all phases of a CoP?



Cross-company CoPs:
How can cross-company CoPs be established, and how do they work?

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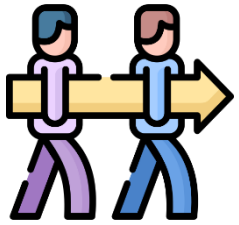
Key findings

- The most common CoPs in LSAD **focus on agile topics or roles**
- Next to knowledge exchange, also the **alignment of people and roles** is a common **reason for the establishment** of CoPs in LSAD
- CoPs play an **essential role in agile organizations**

- CoPs in LSAD should **change regularly**
- CoPs mainly fail due to a **lack of attendance** or an **unclear common goal**

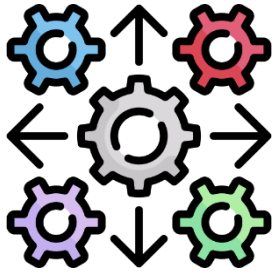


- CoPs should be **self-organized** (autonomy), which contrasts with the identified **high involvement of management** in the establishment of CoPs in LSAD
- A **dedicated person/leader is needed** for successful CoPs in LSAD who is responsible for organizational and structural tasks

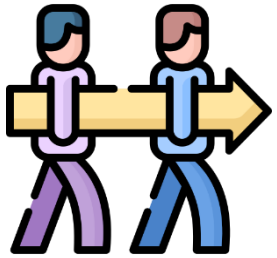
- CoPs in LSAD can have a **decision power**
- **Future Research** on **best practices** and the **impact of CoPs** in LSAD is needed

Future Work

Address the identified open research areas, e.g., the impact of CoPs and best practices.



Development of an artifact to support the industry



Investigation of the decision-making of CoPs

Influence of the (organizational) culture on CoPs

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Back-up

Failures

Organizations

Sector of company	Code name of company	Company size (employees)	Number of interviews
Automotive	CarCo1	149.400+	1
Automotive	CarCo2	87.000+	1
Consultancy	ConsultCo1	360.000+	3
Consultancy	ConsultCo2	self-employed	1
Consultancy	ConsultCo3	5.000+	1
Consultancy	ConsultCo4	self-employed	1
Consultancy	ConsultCo5	27.700+	1
Electronic Retailer	ElectRetailCo1	52.000+	2
Food Retailer	FoodCo1	161.000+	1
Insurance	InsuranceCo1	159.000+	3
Medical Devices	MedicDeviCo1	66.000+	1
Software Development	SoftwareCo1	29	1
Software Development	SoftwareCo2	105.000+	6

Area	Location	Number of interviews
Commerce	Germany	1
Commerce	Poland	2
Manufacturing	Germany	2
Software Delivery	Germany	1

Experts

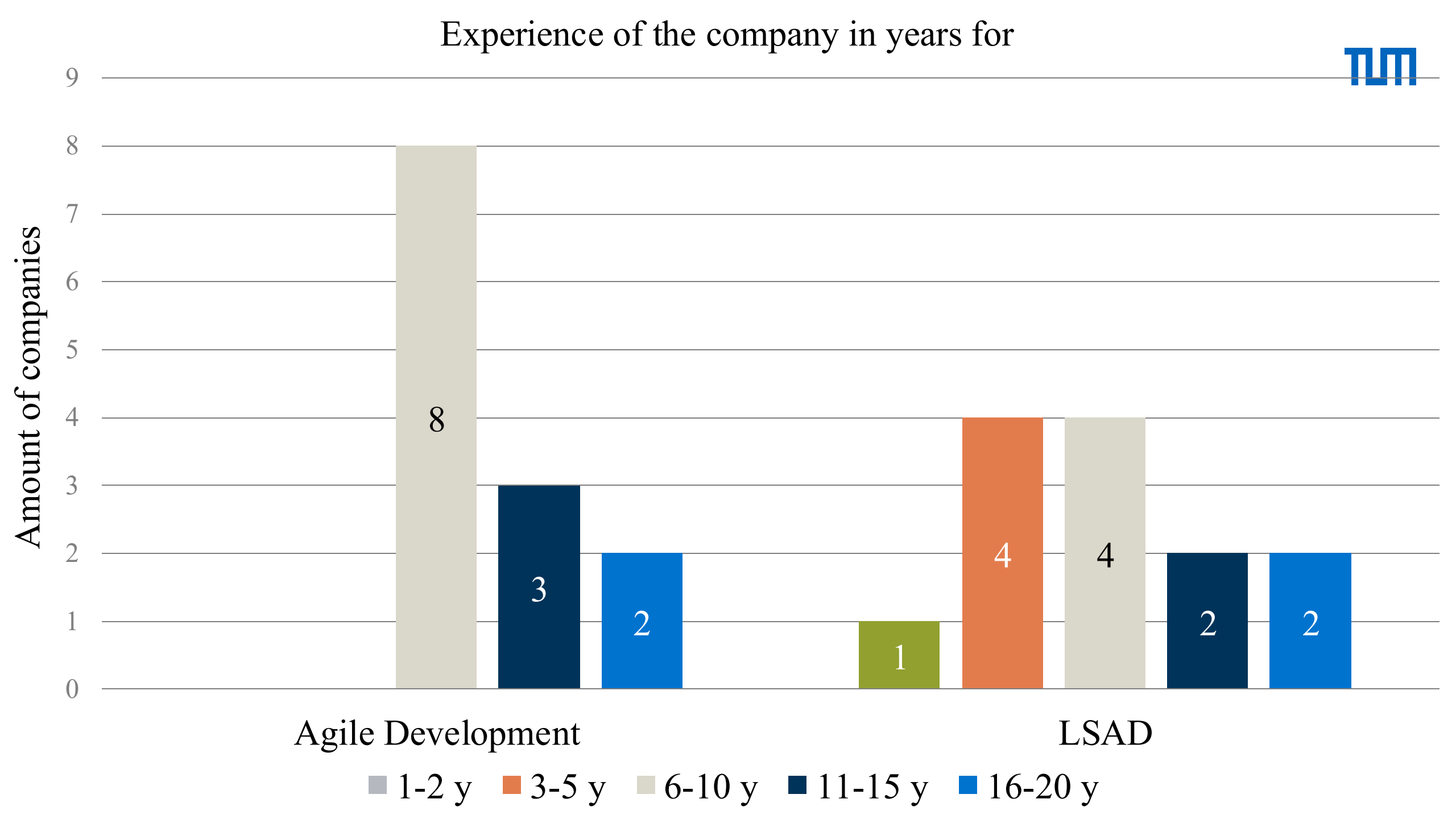
ID	Company	Role	Time in agile software development	Time in LSAD
E1	SoftwareCo1	Manager, Scrum Coach, Enterprise Architect, Software Architect, Solution Architect, DevOps Engineer	11-15 years	11-15 years
E2	InsuranceCo1	Enterprise Architect	1-2 years	1-2 years
E3	SoftwareCo2	Manager, Scrum Coach, Agile Coach	11-15 years	11-15 years
E4	ConsultCo1	Manager	6-10 years	6-10 years
E5	SoftwareCo2	Software Architect	16-20 years	16-20 years
E6	ConsultCo2	Quality Assurance, Agile Coach	11-15 years	1-2 years
E7	CarCo1	Agile Coach, Manager	6-10 years	6-10 years
E8	SoftwareCo2	Scrum Master, Security Expert	11-15 years	< 1 year
E9	SoftwareCo2	Developer, Scrum Master	16-20 years	11-15 years
E10	CarCo2	Agile Coach	6-10 years	3-5 years
E11	ConsultCo1	Business Analyst	6-10 years	6-10 years
E12	SoftwareCo2	Scrum Master	11-15 years	3-5 years
E13	ElectRetailCo1	Scrum Coach, Agile Coach, Manager	16-20 years	6-10 years
E14	ElectRetailCo1	Agile Coach	6-10 years	1-2 years
E15	FoodCo1	Developer, Agile Coach	11-15 years	6-10 years
E16	SoftwareCo2	Scrum Master	6-10 years	6-10 years
E17	ConsultCo3	Agile Coach, Senior Consultant, Product Owner, Circle Lead	11-15 years	11-15 years
E18	ConsultCo1	Scrum Master, Agile Coach	6-10 years	6-10 years
E19	ConsultCo4	Developer, Manager, Product Owner, Quality Assurance, Software Architect, Process Consultant	>20 years	16-20 years
E20	ConsultCo5	Agile Coach	11-15 years	11-15 years
E21	InsuranceCo1	Security Guilt Lead	3-5 years	3-5 years
E22	MedicDeviCo1	Software Architect	11-15 years	11-15 years
E23	InsuranceCo1	Agile Coach, Enterprise Architect	6-10 years	6-10 years

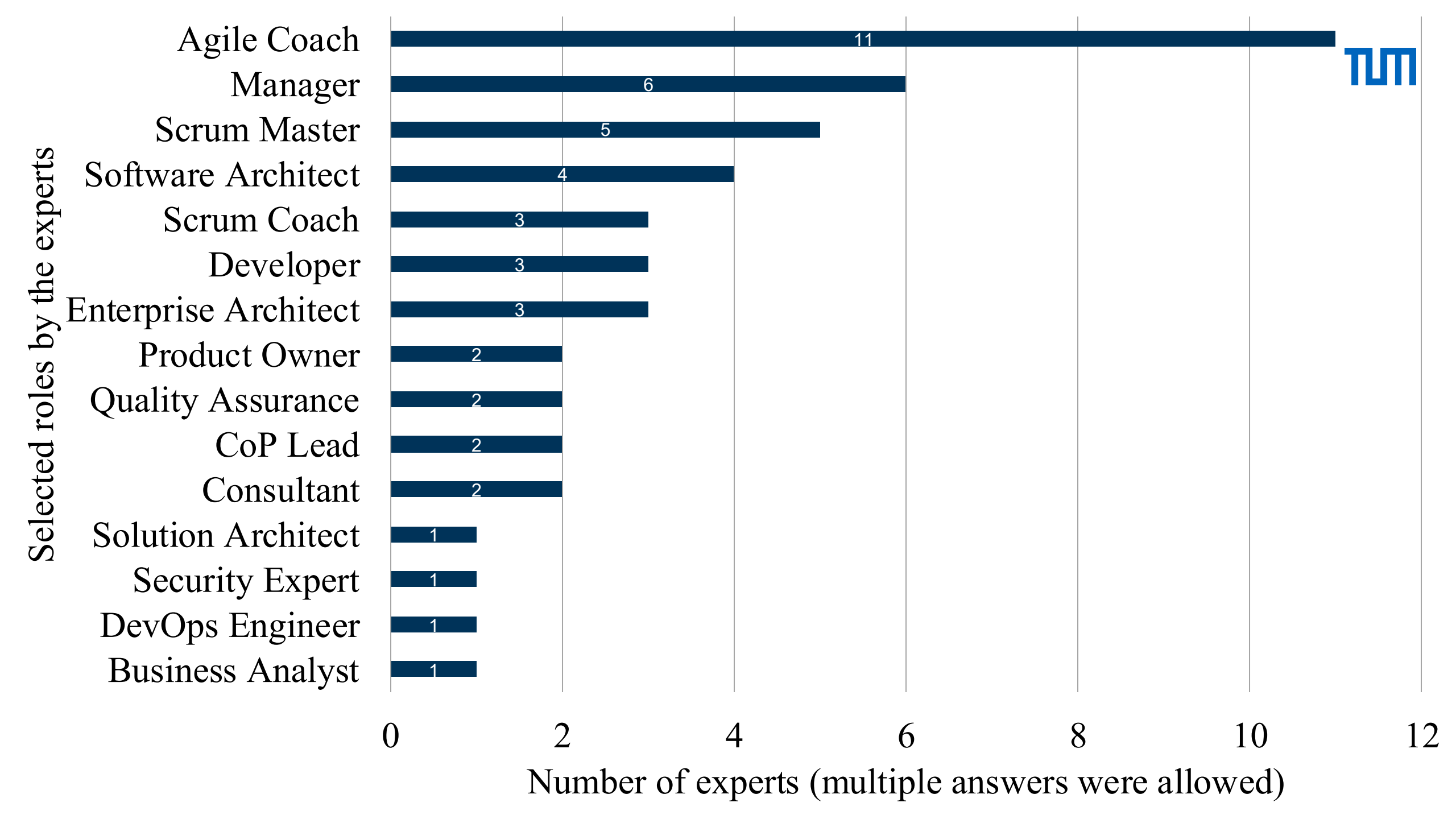
Duration of the interviews

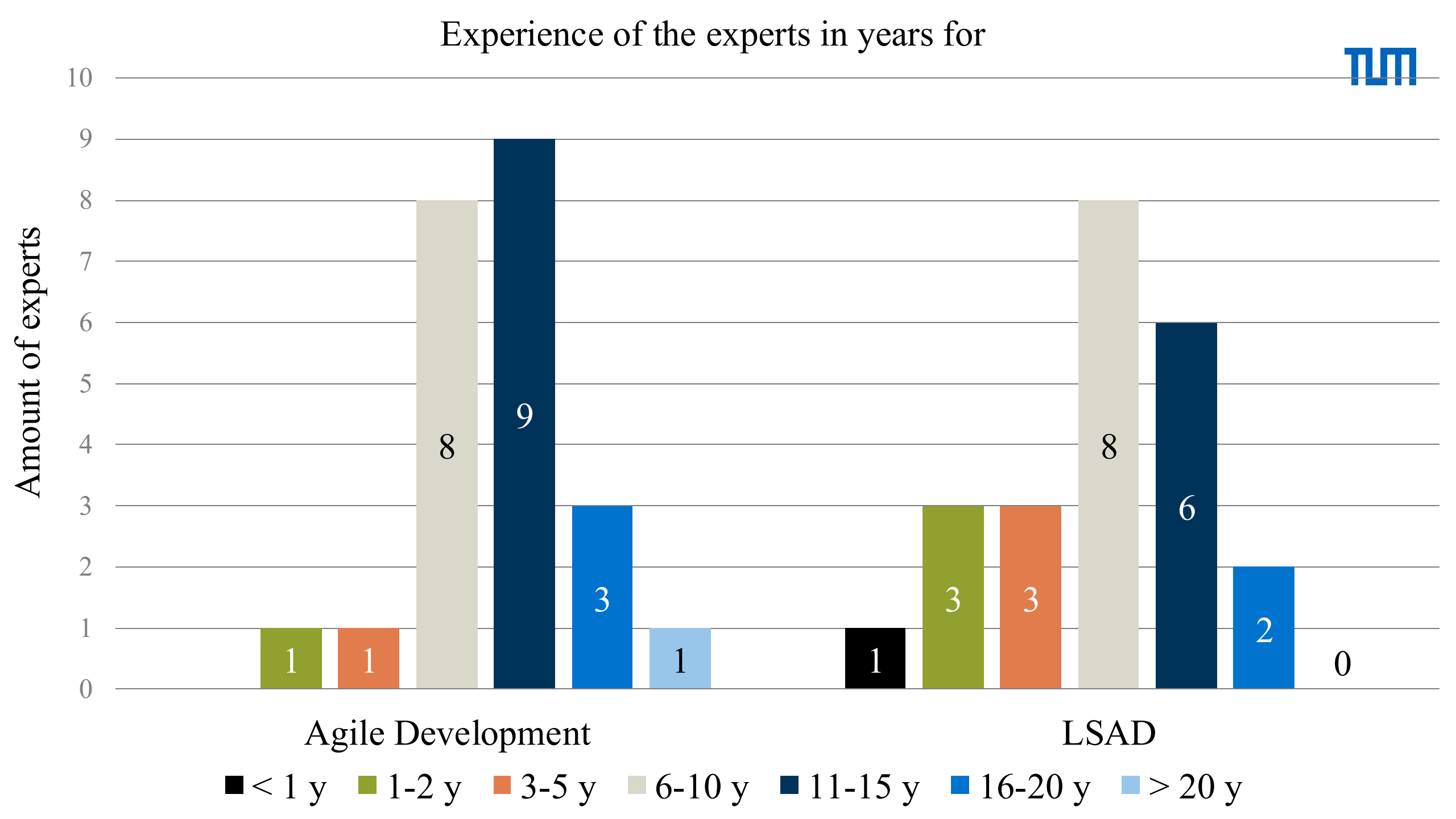
ID	Company	Duration
E1	SoftwareCo1	40 min
E2	InsuranceCo1	52 min
E3	SoftwareCo2	53 min
E4	ConsultCo1	41 min
E5	SoftwareCo2	41 min
E6	ConsultCo2	45 min
E7	CarCo1	52 min
E8	SoftwareCo2	54 min
E9	SoftwareCo2	23 min
E10	CarCo2	62 min
E11	ConsultCo1	47 min
E12	SoftwareCo2	41 min
E13	ElectRetailCo1	44 min
E14	ElectRetailCo1	53 min
E15	FoodCo1	51 min
E16	SoftwareCo2	46 min
E17	ConsultCo3	44 min
E18	ConsultCo1	50 min
E19	ConsultCo4	46 min
E20	ConsultCo5	37 min
E21	InsuranceCo1	41 min
E22	MedicDeviCo1	44 min
E23	InsuranceCo1	53 min

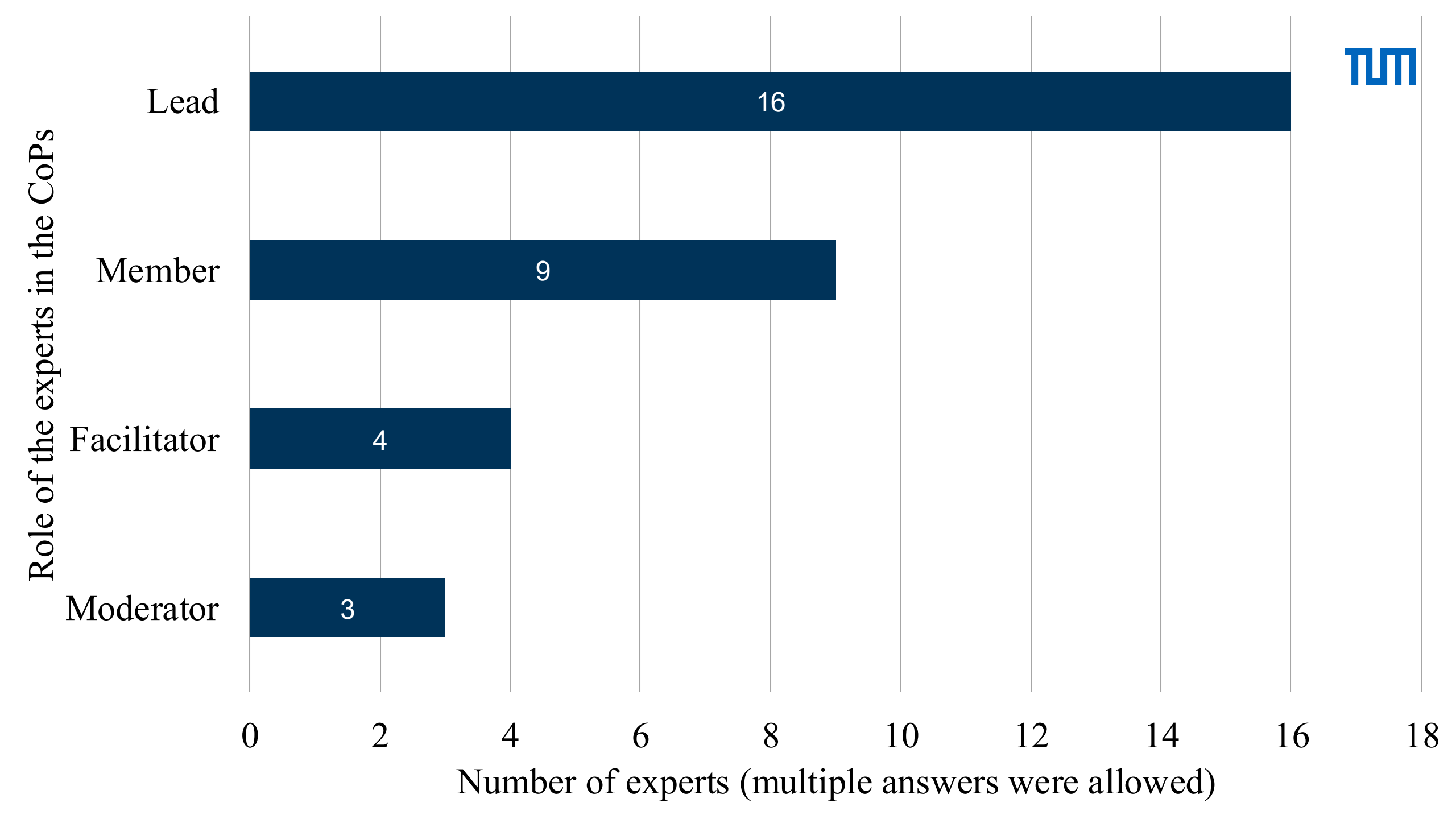
Types of CoPs mentioned by experts

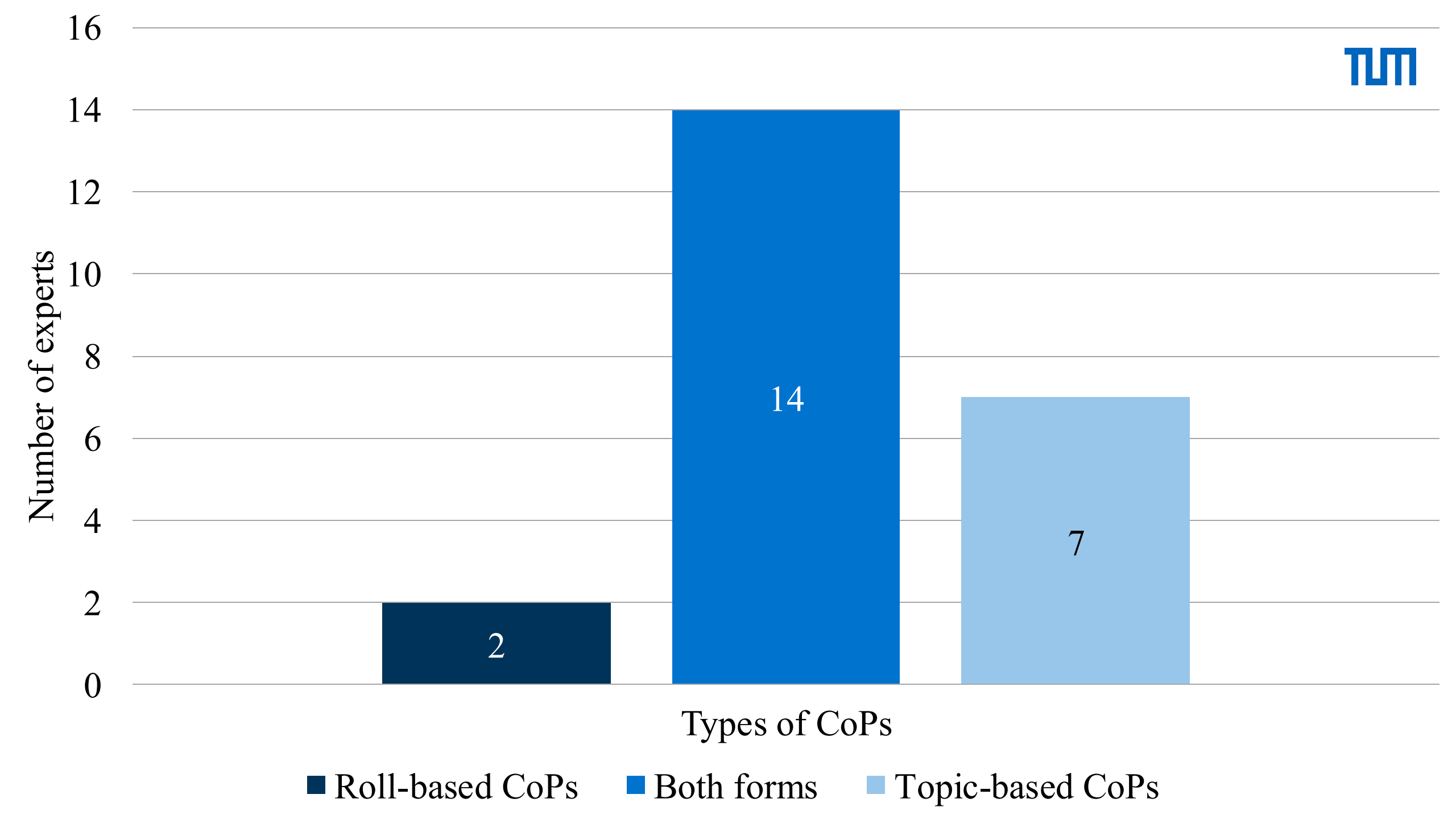
ID	Roll-based	Topic-based
E1	-	Data Science, incognito software quality
E2	PO, agile master	UX, UI, information security
E3	SM, further ones	multiple in the whole company
E4	Business analysts, architects, PO	Agility, UX, operation
E5	-	Fiori-Elements
E6	Testing, SM	Security compliance, cloud technology
E7	Agile masters, architects, operations responsibilities, testing, disciplinary manager	-
E8	-	Big one (SM, PO, manager), further small ones
E9	Quality, PO	Security architecture
E10	-	Architecture, methodology topics, SAP domain, cloud domain, agile domain, collaboration tools
E11	-	Business, development, operations, UX, engagement management, agility
E12	SM	Agile academy, product teams and chapter skill based (e.g Agile Coaches)
E13	Engineers, architects	Chats based on different topics (e.g., architecture)
E14	Agile coaches, engineering delivery lead	on several topics
E15	PO, SM, principle engineers, management assistance	Architecture, software craftsmanship
E16	local and global SM, PO	-
E17	-	Agility, high performance, digitalization, agile in life science and health care, meta-verse, cloud computing, AI
E18	SM	Agility, technology related ones, account related ones
E19	-	DACH companies, consultancy, Scrum Coffee
E20	SM, manager, PO	Security, DevOps, Agility
E21	no specific mentioned	no specific mentioned
E22	Developer, testing, SM, PO	Integration, requirements, architecture
E23	Security, architects, UX&UI, software excellence, PO, tribe leader, manager	Cloud

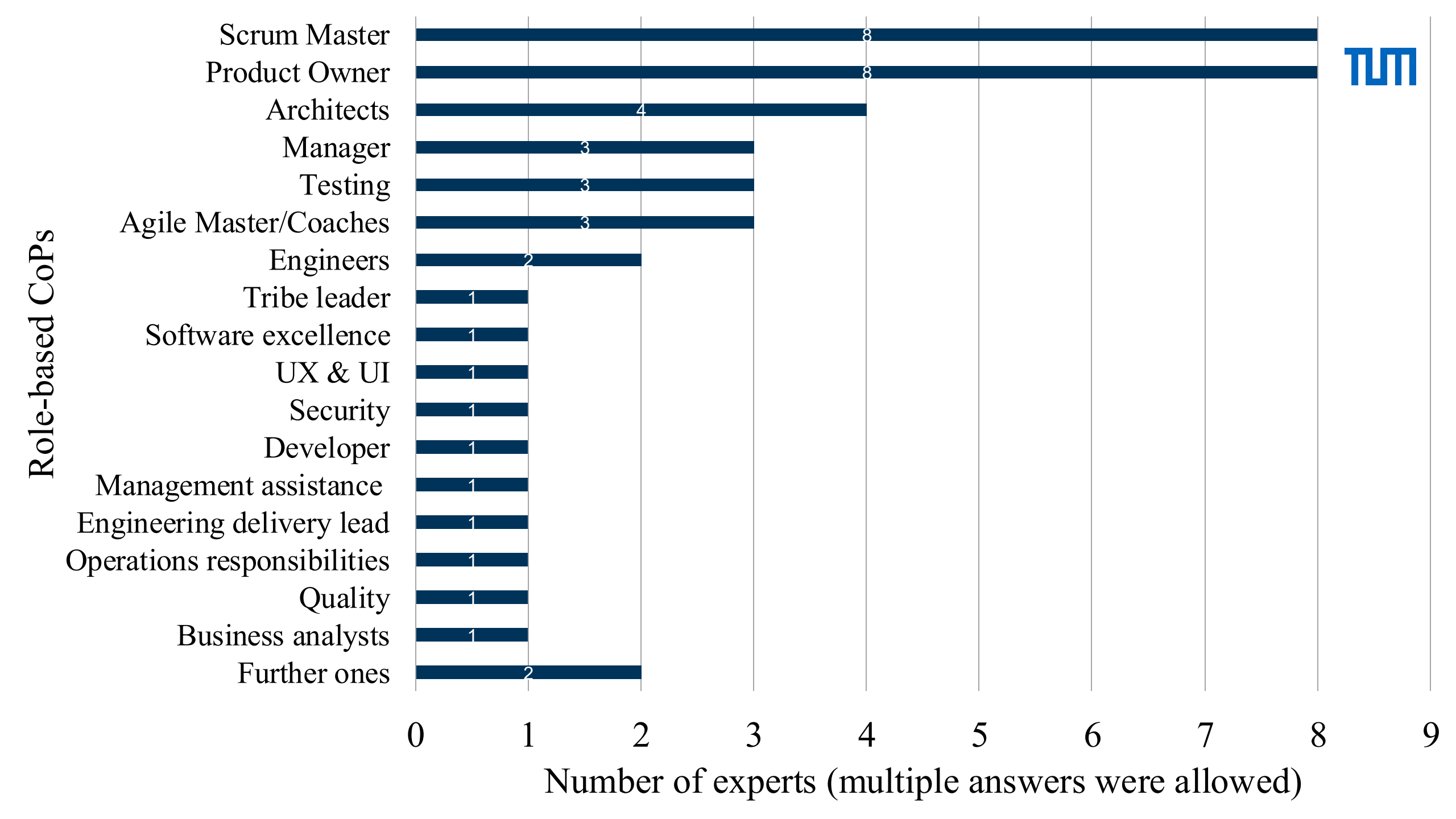

Experience of the company in years for
Amount of companies
0
1
2
3
4
5
6
7
8
9
8
3
2
1
4
4
2
2
Agile Development
LSAD
1-2 y
3-5 y
6-10 y
11-15 y
16-20 y

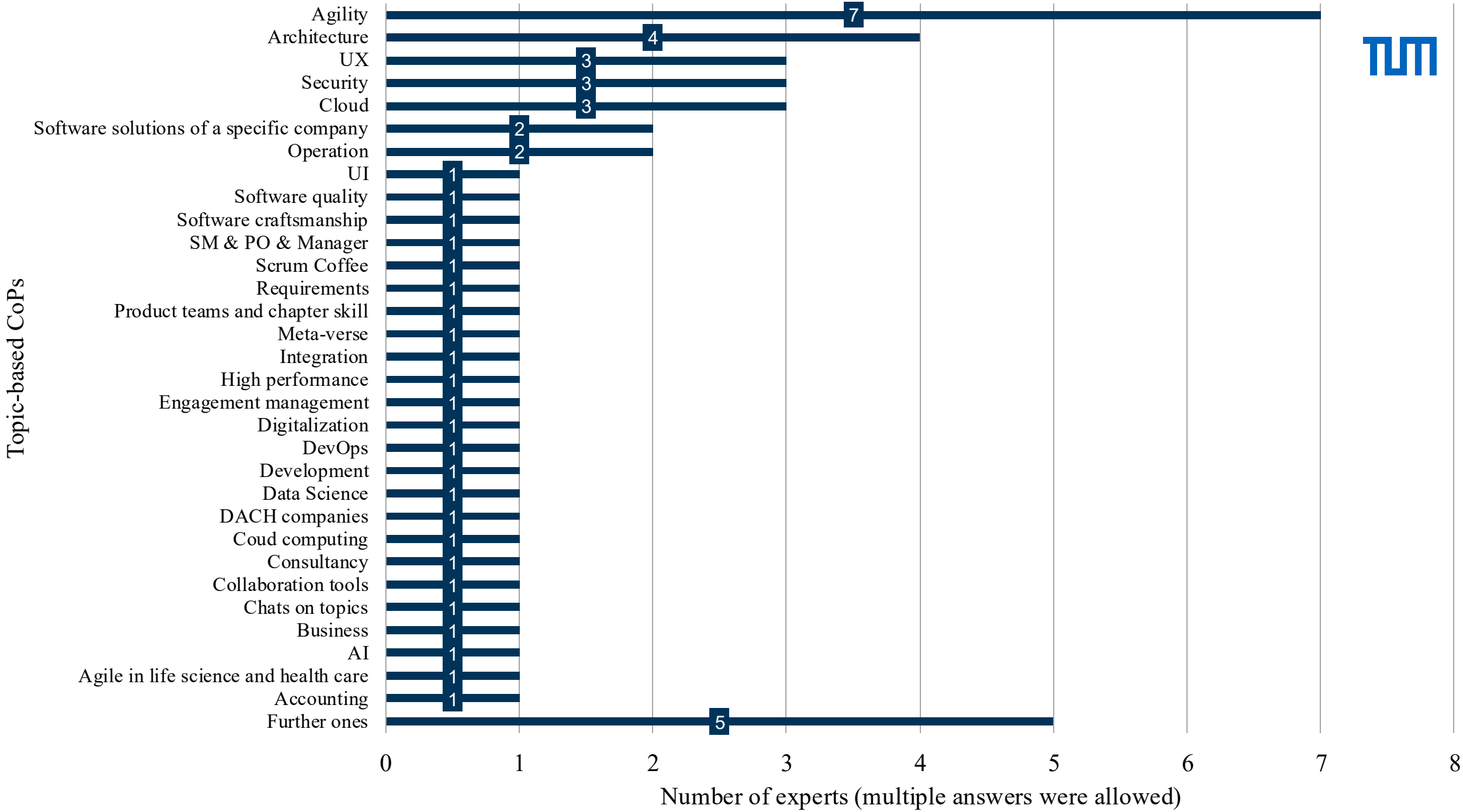

Agile Coach
Manager
Scrum Master
Software Architect
Scrum Coach
Developer
Enterprise Architect
Product Owner
Quality Assurance
CoP Lead
Consultant
Solution Architect
Security Expert
DevOps Engineer
Business Analyst
11
6
5
4
3
3
3
2
2
2
2
1
1
1
1
Selected roles by the experts
0
2
4
6
8
10
12
Number of experts (multiple answers were allowed)


Experience of the experts in years for
Amount of experts
10
9
8
7
6
5
4
3
2
1
0
1
1
8
9
3
1
1
3
3
8
6
2
0
Agile Development
LSAD
< 1 y
1-2 y
3-5 y
6-10 y
11-15 y
16-20 y
> 20 y

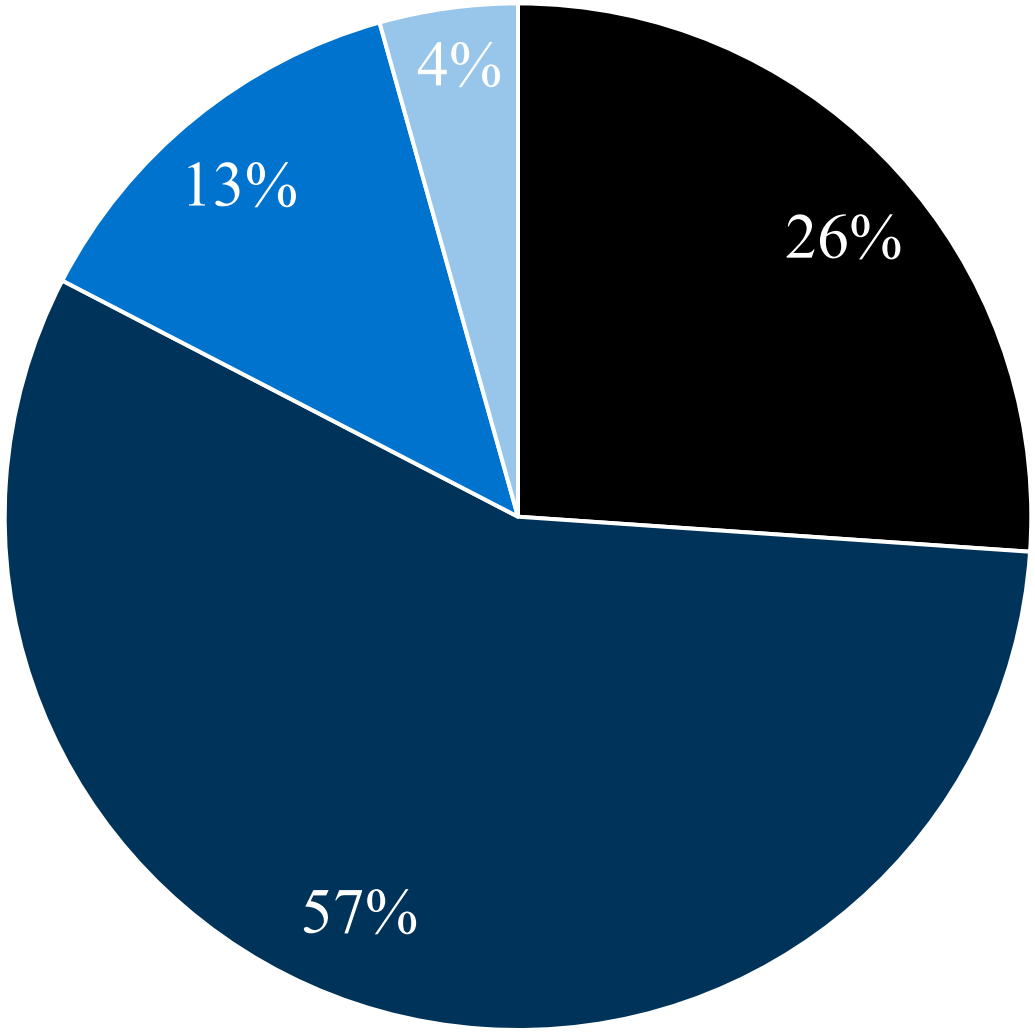

Role of the experts in the CoPs
Lead
Member
Facilitator
Moderator
16
9
4
3
0
2
4
6
8
10
12
14
16
18
Number of experts (multiple answers were allowed)

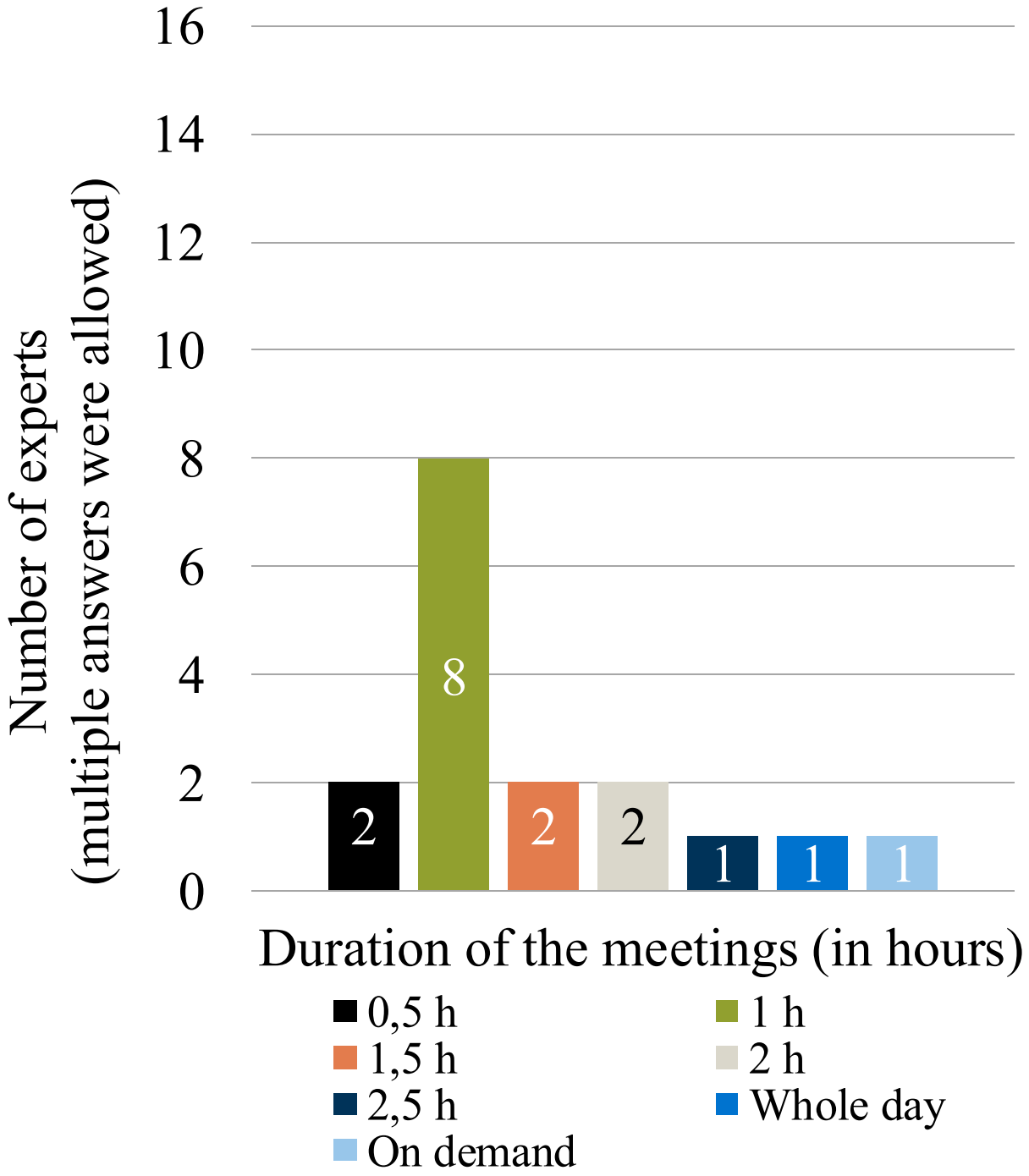

16
14
12
10
8
6
4
2
0
Number of experts
14
7
2
Types of CoPs
Roll-based CoPs
Both forms
Topic-based CoPs

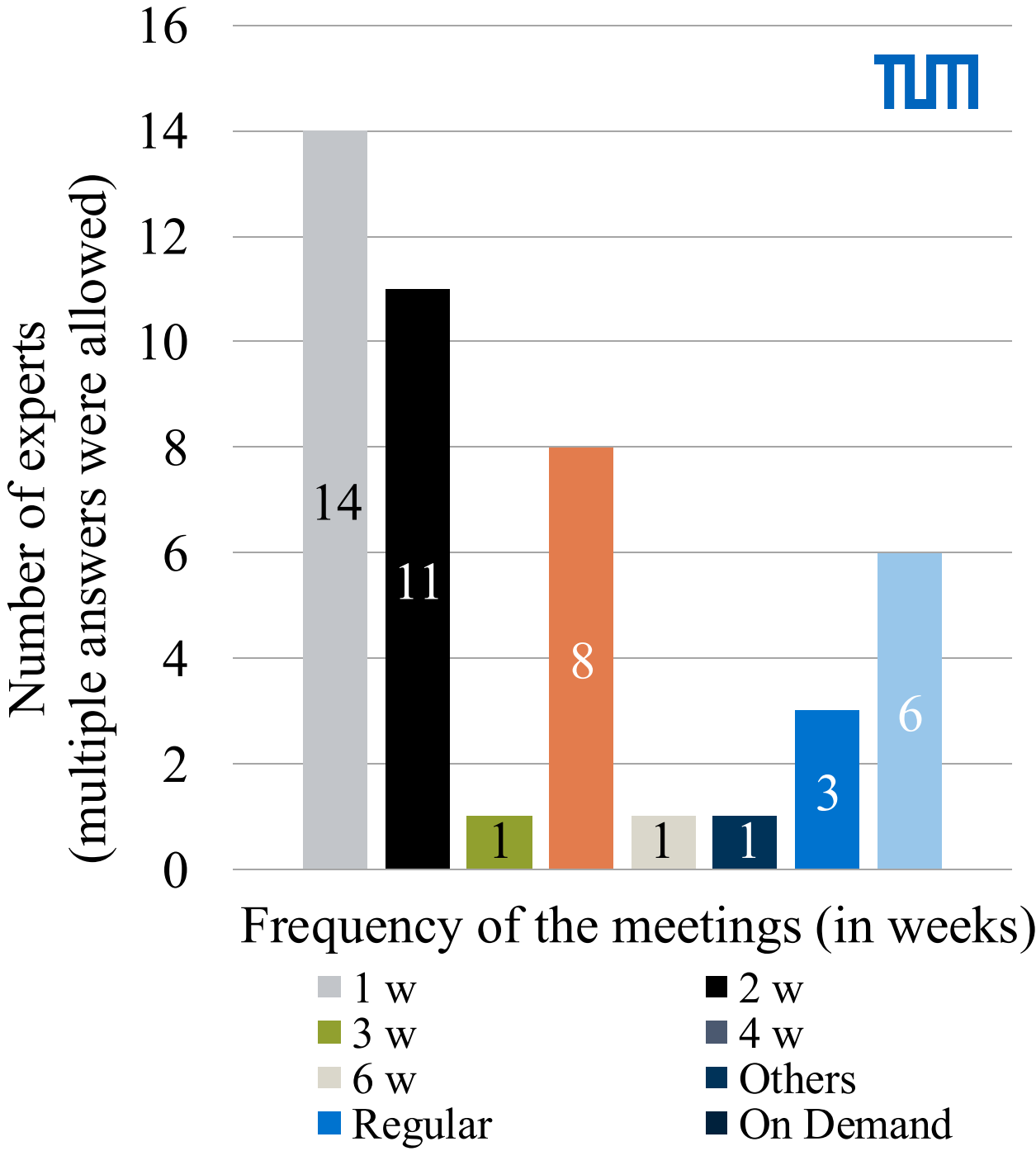

Role-based CoPs
Scrum Master
Product Owner
Architects
Manager
Testing
Agile Master/Coaches
Engineers
Tribe leader
Software excellence
UX & UI
Security
Developer
Management assistance
Engineering delivery lead
Operations responsibilities
Quality
Business analysts
Further ones
8
8
4
3
3
3
2
1
1
1
1
1
1
1
1
1
1
2
0
1
2
3
4
5
6
7
8
9
Number of experts (multiple answers were allowed)

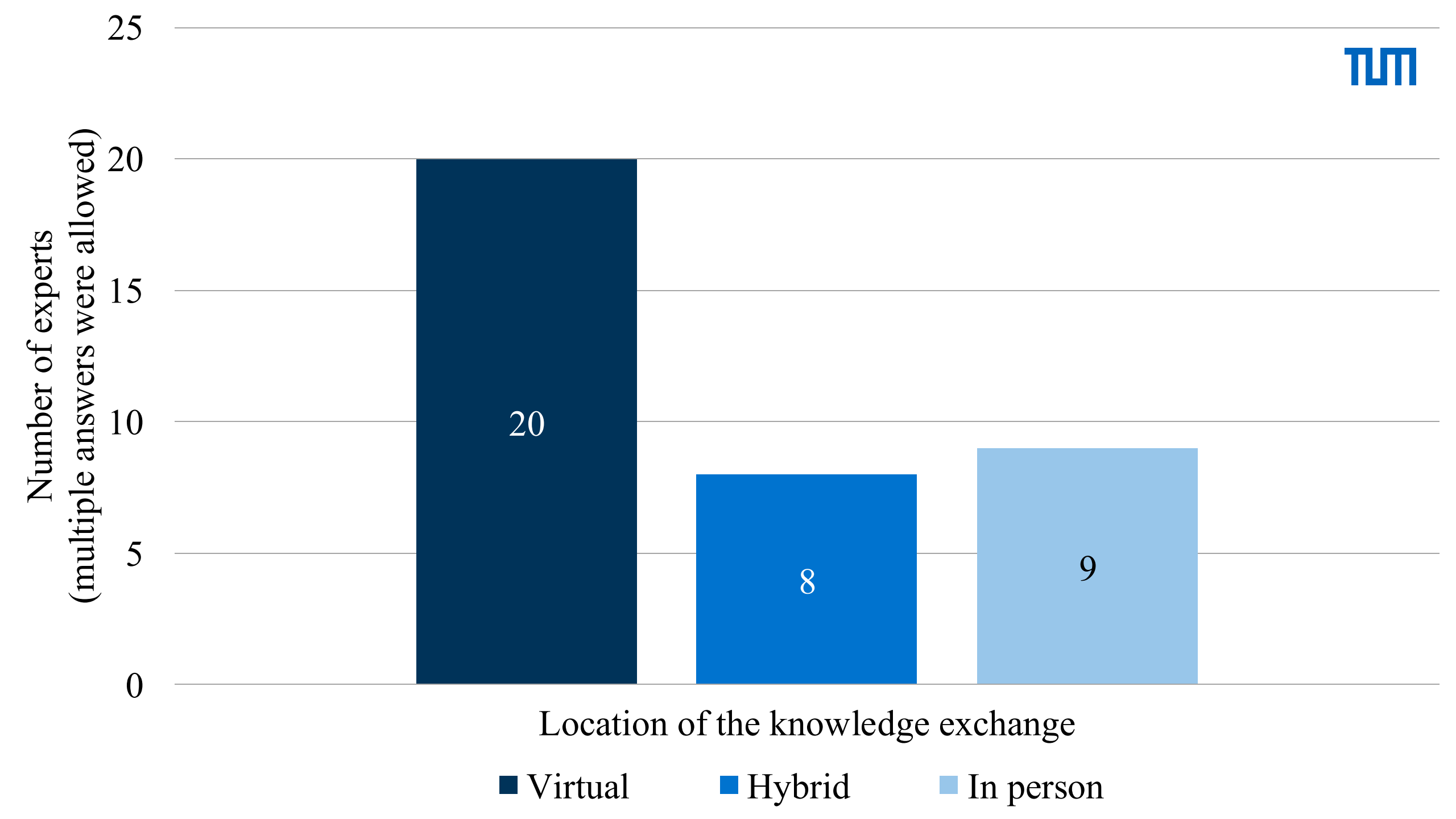

Agility
Architecture
UX
Security
Cloud
Software solutions of a specific company
Operation
UI
Software quality
Software craftsmanship
SM & PO & Manager
Scrum Coffee
Requirements
Product teams and chapter skill
Meta-verse
Integration
High performance
Engagement management
Digitalization
DevOps
Development
Data Science
DACH companies
Coud computing
Consultancy
Collaboration tools
Chats on topics
Business
AI
Agile in life science and health care
Accounting
Further ones
7
4
3
3
3
2
2
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1
5
Topic-based CoPs
0
1
2
3
4
5
6
7
8
Number of experts (multiple answers were allowed)

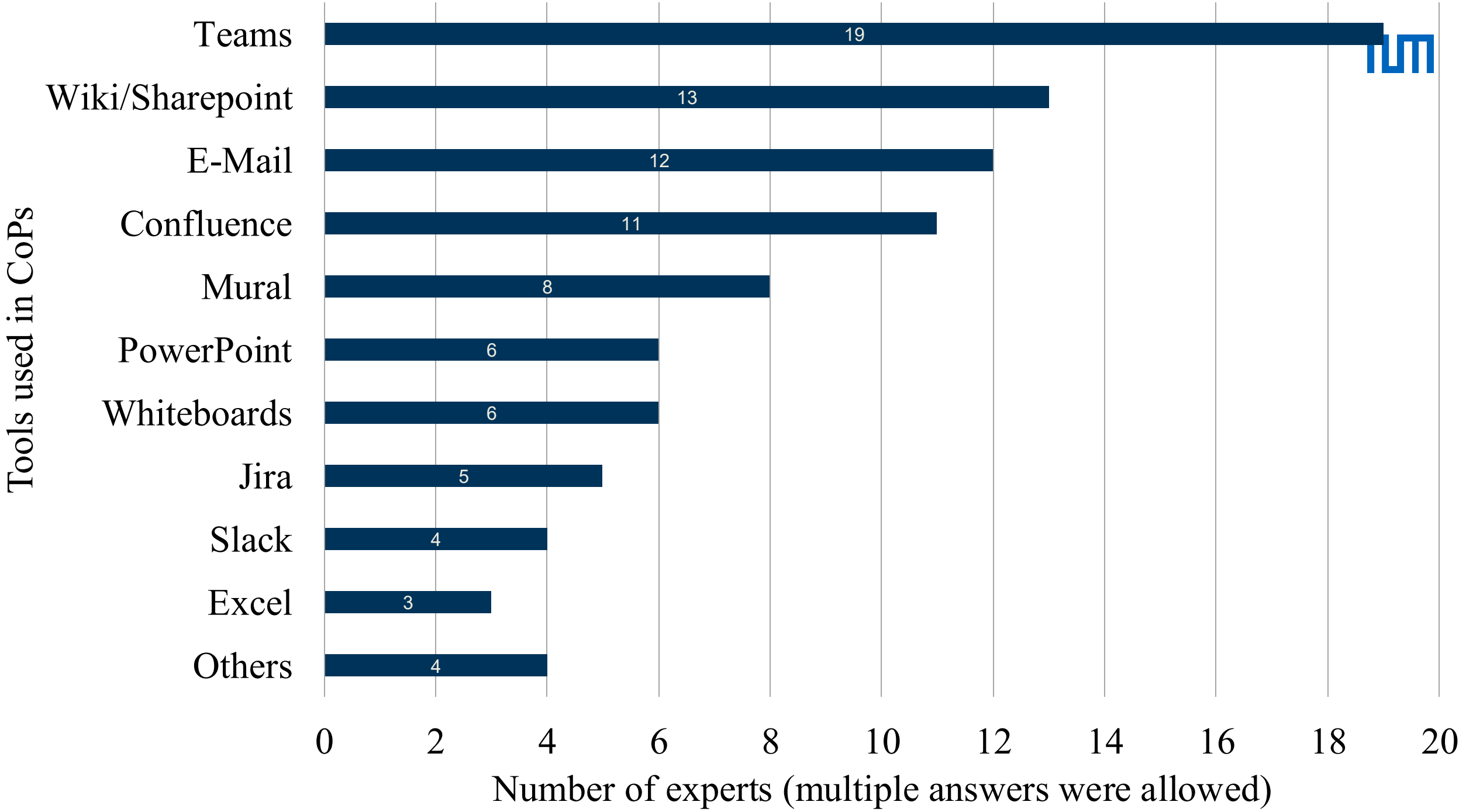
Planned to establish further CoPs (mentioned by the experts)

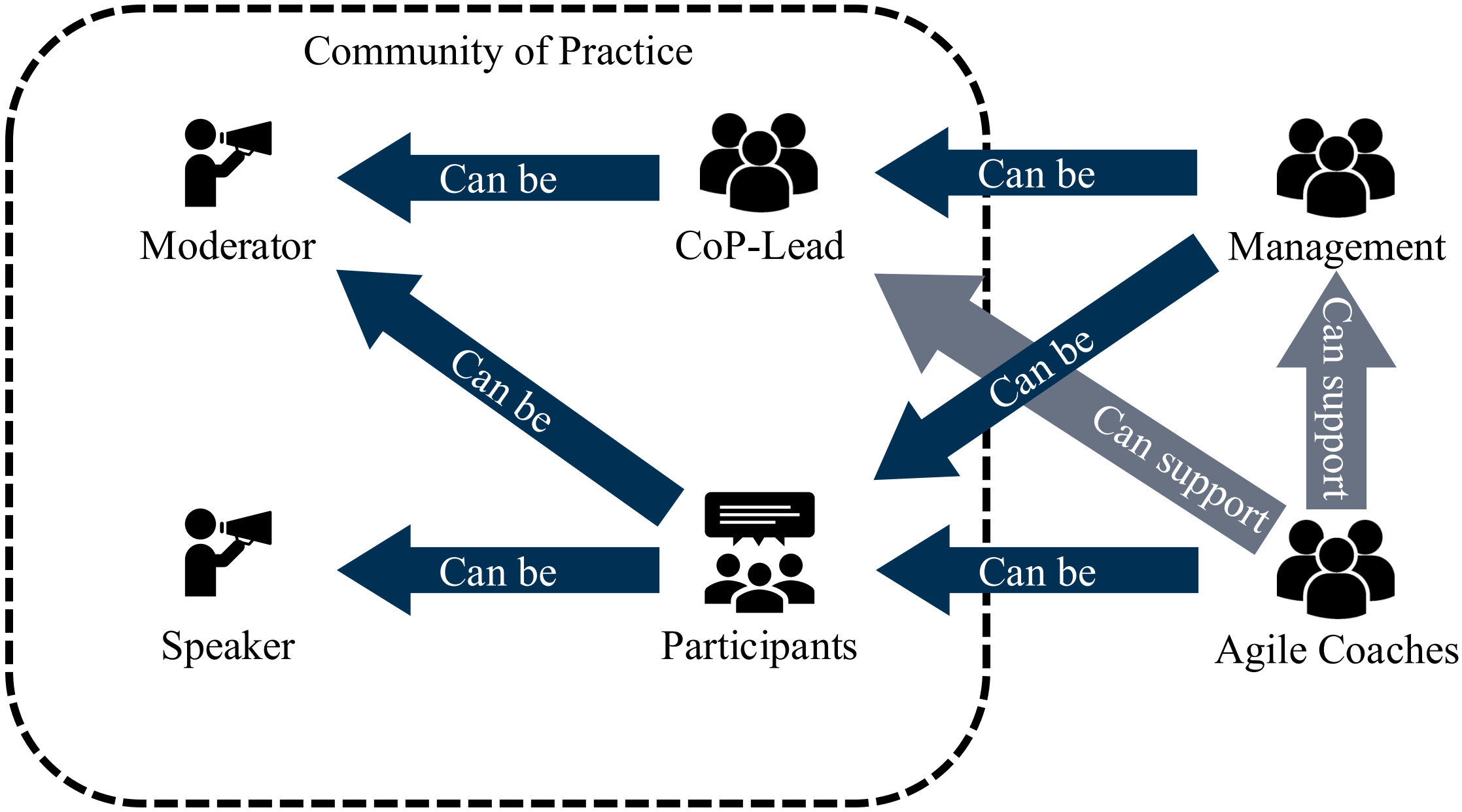


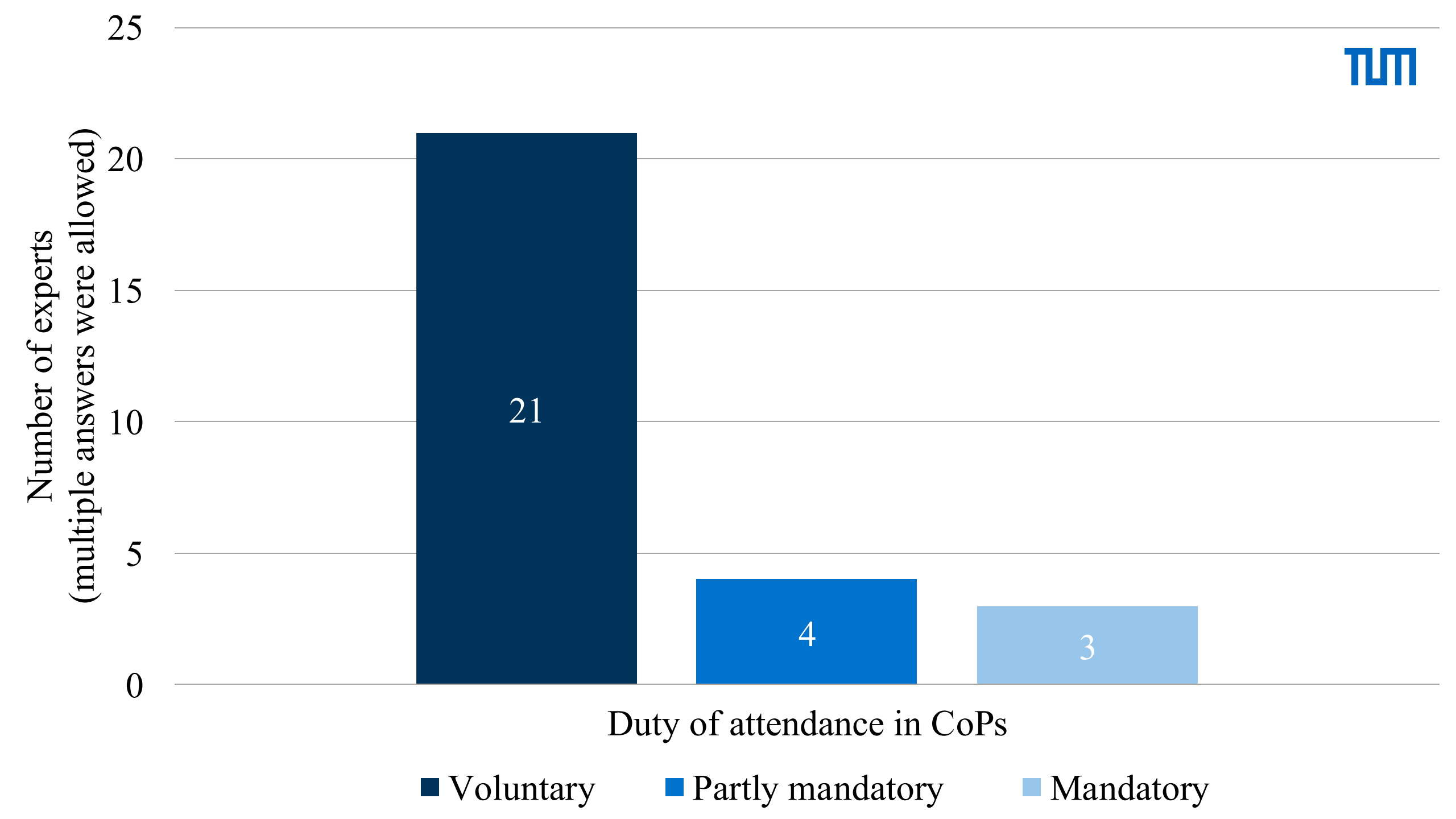

Number of experts
(multiple answers were allowed)
16
14
12
10
8
6
4
2
0
2
8
2
2
1
1
1
Duration of the meetings (in hours)
0,5 h
1 h
1,5 h
2 h
2,5 h
Whole day
On demand

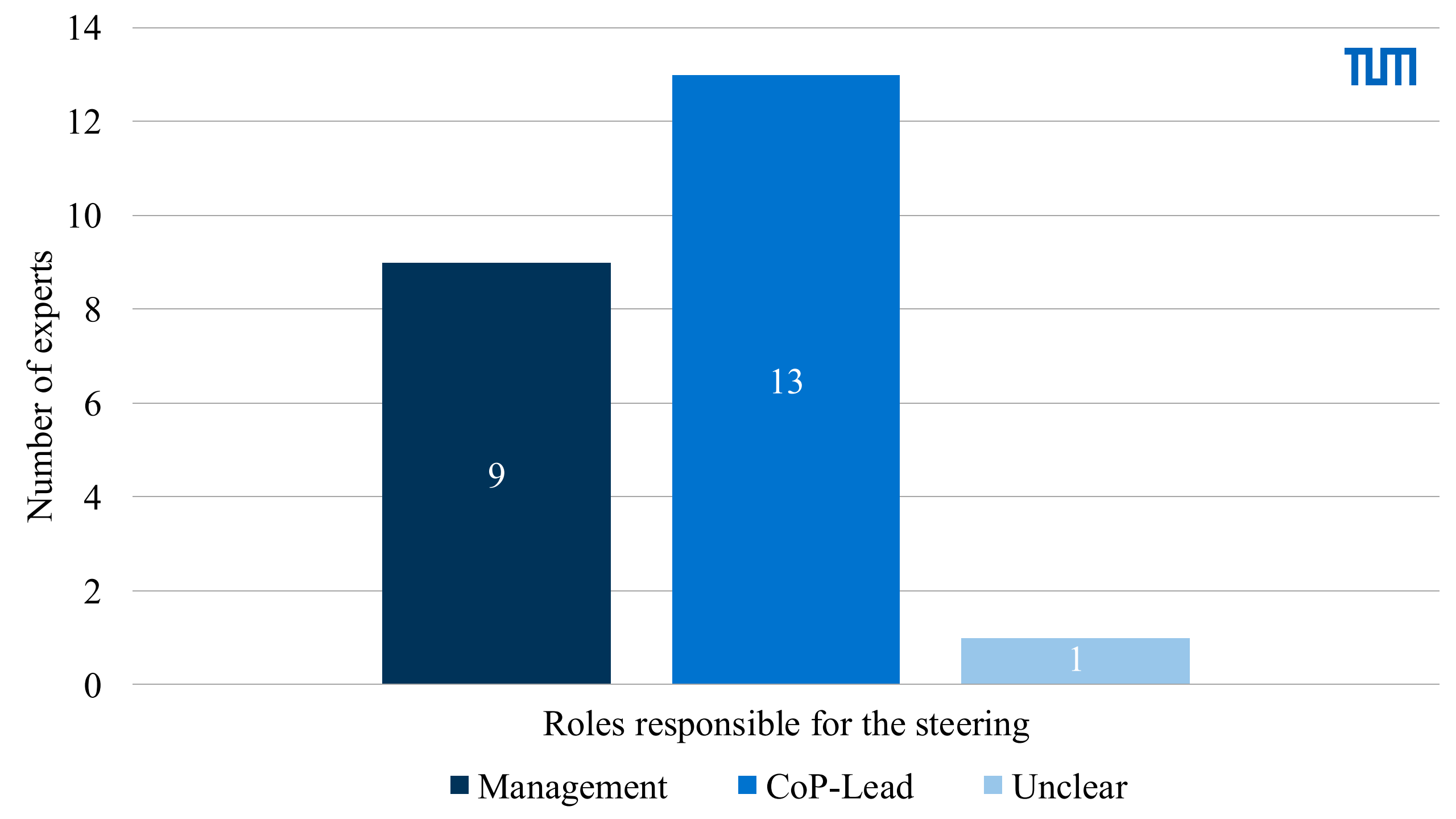

Number of experts
(multiple answers were allowed)
16
14
12
10
8
6
4
2
0
14
11
1
8
1
1
3
6
Frequency of the meetings (in weeks)
1 w
2 w
3 w
4 w
6 w
Others
Regular
On Demand

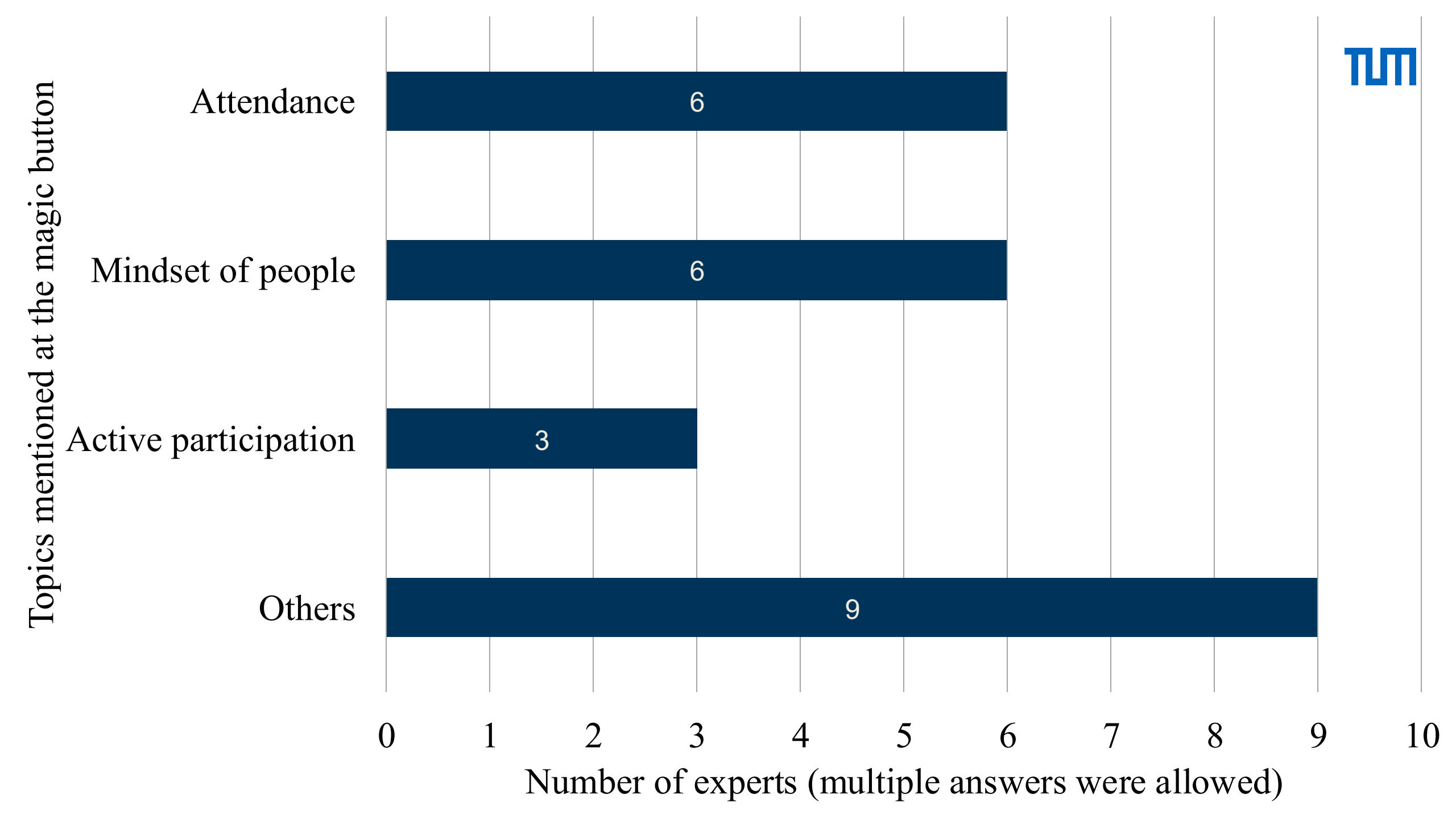

25
20
15
10
5
0
Number of experts
(multiple answers were allowed)
20
8
9
Location of the knowledge exchange
Virtual
Hybrid
In person

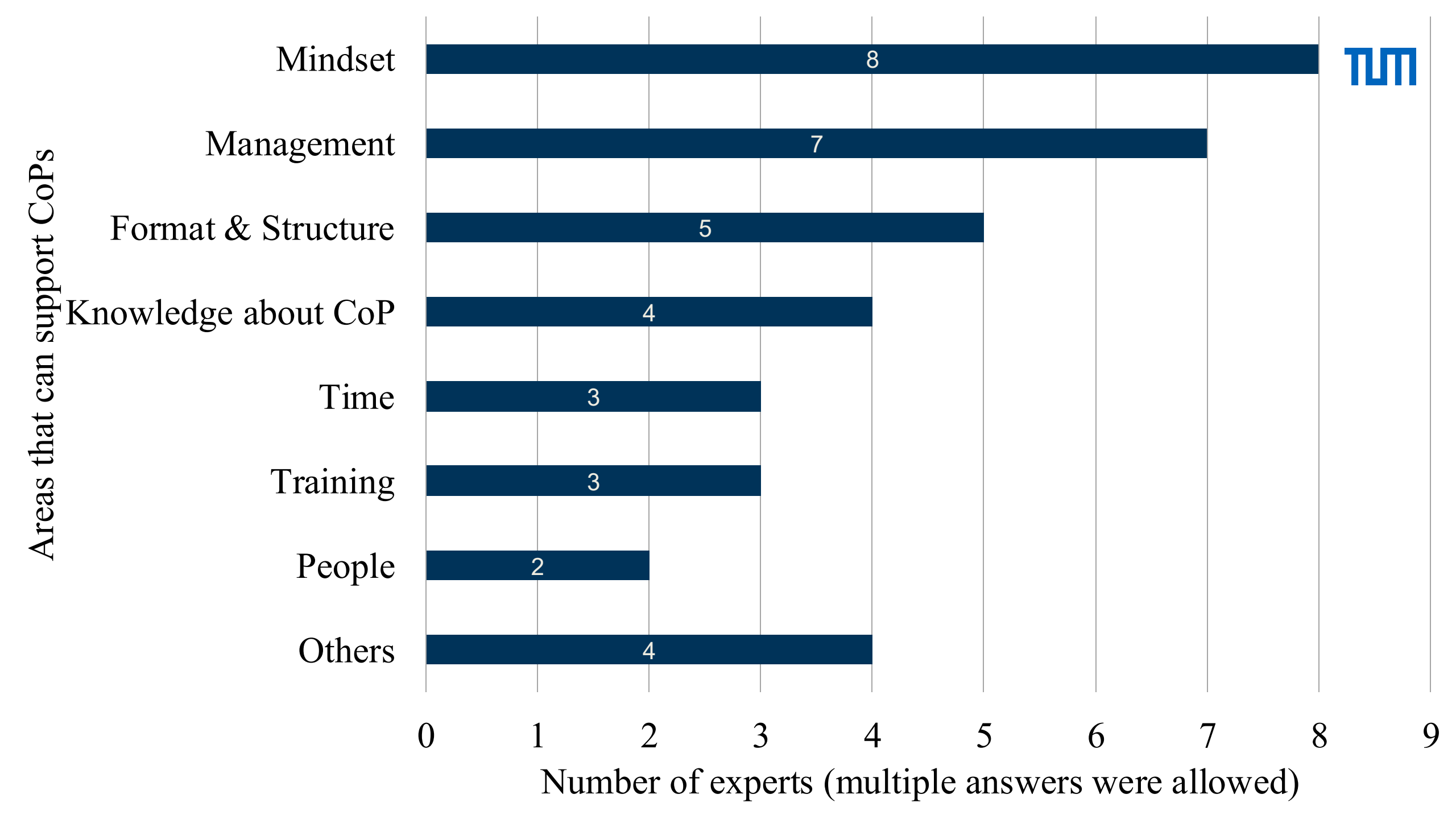

Tools used in CoPs
Teams
19
Wiki/Sharepoint
13
E-Mail
12
Confluence
11
Mural
8
PowerPoint
6
Whiteboards
6
Jira
5
Slack
4
Excel
3
Others
4
0
2
4
6
8
10
12
14
16
18
20
Number of experts (multiple answers were allowed)

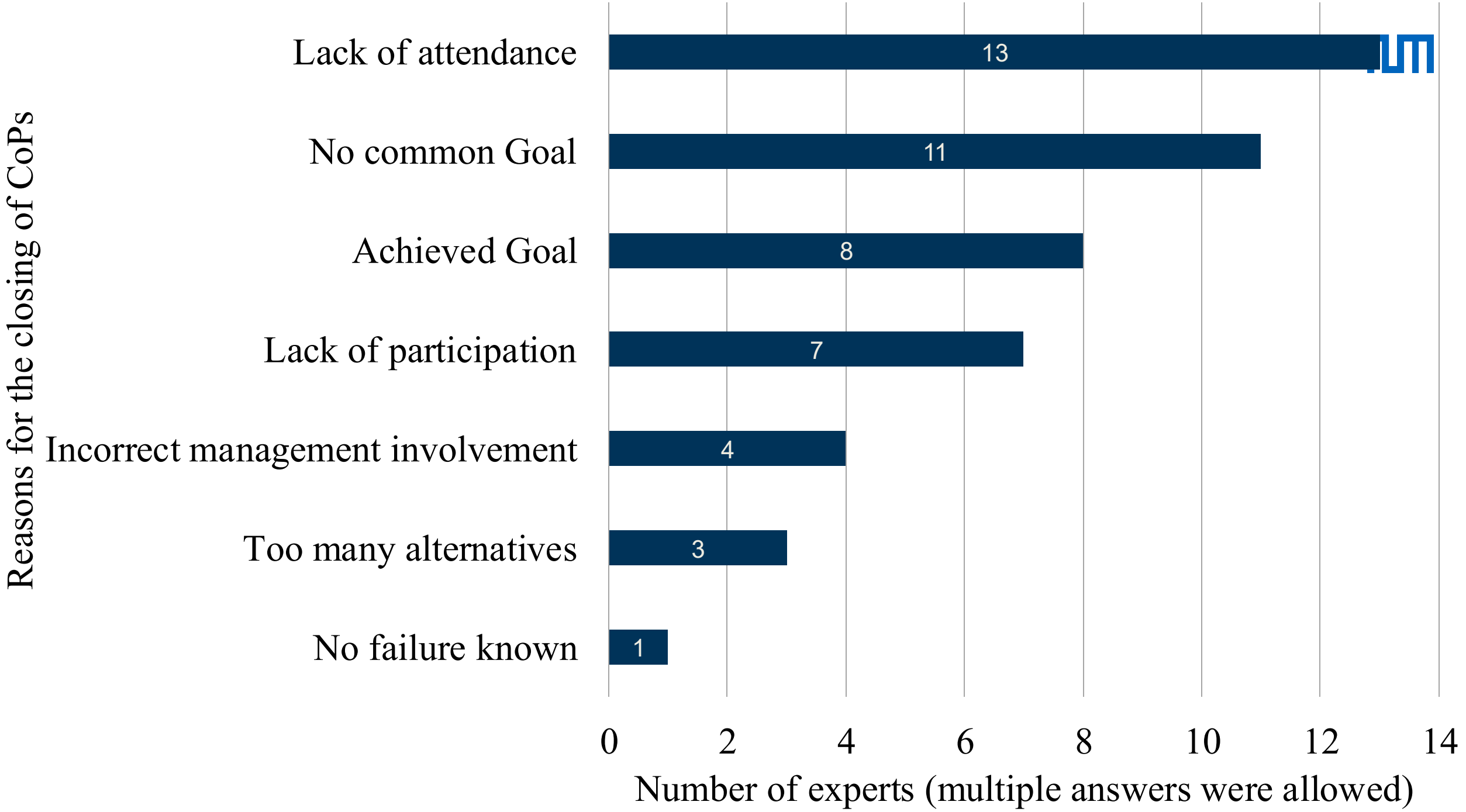

Community of Practice
Moderator
Can be
CoP-Lead
Can be
Management
Can be
Can be
Can support
Can support
Speaker
Can be
Participants
Can be
Agile Coaches

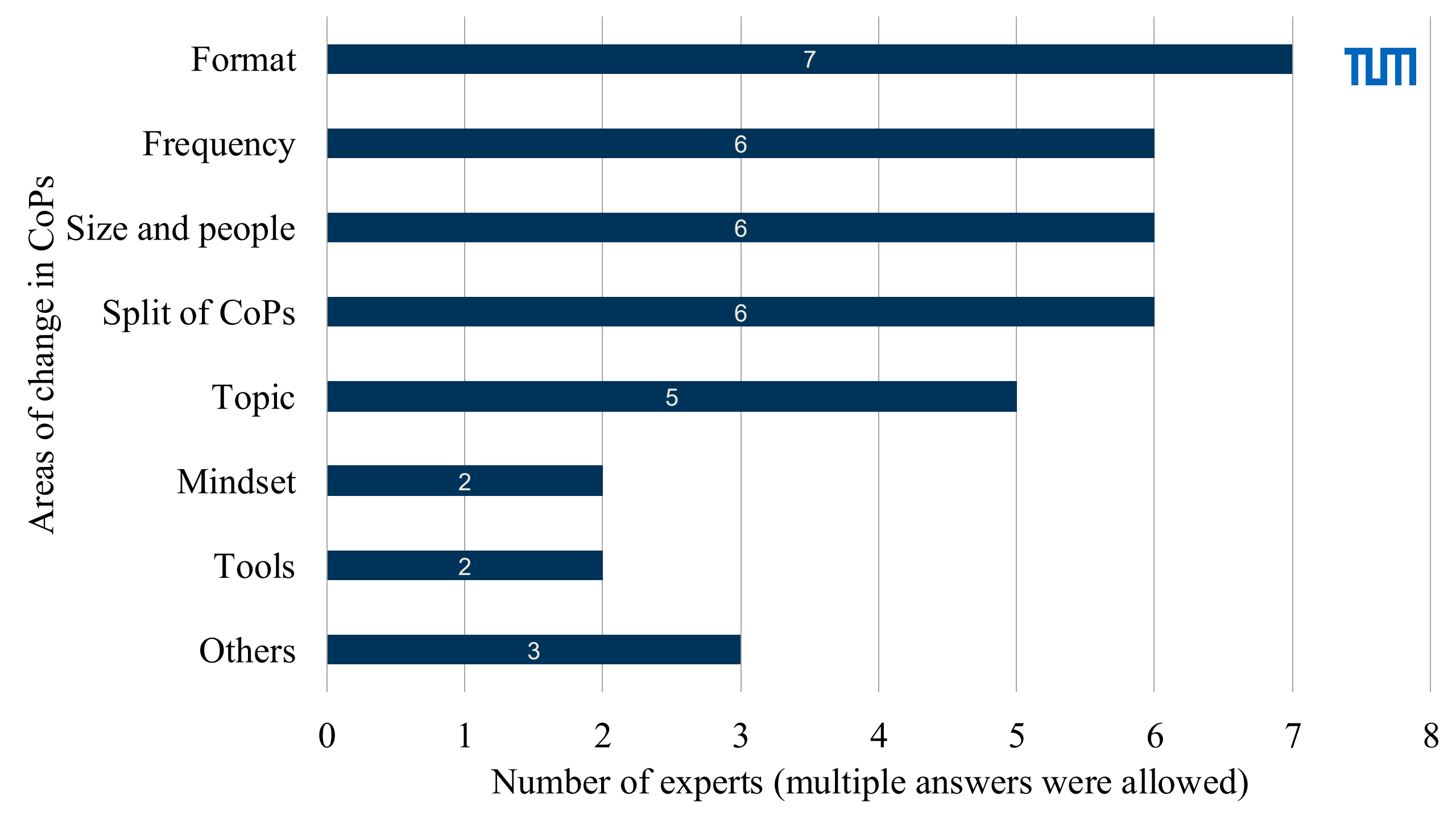

25
20
15
10
5
0
Number of experts
(multiple answers were allowed)
21
4
3
Duty of attendance in CoPs
Voluntary
Partly mandatory
Mandatory


14
12
10
8
6
4
2
0
Number of experts
9
13
1
Roles responsible for the steering
Management
CoP-Lead
Unclear


Topics mentioned at the magic button
Attendance
6
Mindset of people
6
Active participation
3
Others
9
0
1
2
3
4
5
6
7
8
9
10
Number of experts (multiple answers were allowed)


Areas that can support CoPs
Mindset
Management
Format & Structure
Knowledge about CoP
Time
Training
People
Others
8
7
5
4
3
3
2
4
0
1
2
3
4
5
6
7
8
9
Number of experts (multiple answers were allowed)


Reasons for the closing of CoPs
Lack of attendance
13
No common Goal
11
Achieved Goal
8
Lack of participation
7
Incorrect management involvement
4
Too many alternatives
3
No failure known
1
0
2
4
6
8
10
12
14
Number of experts (multiple answers were allowed)


Areas of change in CoPs
Format
Frequency
Size and people
Split of CoPs
Topic
Mindset
Tools
Others
7
6
6
6
5
2
2
3
0
1
2
3
4
5
6
7
8
Number of experts (multiple answers were allowed)