
University of Applied Sciences and Arts
Northwestern Switzerland
Zurich University of Applied Sciences
zh aw
international agile research study
Satisfaction, Experience and Culture in Agile Software Development
Empirical Analysis of the Swiss Agile Studies
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http://www.swissagilestudy.ch
TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON
Software Innovation New Zealand
Carleton UNIVERSITY

Content

- Study Setup
- Satisfaction in Agile Projects
- Experience and Culture
- Personal and Sociological Effects of Agile

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About the Study

- Bi-annual study in Switzerland since 2012
- Conducted as an online survey
- Two surveys in parallel
  - A company survey, addressing one representative of a company (management view)
  - A anonymous survey, addressing any IT professionals (employees' view)
- Target participants
  - "classical" and "agile" companies and IT professional
- 21+1 Questions
- Consequently use 4-5 level Likert scale

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The Swiss Agile Study is organized by the Zurich University of Applied Sciences and the University of Applied Sciences Northwestern Switzerland and supported and funded by the above IT associations and the Hasler foundation.
This in-depth analysis has been a done in a common research project with the Carleton University, Ottawa, Canada.

3. Swiss Agile Study 2016

- Survey statistics
  - IT-Companies directly contacted (personalized links)
    - 1399 contacted
    - 254 started (18.2%)
    - 142 finished (10.2%)
  - IT-Professionals anonymous
    - 529 on site
    - 328 started (62.0%)
    - 165 finished (31.2%)
- Participant addresses
  - Company: From collaborating IT associations and own databases
  - Anonymous: spread per emailing, social media

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Study Demographics

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- Company Survey

Role	%
CEO	34%
CTO	17%
Development Manager	11%
Team Leader	10%
CIO	7%
Project Manager	6%
Designer / Architect	2%
Software Developer	2%
Product Manager	1%
Researcher	1%
Other	9%

Size	%
Micro enterprise ($\leq$ 9)	25%
Small enterprise (10-49)	37%
Medium enterprise (50-249)	19%
Large enterprise $\geq$ 250)	19%

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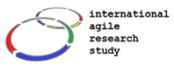
Our Research Questions



Post-study analysis

RQ1: How does the applied software development method influence satisfaction of the team?

RQ2: How does satisfaction correlate to the applied practices?

RQ3: Does satisfaction depend on the influences achieved with the development method?

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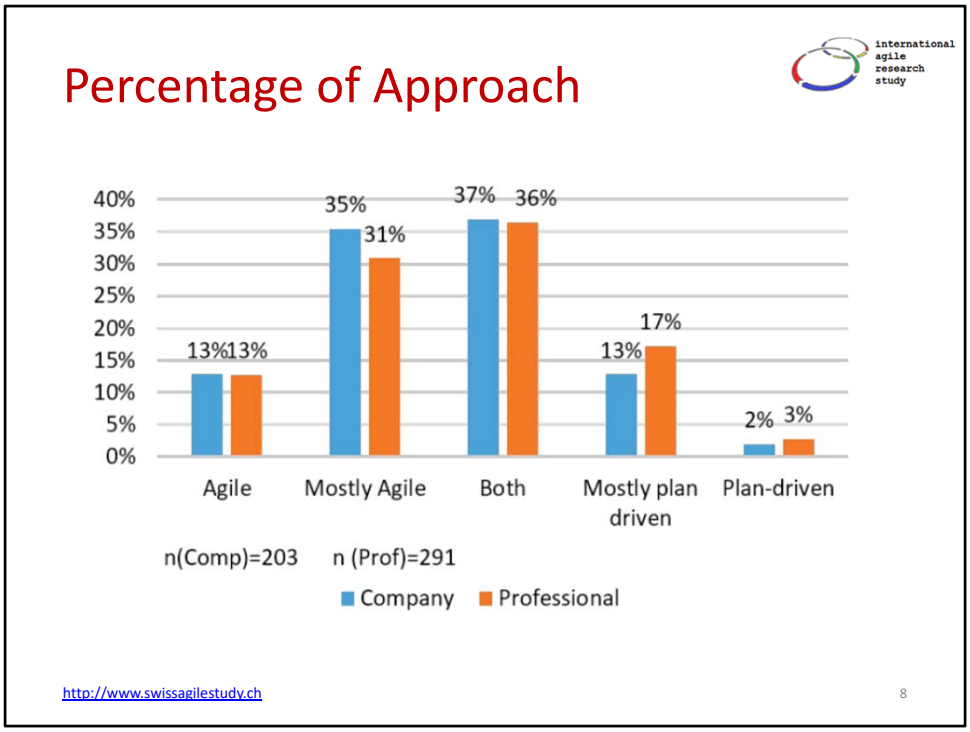
Percentage of Approach
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40%
35%
30%
25%
20%
15%
10%
5%
0%
13%13%
35%
31%
37%
36%
13%
17%
2%
3%
Agile
Mostly Agile
Both
Mostly plan driven
Plan-driven
n(Comp)=203
n (Prof)=291
Company
Professional
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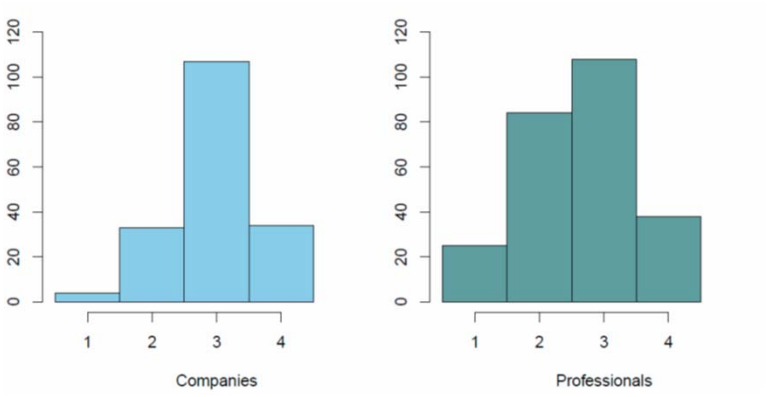
Self-rating

Overall Satisfaction



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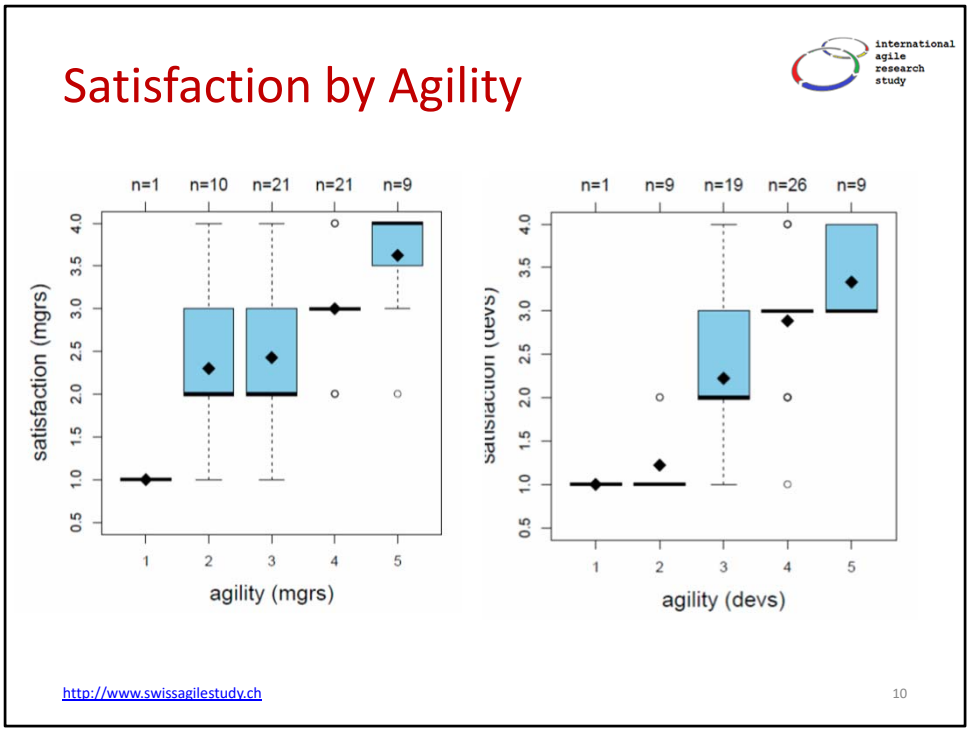
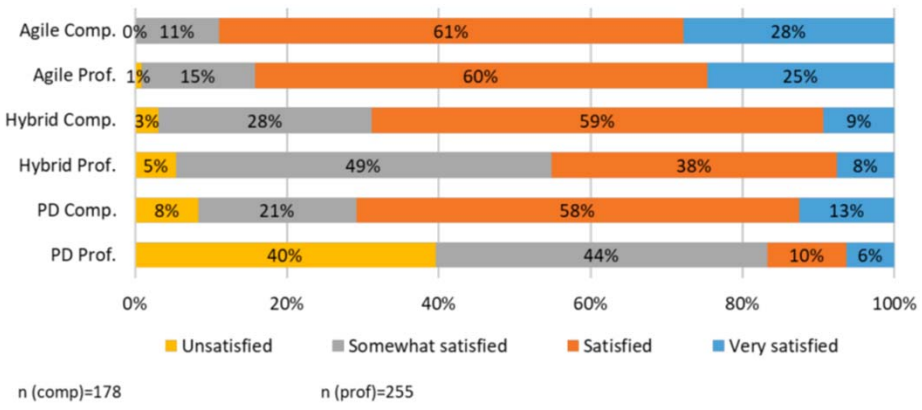


It professionals, divided by job title

Satisfaction by Agility



n (comp)=178 n (prof)=255

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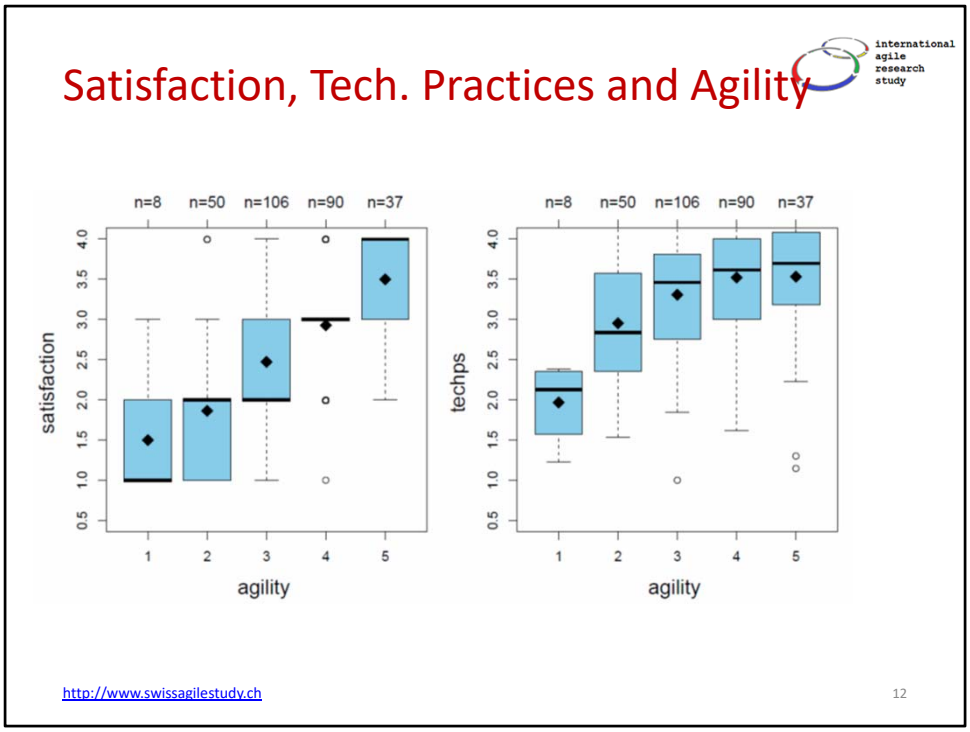

Satisfaction levels by level of agility claimed (left) 1–4, and mean level of technical practices by level of agility (right) 1–5 claimed. Together these show that satisfaction is related to level of agility, and that the claimed level is indeed based on the level af actual technical practices used. Company data

Reasons for Satisfaction?

- Relating satisfaction to practices and influences

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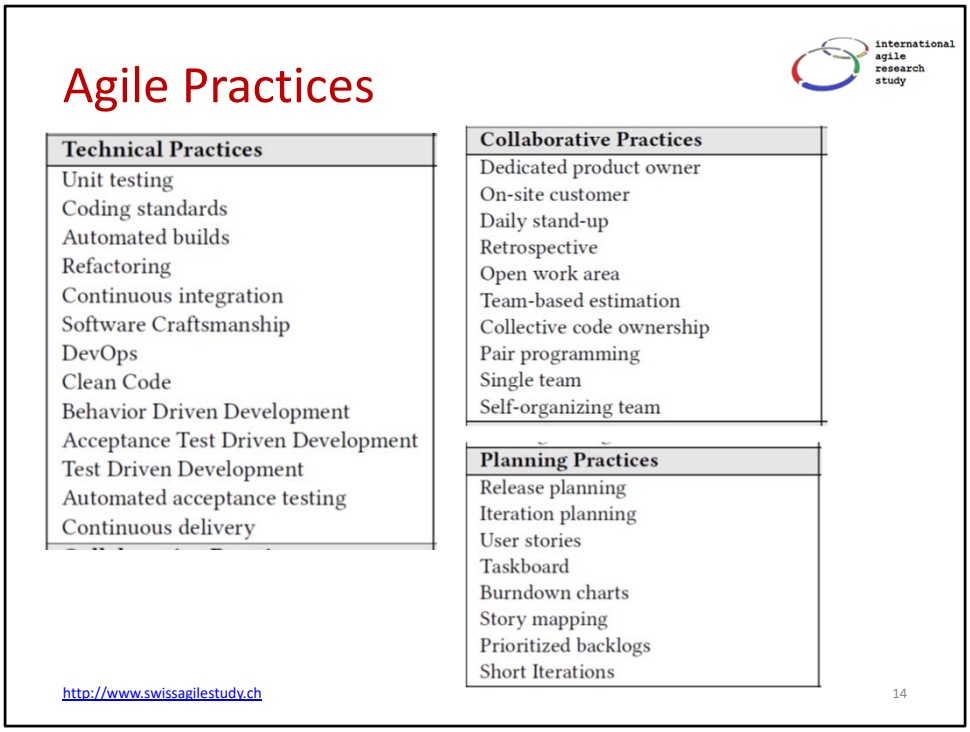

Figure 6 presents boxplots for these two issues, showing how they relate to satisfaction. Moreover, the top 5 are all either collaborative practices or planning practices. Although 3 technical practices are in the top 10, the pattern seems clear: it is collaboration and planning practices that most closely match satisfaction.

Correlation with Practices

#	Practices Questions	rho	p.value
1	CP Self organizing team	0.446	<.001
2	CP Collective code ownership	0.375	<.001
3	PP Story mapping	0.306	<.001
4	PP Short Iterations	0.299	<.001
5	CP Single team integrated development and testing	0.293	<.001
6	TP Software Craftsmanship	0.275	0.001
7	PP Prioritized backlogs	0.258	<.001
8	CP Team based estimation	0.247	<.001
9	TP Refactoring	0.245	<.001
10	TP Acceptance Test Driven Development ATDD	0.235	0.001

CP – Collaborative Practice
PP – Planning Practice
TP – Technical Practice

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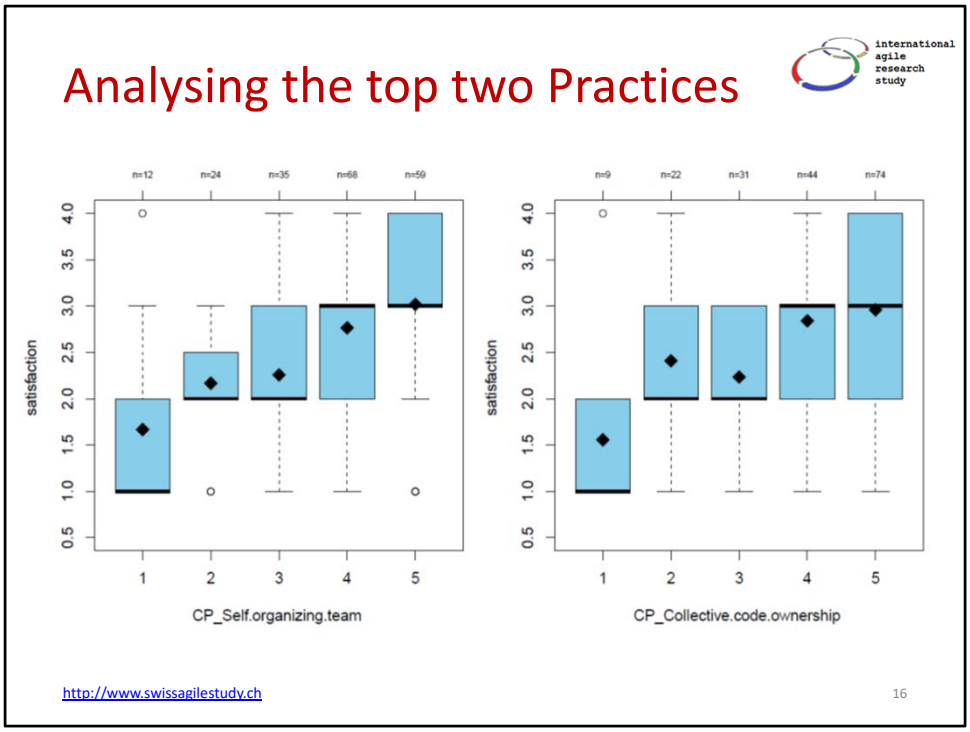
To compute the correlation, we use Spearman's non-parametric "rho" (ρ) method, rather than Pearson's r, because our Likert scale data is ordinal, and this approach supports more conservative results.

In the table, we can see that the highest correlation for satisfaction with practices comes from the collaborative practice of a self-organizing team, followed by that of collective code ownership and Story mapping, and these are the only practices with rho>0.3

Moreover, the top 5 are all either collaborative practices or planning practices. Although 3 technical practices are in the top 10, the pattern seems clear: it is collaboration and planning practices that most closely match satisfaction.



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Agile Influences

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Business Influences
Time to market
Manage changing priorities
Alignment between IT & business objectives
Project visibility
Handling of project risk
Development process
Management of distributed teams
Requirements management
Delivery predictability

Software Influences
Product / software innovation
Software quality
Software maintainability
Engineering discipline
Software architecture
Defect rate

Team Influences
Team productivity
People development
Effectiveness of meetings
Impediment management
Engagement of product owner
Team morale / motivation
Stress at work
Working overtime

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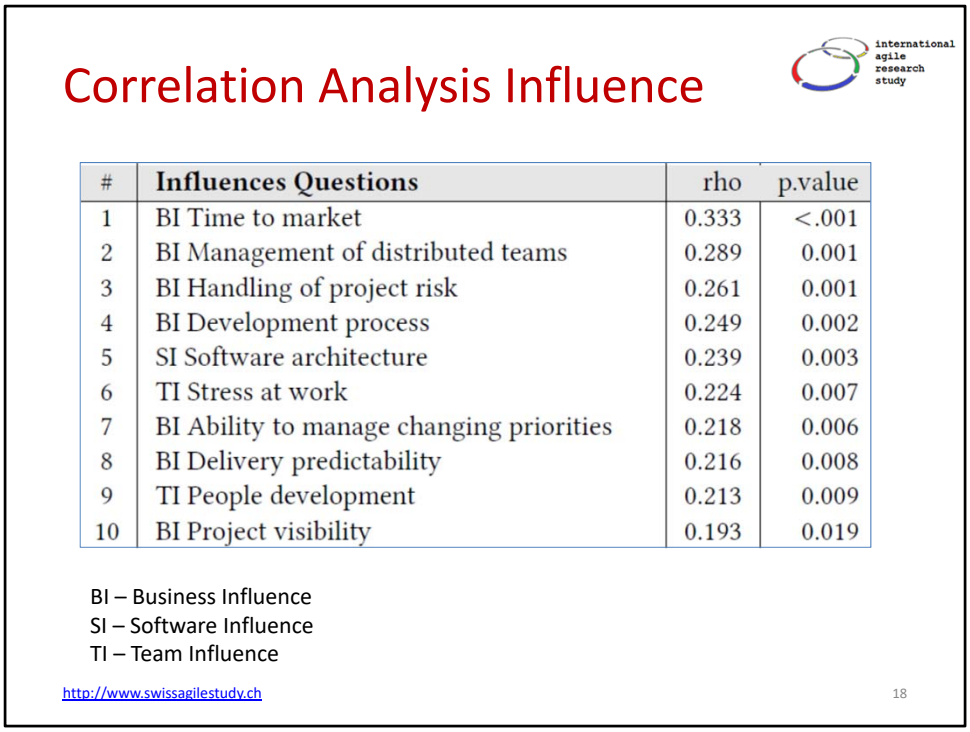
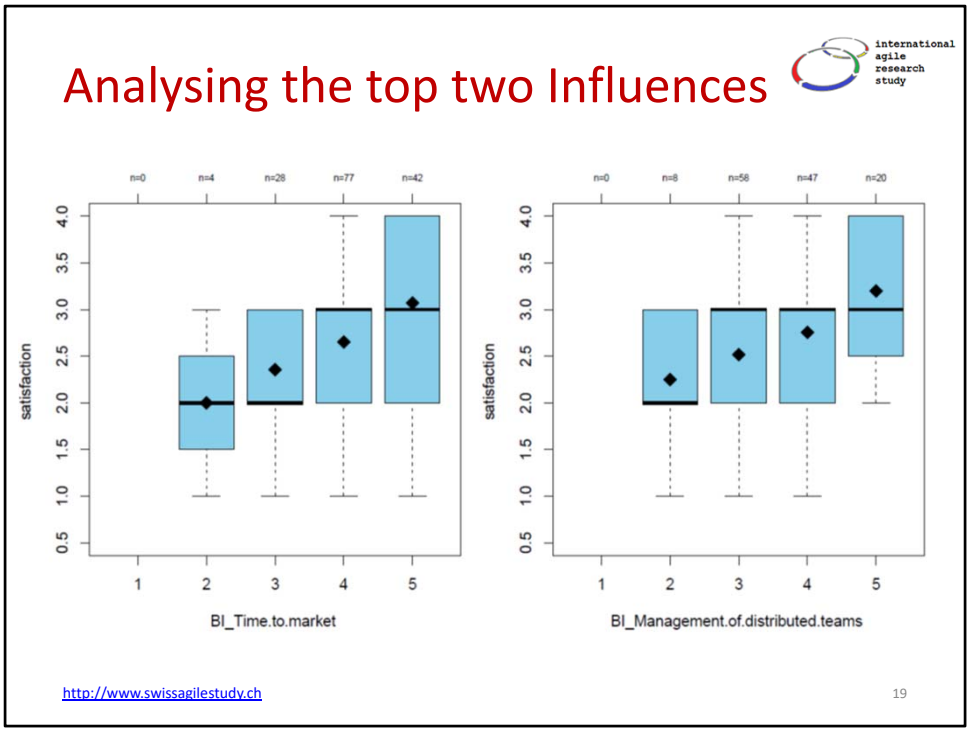


#	Influences Questions	rho	p.value
1	BI Time to market	0.333	<.001
2	BI Management of distributed teams	0.289	0.001
3	BI Handling of project risk	0.261	0.001
4	BI Development process	0.249	0.002
5	SI Software architecture	0.239	0.003
6	TI Stress at work	0.224	0.007
7	BI Ability to manage changing priorities	0.218	0.006
8	BI Delivery predictability	0.216	0.008
9	TI People development	0.213	0.009
10	BI Project visibility	0.193	0.019

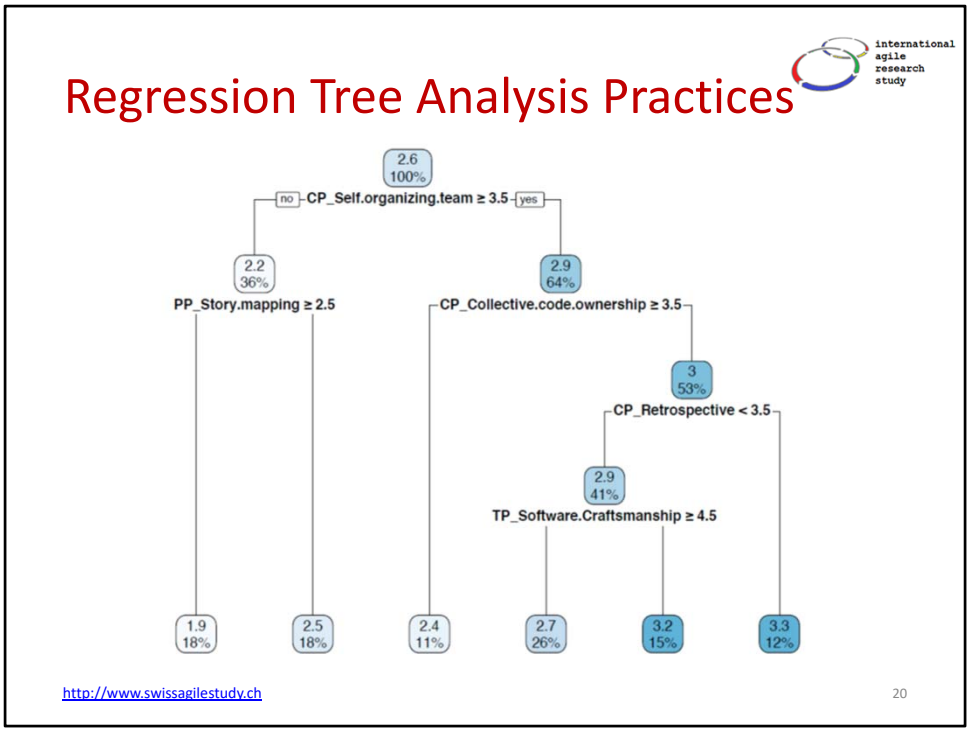
Here the most highly correlated answer is about time to market. This could be an indication that fast time to market might generate higher satisfaction.
Interestingly, the second most highly correlated answer is about management of distributed teams. This might seem odd,
because Agile methods are often regarded as poor on this aspect,
but the finding simply means that when management of distributed teams is done well, satisfaction is high.

Note also row 5 on the
right of Table 5, Software architecture, the highest and only “Software Influence” measure in the top 10. Row 6 is Stress at work:
we reverse-coded this aspect, so a high result means lower stress:
it makes sense that this is related with high satisfaction. Overall,
it is interesting that 7 of the top 10 are business influences



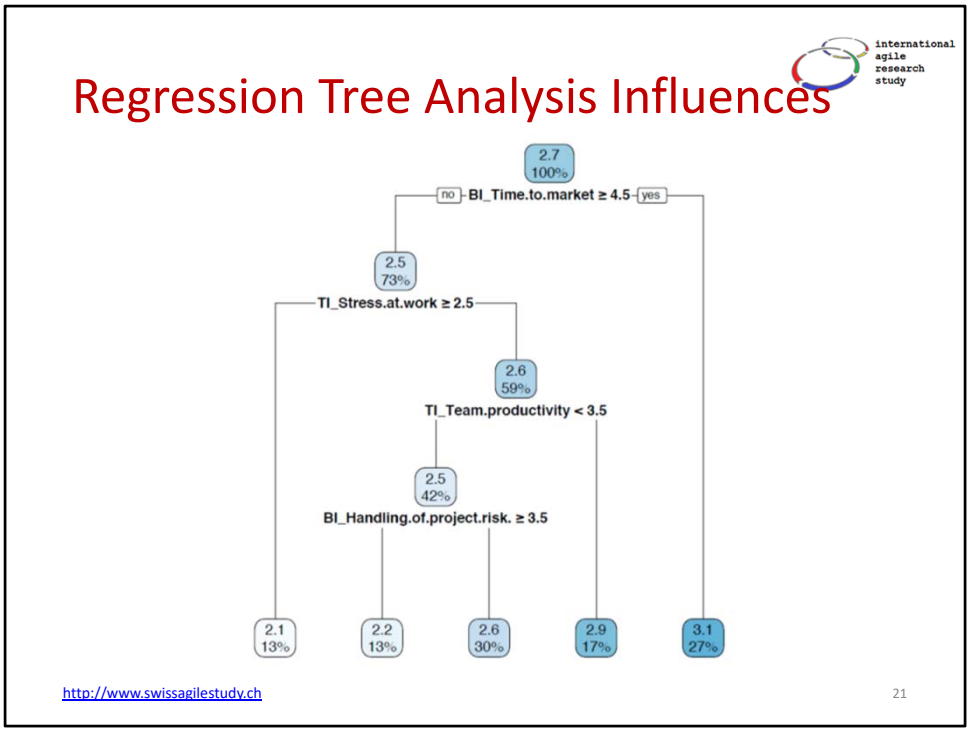
The relationships for these
are shown in the boxplots in Figure 7.

satisfaction is highly correlated with
collaborative and planning practices, together with success in business aspects. However, this is not the whole story. Referring again to Table 5, we can see that even the highest correlations are only in the range of .3 or .4, and so nowhere near the 1 indicating a perfect correlation. This is not surprising, because software development is complex, and we should not expect any one practice or influence to lead to perfect satisfaction. Rather, it makes more sense that several aspects would be necessary for high satisfaction



NOTE: higher satisfaction with less retrospective!!!

Accordingly, we took an approach that looks for critical points in the data that affect satisfaction. To do this, we used Recursive Partitioning to create a Regression Tree [4, 15]. In this approach, the analysis begins with the whole data set, and determines which independent variable (IV), and at what point, best divides distinctly the DV (dependent variable). Thus we obtain two sets, one with lower satisfaction, and one with higher. The process is then applied recursively.



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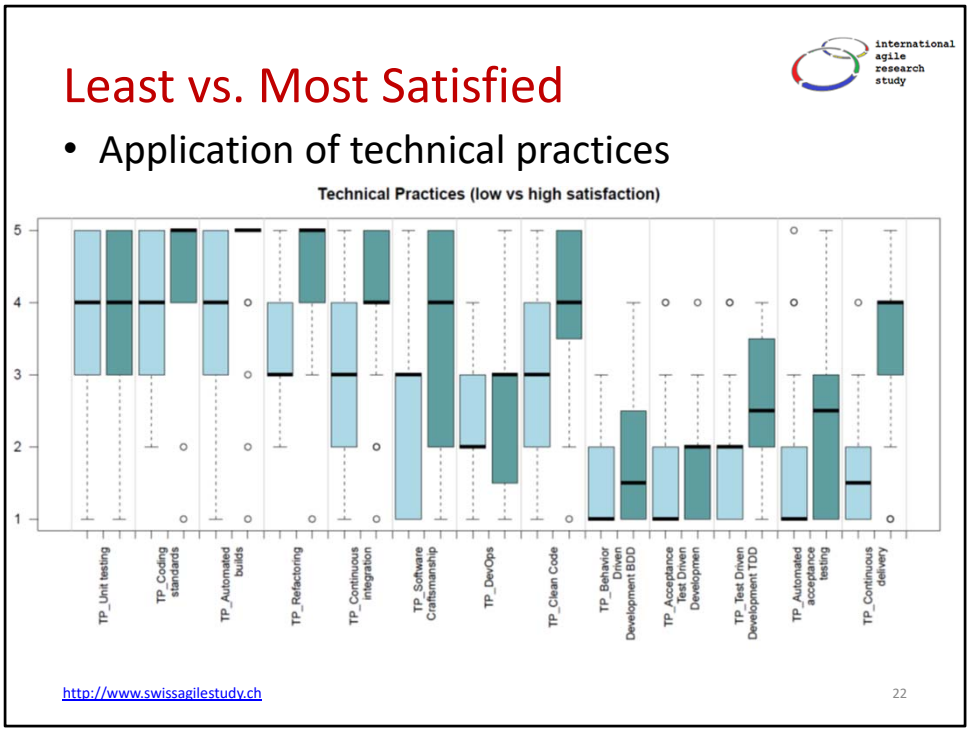
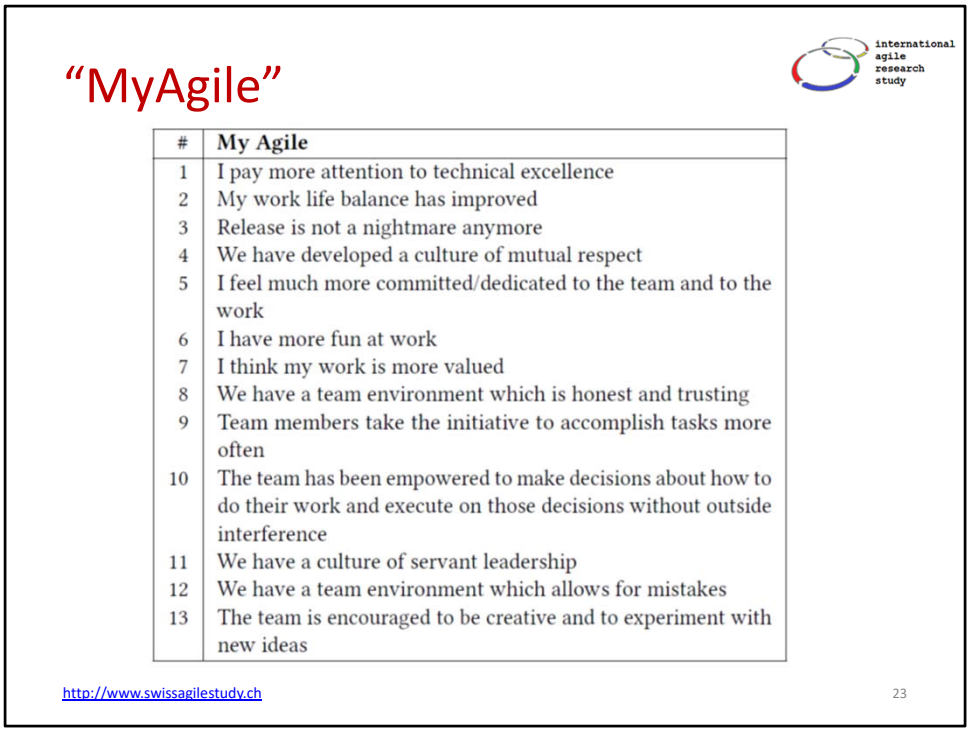
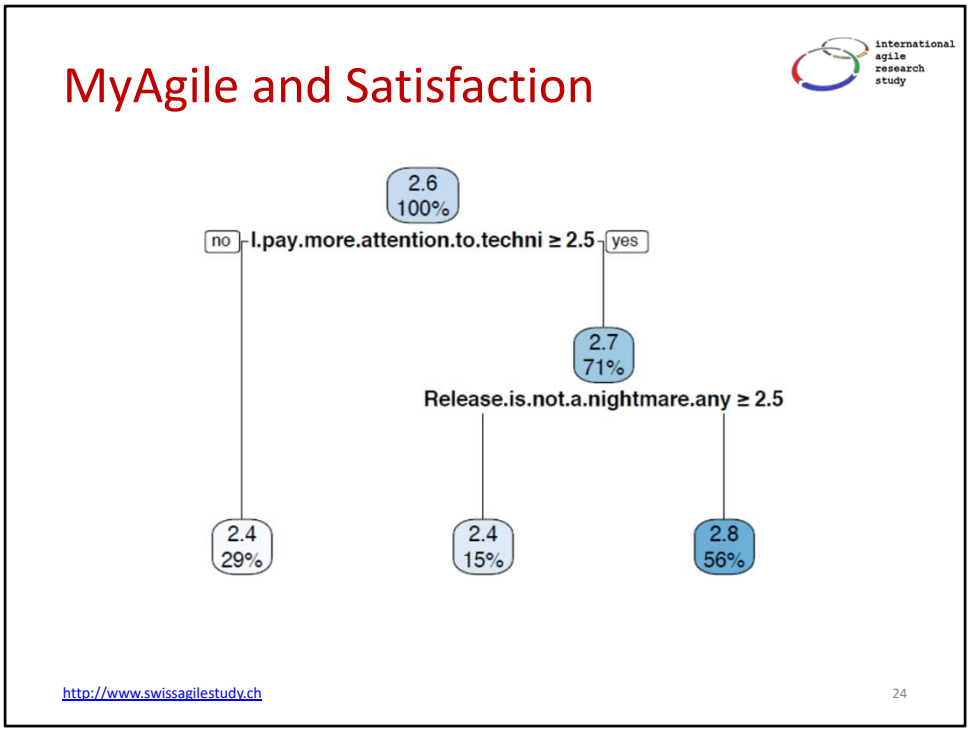


The figure shows the
results for the questions about technical practices for the leftmost(fair blue) (18%) and rightmost (12%) (green) branches of the satisfaction tree about practices: the least and most satisfied professionals.

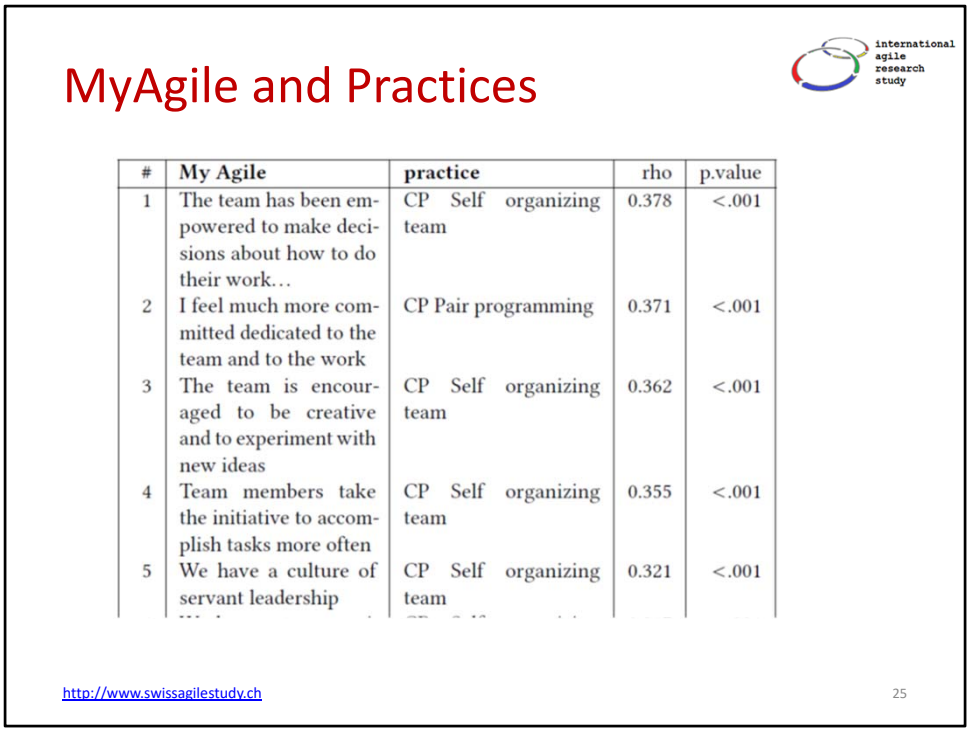


#	My Agile
1	I pay more attention to technical excellence
2	My work life balance has improved
3	Release is not a nightmare anymore
4	We have developed a culture of mutual respect
5	I feel much more committed/dedicated to the team and to the work
6	I have more fun at work
7	I think my work is more valued
8	We have a team environment which is honest and trusting
9	Team members take the initiative to accomplish tasks more often
10	The team has been empowered to make decisions about how to do their work and execute on those decisions without outside interference
11	We have a culture of servant leadership
12	We have a team environment which allows for mistakes
13	The team is encouraged to be creative and to experiment with new ideas

In the survey, professionals were also asked questions about their personal perspective on Agile processes, "My Agile": see Table 6. The question we asked was: 7.1 To what extent do you agree with the following statements?. The participants could choose on a scale from "completely agree", "agree", "disagree" and "completely disagree".



We explored the relationship with satisfaction using the recursive partition approach, obtaining the tree shown in Figure 11. As we can see here, two factors stand out. The dominant finding is a relationship between satisfaction and the factor “I pay more attention to technical excellence”: showing the importance to people of the quality of their work.



My Agile and practices correlations – it's about self organisation!

MyAgile and Practices

#	My Agile	practice	rho	p.value
1	The team has been empowered to make decisions about how to do their work…	CP Self organizing team	0.378	<.001
2	I feel much more committed dedicated to the team and to the work	CP Pair programming	0.371	<.001
3	The team is encouraged to be creative and to experiment with new ideas	CP Self organizing team	0.362	<.001
4	Team members take the initiative to accomplish tasks more often	CP Self organizing team	0.355	<.001
5	We have a culture of servant leadership	CP Self organizing team	0.321	<.001
6	We have a team environment which allows for mistakes	CP Self organizing team	0.317	<.001
7	I think my work is more valued	TP Software Craftsmanship	0.309	0.001
8	I think my work is more valued	PP Story mapping	0.300	<.001
9	We have a team environment which allows for mistakes	CP Pair programming	0.299	<.001
10	We have developed a culture of mutual respect	CP Self organizing team	0.298	<.001

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Conclusions 1

- **Agile professionals** are **more satisfied** than plan-driven
- **Satisfaction** correlates especially with *collaborative practices* and with *business influences*
- **MyAgile** correlates with self-organisation

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We acknowledge a number of threats to validity. Our data was self-reported, and from a single country, Switzerland, so local organizational culture might influence the results. There was little evidence for our initial idea about the origin of stress, so our exploration was post-hoc.

No casuality
Retrospective

Agile development seems to lead to greater satisfaction primarily because of collaborative practices and business influences. Technical practices and team influences are important, but at lesser levels.
On a personal basis, however, an ability to focus more on technical quality is seen as critical.


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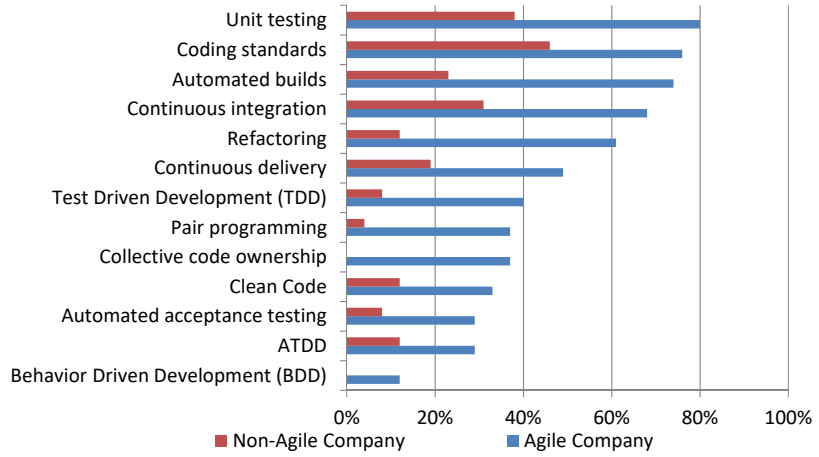
Martin

In this in-depth analysis we especially focus on the aspect if and how agile experience and the organizational culture influences the application of agile practices and the success in agile projects, and what lessons we can learn from it.

Technical Practices

Item 3.1: Which of the following technical practices could be observed by someone visiting your company next month?



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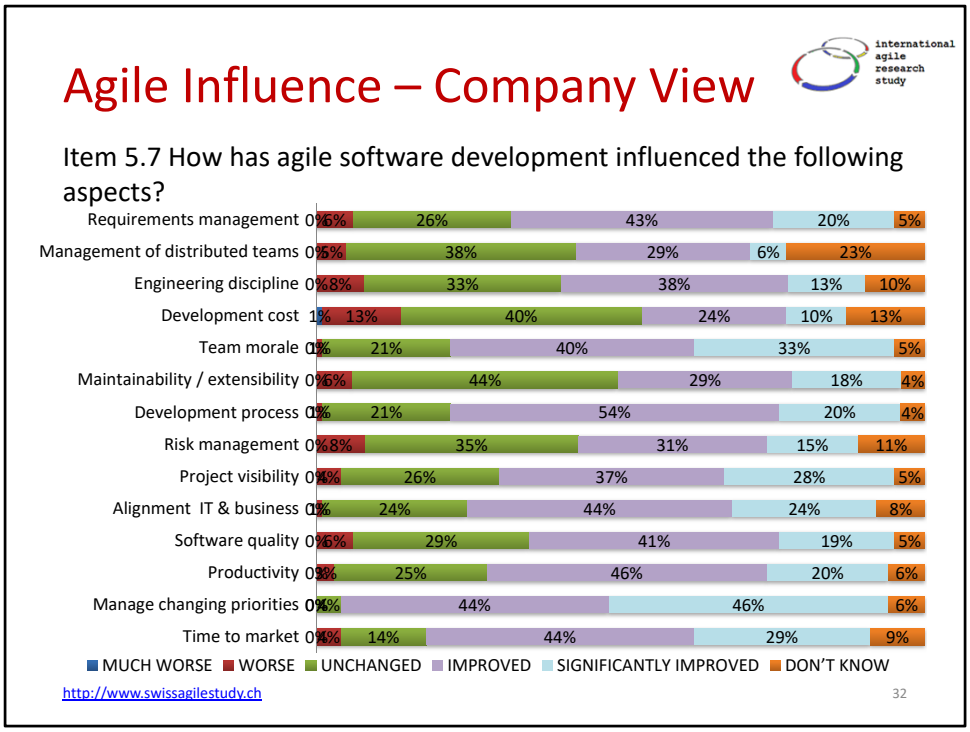
Higher standard practice spread than non-agile companies(5-30%)
Coding-Standards >30% Unterschied
Unit-Testing: 30% Unterschied
CI: 30%
Automated Builds: 40%

Bei den Managing Practices (Release Planning, User Stories, …) noch ausgeprägter, da dies reine “agile” Management Praktiken sind.

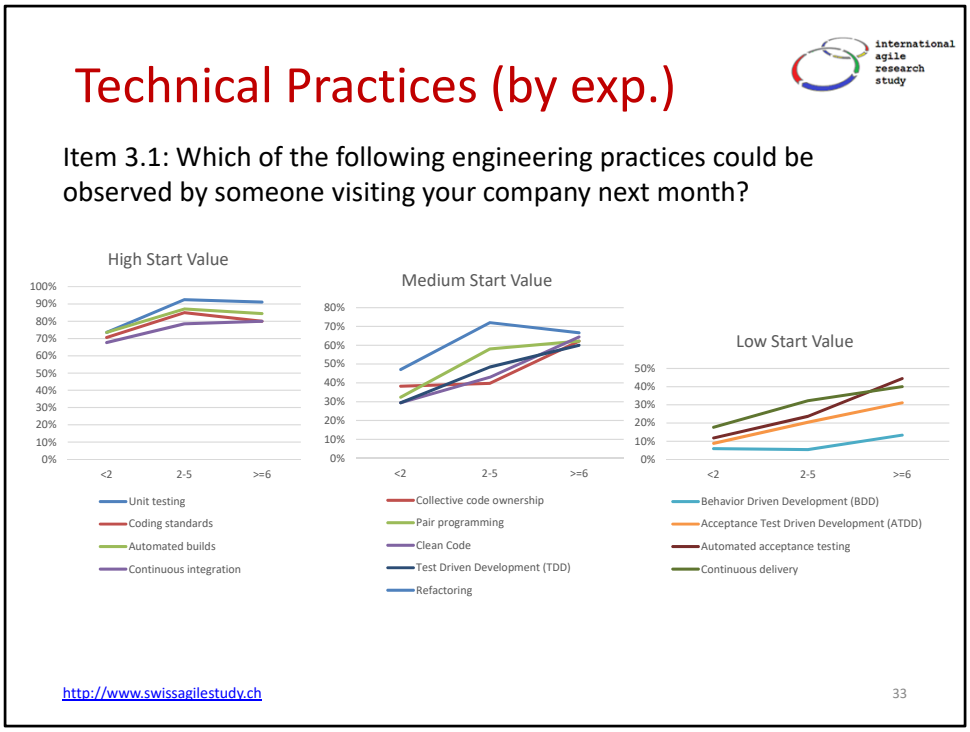
“Advanced” Techniken immernoch relativ wenig.

This bars compares the overall application of management (or collaborative) practices of agile and non-agile companies.
Not astonishing here the practices are very big, too. Since most practices are agile practices.

Agile Influence – Company View

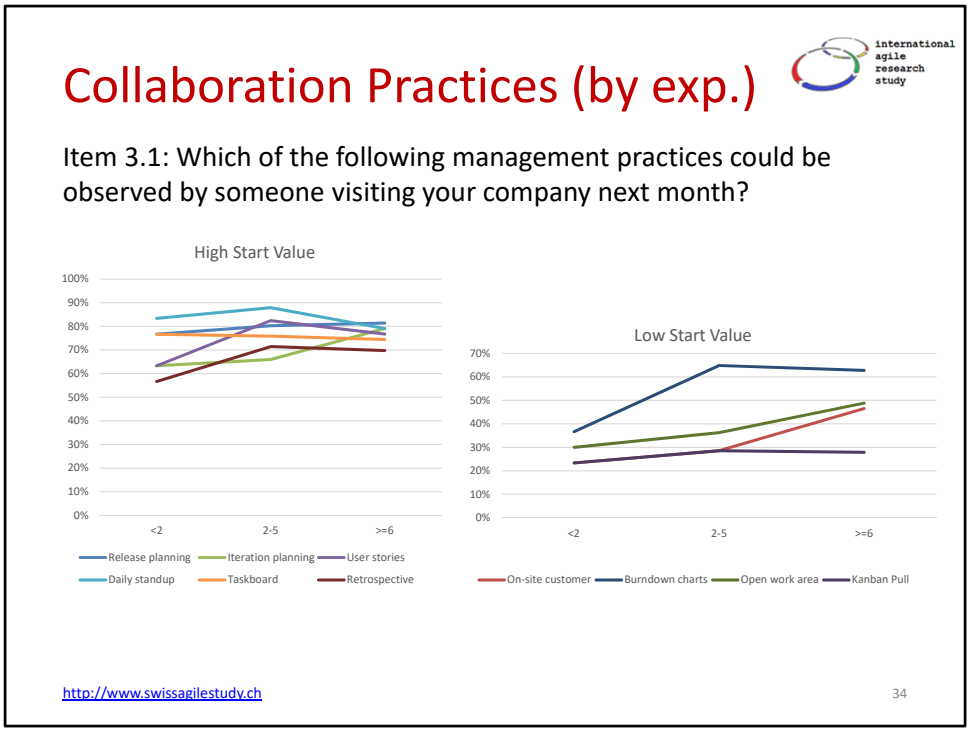


Note:
Priority Management, Time-To Market, Dev-Process, Team Morale, Visibility, IT&Business Alignment



These graphs show the application of engineering (technical) practices depended on how long professionals have been doing agile software development.

Basic practices like unit testing are applied also by less experienced agile professionals
More advanced practices are not very much applied by less experienced professionals



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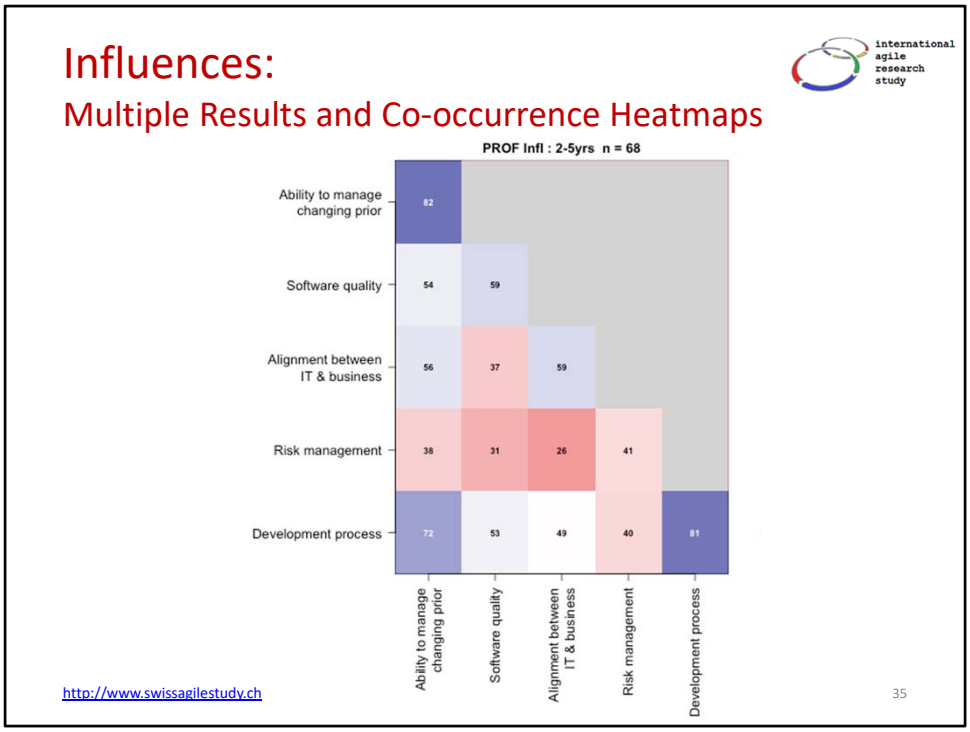
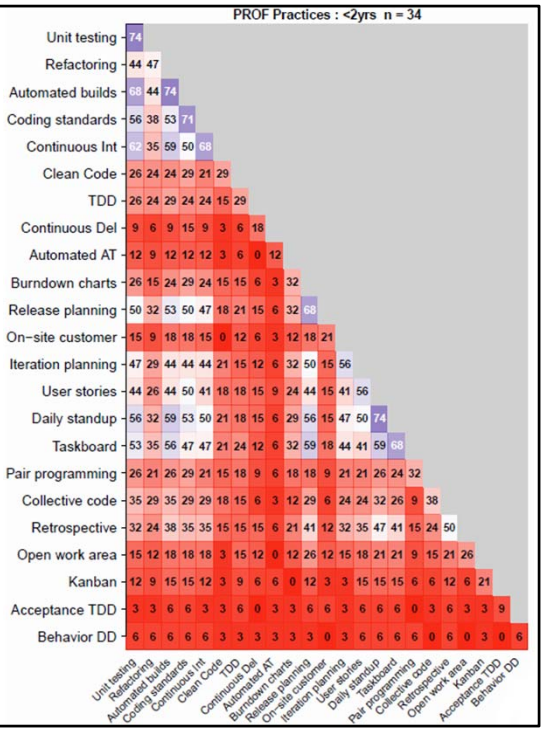


Robert

Several items in the survey allow multiple answers, for example saying which agile practices are used. To present this data we use Co-occurrence Heatmaps, which have the benefit of highlighting multiple answers given by the same people. This illustrates common sets of answers, such as which practices are used together. The heatmap shows **percentage** numbers and colours, blue for common (high percentage), and red for uncommon (low percentage).

The heatmap shows influences being by professionals in organizations with 2-5 years experience with agile.
We can see that the many people identify ability to change priorities, and the development process.: most say both of these.
However, few people identify risk management.
Note that few people who stress software quality also stress business/IT alignment.

Practices by Experience Professionals < 2 years



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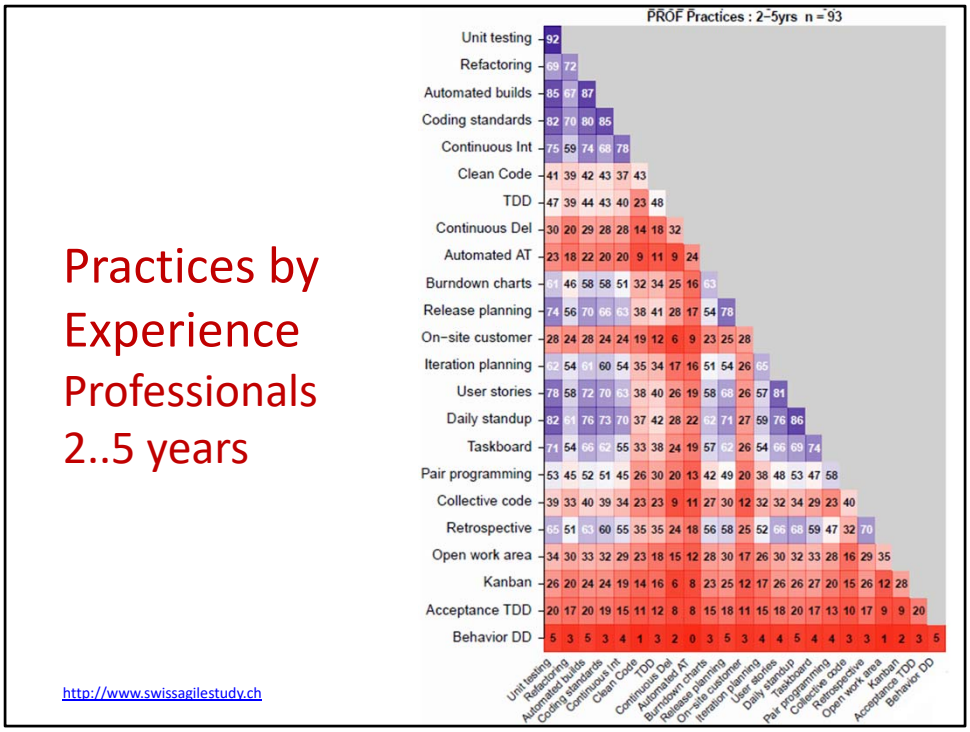
These co-occurrence maps show also the application of practices depended on the agile experience of the professionals

For an explanation of the co-occurrence concept see slide 10.

The graphics clearly show, that less experienced professionals start with technical practices, collaborative practices follow later.



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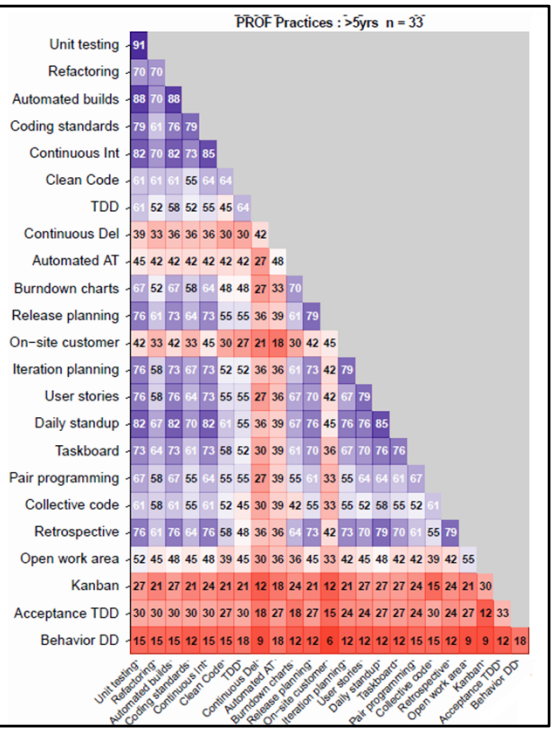
Practices by Experience Professionals > 5 years



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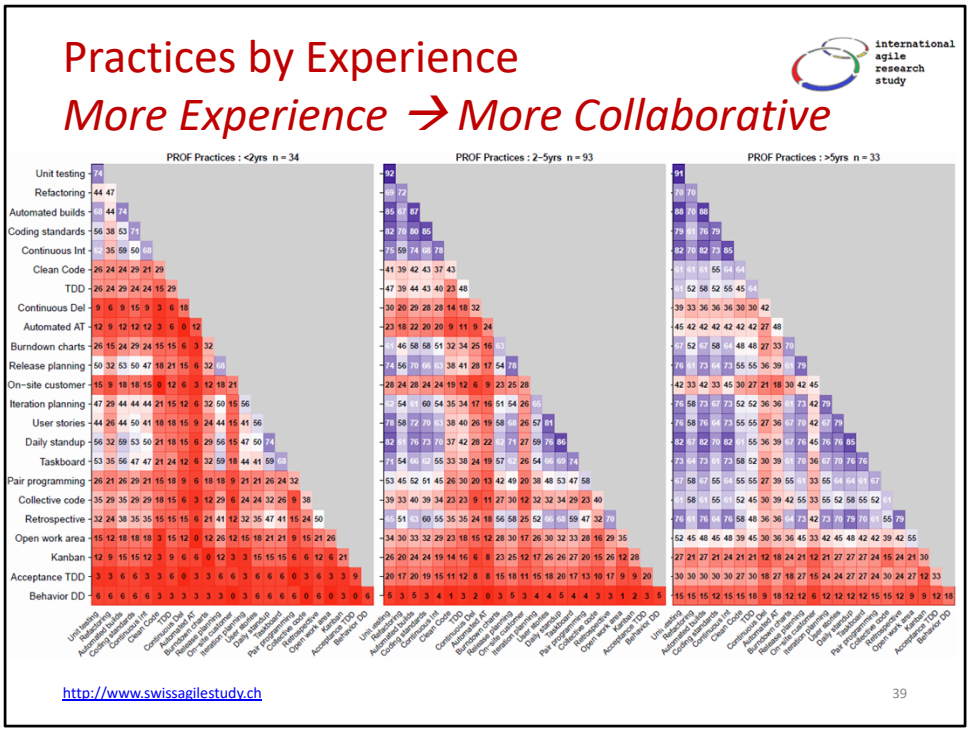

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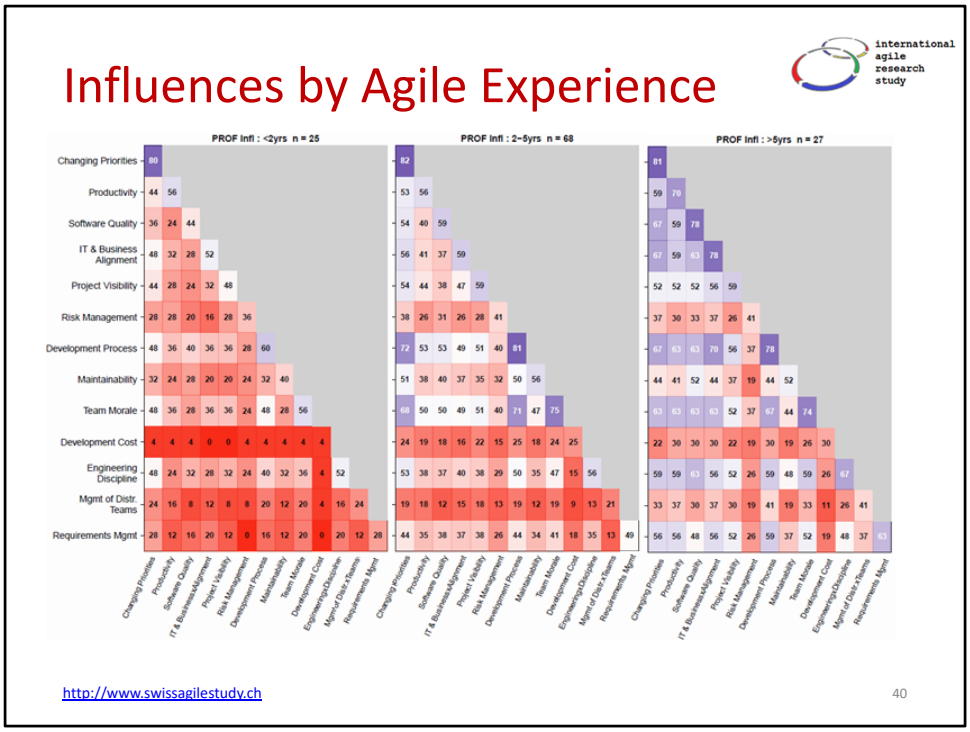


In the survey results, the influences reported were different depending on the amount of agile experience.

For those with less than 2 years experience:
•Ability to react to changing priorities was by far the dominant influence - nothing else comes close.
For those with more experience:
•A cluster of influences are regarded important, including software quality, productivity, and business/IT alignment.

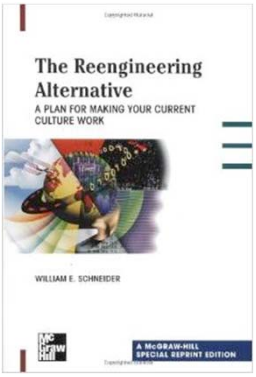
Note that for beginnings, team morale was not regarded as an influence, whereas it was for more experienced teams.

Also note that nobody regarded distributed teams as an influence, nor was development cost.

Life in the Organization

international agile research study

- Schneider's Model:
  - **Control** Culture
  - **Collaboration** Culture
  - **Competence** Culture
  - **Cultivation** Culture
- No organization has only one, but most have a dominant culture...



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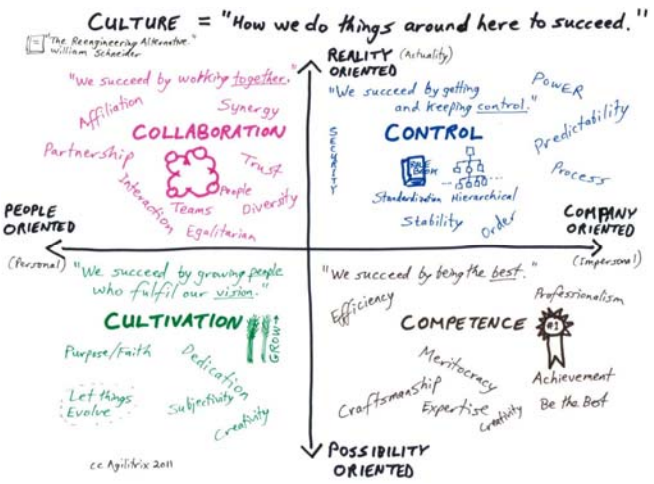
In the 2014 survey, we asked questions suggested by Schneider in his book "The Reengineering Alternative" (1994). They allow us to identify which culture is dominant in an organization.
Schneider's model has 4 cultures, as follows:
Control: where top-down structure is emphasized, and there is little flexibility.
Collaboration: where working together is emphasized, to gain the advantages of different strengths.
Competence: where excellent processes and rigour are emphasized.
Cultivation: where enrichment and continual learning are emphasized.

Organizational Culture



http://www.infoq.com/articles/organizational-culture-and-agile, 15.1.2016

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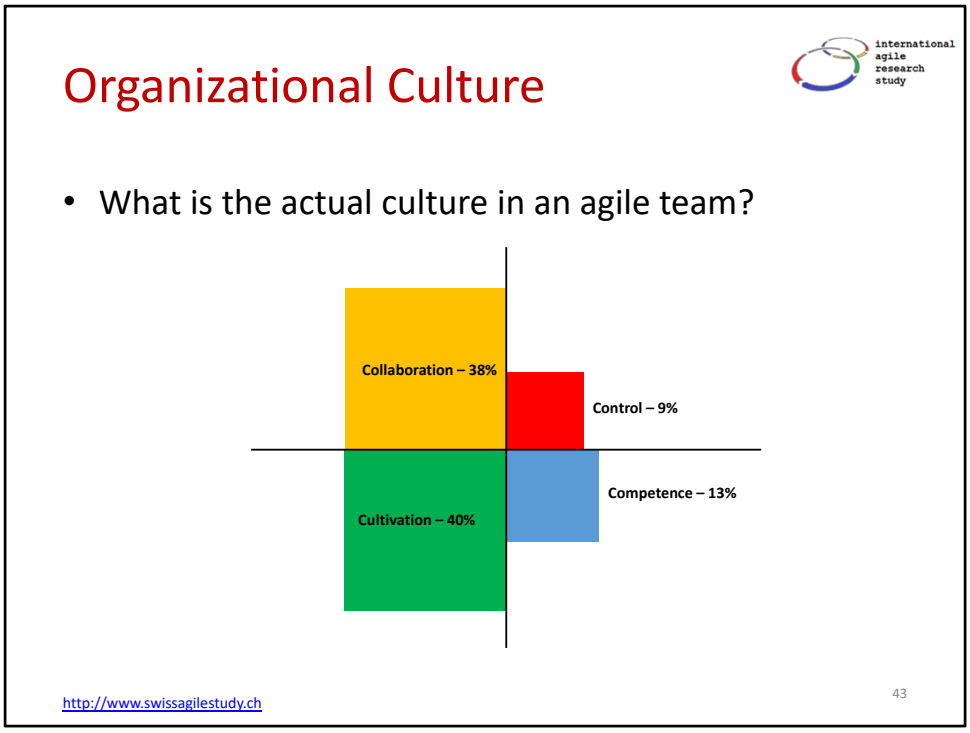
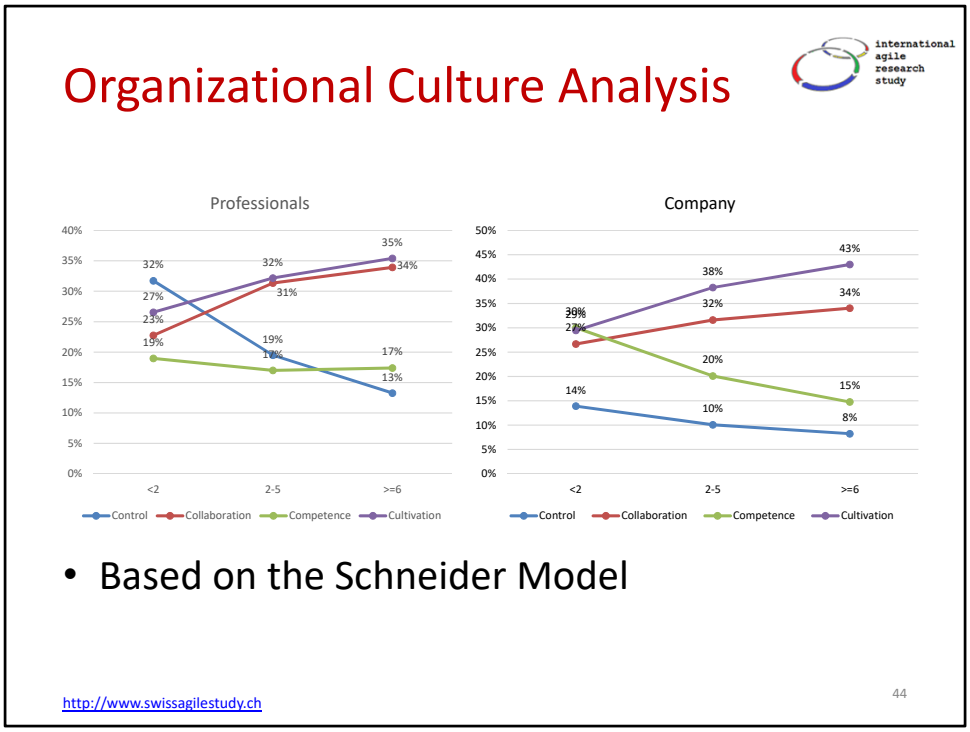
Martin

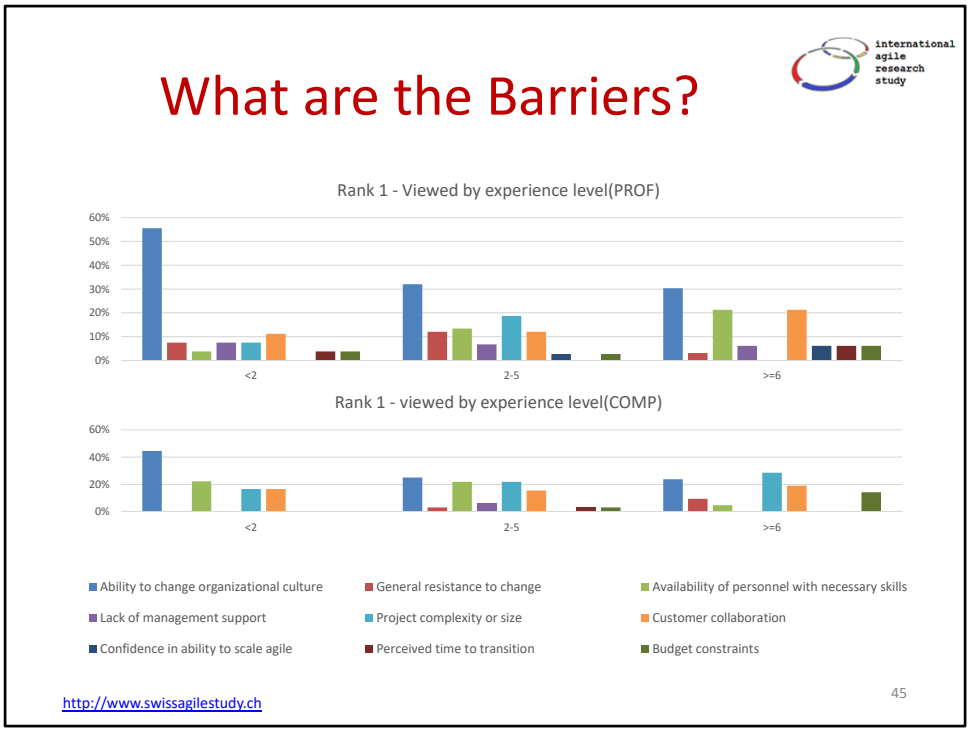


The final of the four core cultures is called Cultivation. Its quest is for meaning, for making a contribution. The relationship to its customer (or constituent) is their growth, the realization of their highest potential. Leaders in the Cultivation culture are catalysts, cultivators and stewards of human potential. The role of employees can vary from functionalist to generalist to specialist, depending on organizational need and personal inclination. Mentoring, sponsoring and a fervor to learn and grow are common. The climate of such an organization is lively, magnetic, committed, emotional and giving. The organizational structure is unconventional such as a wheel or lattice. Cultivation is the ultimate 'values-driven' organization. It is the least common type in the for-profit world, but quite prevalent in non-profits and religious and spiritual organizations, which provide the underlying archetype. *Self-actualization* is the primary motivator in a Cultivation culture.

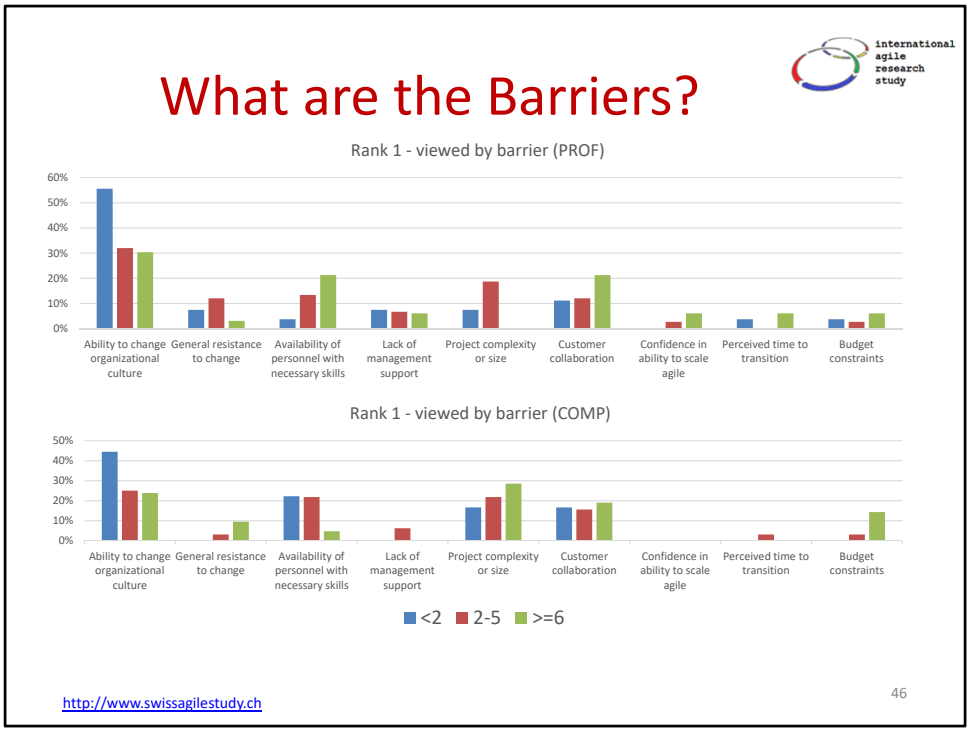


We asked 10 out of 20 questions from William Schneiders questionnaire to find out which organizational culture agile companies and professionals prefer. The graphs indicate for both the companies and the professionals, that the more experience they have, they more tend to follow an collaboration and cultivation culture.

How to read the graphs:
Example:
35% percent of the experienced professionals responded that they follow more closely an collaborative culture.



These bars shows which the major barriers are for further adoption agile methodology, depending on the experience of the companies and the professionals. For both less experienced, by far most named “the ability to change the organizational culture” as the biggest barrier



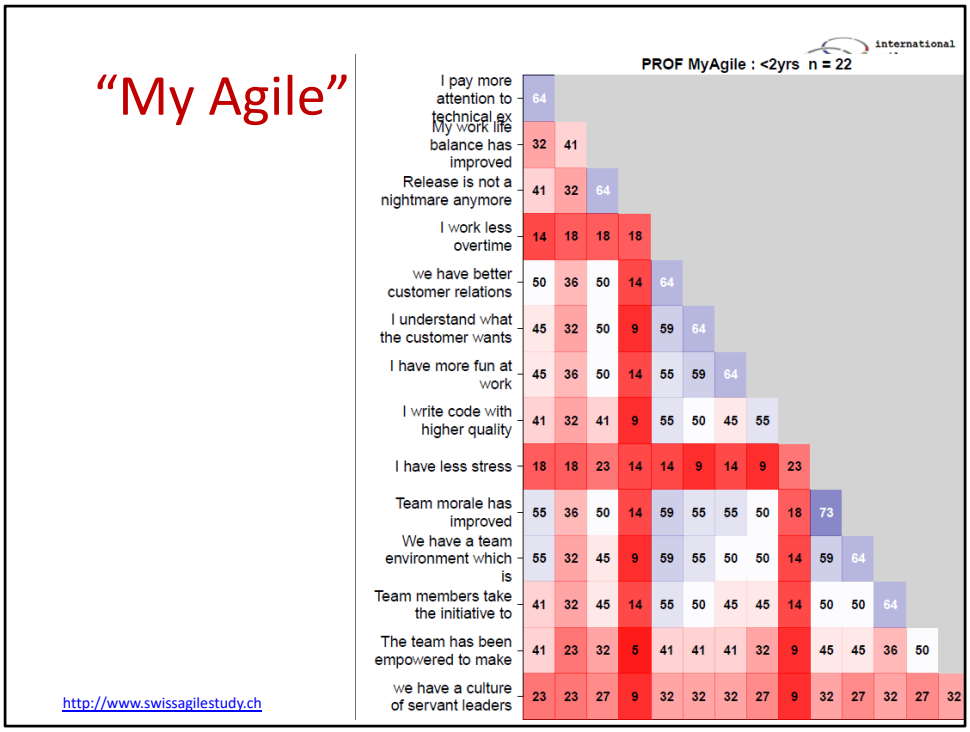
These bars shows again which the major barriers are for further adoption agile methodology, depending on the experience of the companies and the professionals.

However now each possible barrier is directly compared according to the experience of the professional and the company.

There are quite some different view what the barriers of “availability of necessary skills”, and “project complexity” concerns.

My Agile Results

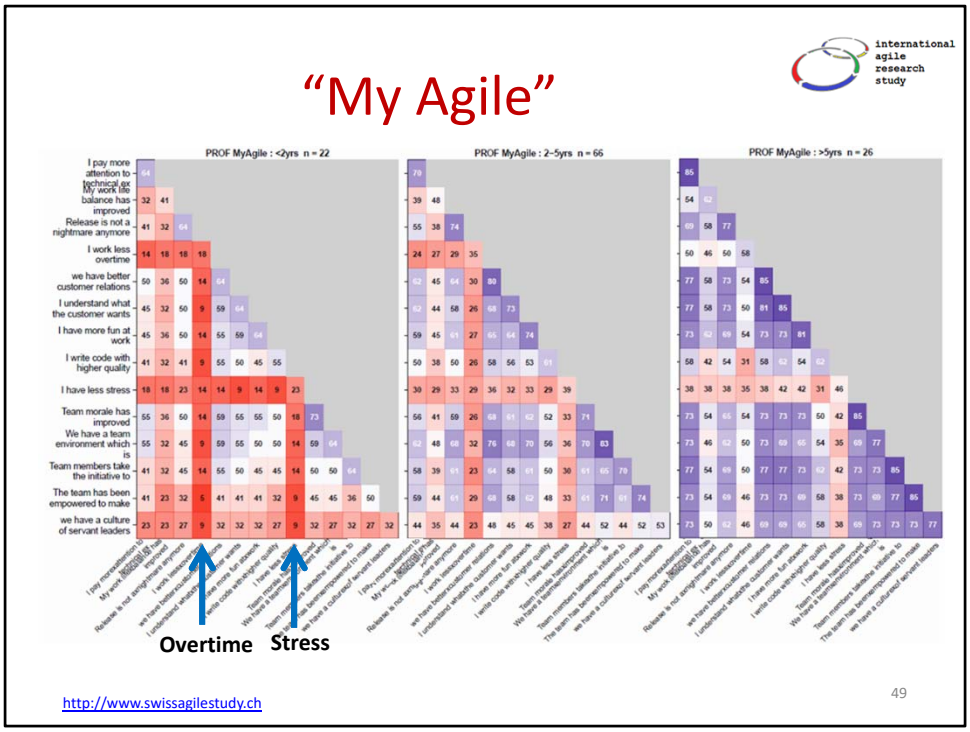
Oxford University, Oct 2019 47



These co-occurrence maps show how the professional feels about using agile methods, his personal experience.

For an explanation of the co-occurrence concept see slide 10.

The graphics clearly show, that especially for less experienced less professional the move to agile generates a lot of stress. Surprising, even for experienced professionals , agile still seems to cause some stress.



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Hypothesis

Stress in Agile might relate to an under-adoption of collaborative practices

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Research Questions

- How do professionals rate how Agile has influenced their stress?
- How is their stress related to the level of agility in their process?
- How is their stress related to their team practices and to the influences they see resulting from their process?

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The 2016 Stress Question

How has Agile software development influenced your stress at work?

- Scale from 1 (significantly less stress) to 5 (significantly more stress).

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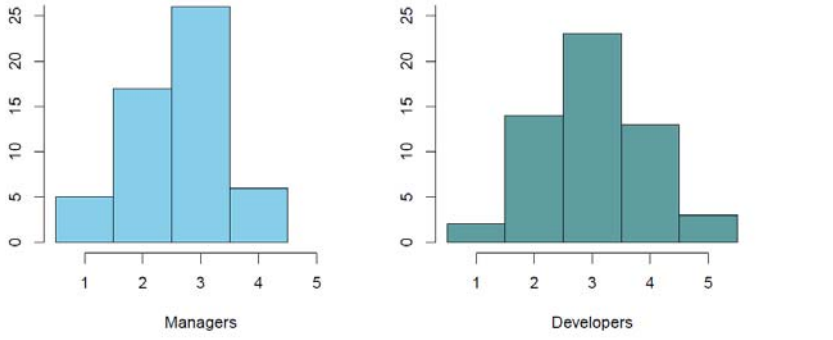
How has stress changed?



1: significantly less – 5: significantly more

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Although these
results are not extreme, they do suggest some reason for concern, with sizeable numbers reporting they are more stressed or signicantly more stressed (levels 4 and 5).

Stress correlation with influences

	question	rho	p.value	
1	SI Defect rate	-0.439	<.001	D
2	TI Team morale motivation	-0.413	<.001	D
3	SI Software architecture	-0.374	<.001	M
4	SI Software quality	-0.362	<.001	M
5	BI Requirements management	-0.353	0.001	M
6	SI Engineering discipline	-0.337	0.001	M
7	SI Software maintainability	-0.335	0.001	M
8	TI Engagement of customer product owner	-0.333	0.001	M
9	BI Ability to manage changing priorities	-0.323	0.002	D
10	TI Effectiveness of meetings	-0.321	0.002	M

we use Spearman's non-parametric rho method (better suite to Likert scale)
D – Developers
M – Managers
BI – Business Influence
SI – Software Influence
TI – Team Influence

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To explore how the practice and influences related to the stress, we looked for correlations. To compute the correlation, we use Spearman's non-parametric \rho" () method, rather than Pearson's r, because our Likert scale data is ordinal, and this approach supports more conservative results. A rho approaching 1 is an extremely close match, approaching 1 is a strong inverse match, and rho approaching 0 is a very poor match. Our speculation was a relationship between collaborative processes overall,

Looking at differences between managers and developers, we found most of the influence relationships concerned managers, but it was developers who most highly rated low defect rates, team morale, and ability to manage changing priorities as most related to reduced stress.

Stress correlation with practices

question	rho	p.value
1 CP Self organizing team	-0.27	0.02

- That was the only significant correlation we found

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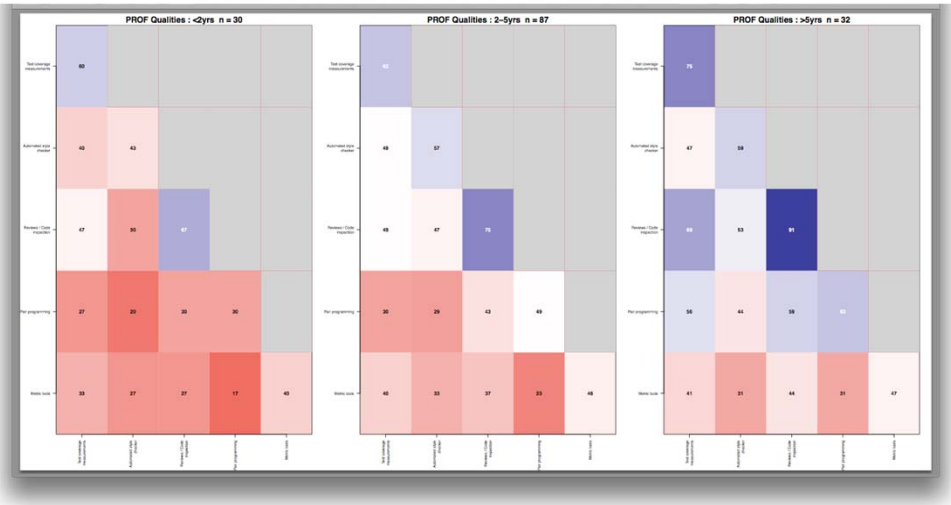
For practices, we found the only practice with a significant effect was the \Self-Organizing Team" collaborative practice showing = 0:27; p = 0:02 (Bonferroni corrected). On further inspection, we found this relationship was strongest with managers, with = 0:54.

How is Code Quality Controlled?
More Experience->More Controls

international agile research study



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These co-occurrence maps shows how many quality control measures were used by the professionals dependent on their agile experience.

For an explanation of the co-occurrence concept see slide 10.

The graphics clearly show, that the more experience the more measures are applied.

Metric tools are not used that much, even by experienced professionals.

Professionals vs. Managers

Professionals Report More Practices

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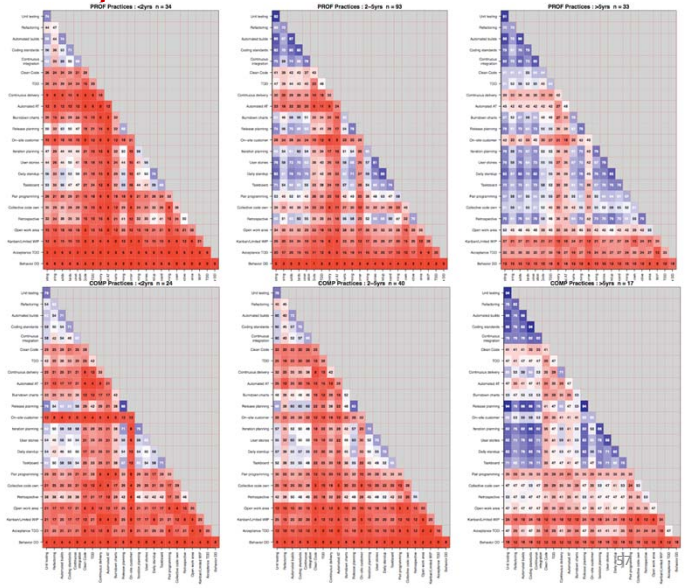
- Individual Professionals
- Company Managers



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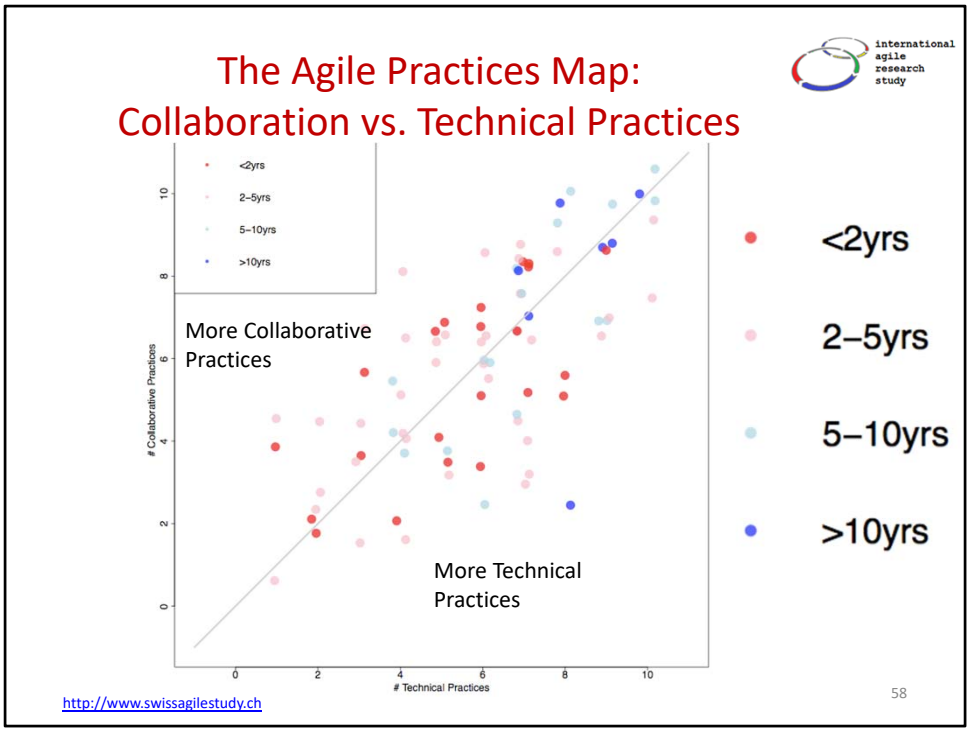
These co-occurrence maps show also the application of practices depended on the agile experience of the professionals and compares it with those of the company survey

For an explanation of the co-occurrence concept see the earlier slide.

The graphics clearly show, that less experienced professionals start with technical practices, collaborative practices follow later.



This “Agile Practices Map” shows for each participating company, how much of the 10 collaboration practices and 10 technical practices each company applies.
The color indicates how long the company has been practicing agile software development.

Summary: What Have We Learned?

- **Tech Practices precede Collaborative Practices:**
  - Why? Initial Misunderstanding of Importance?
- **Organization Culture linked to Agile Experience:**
  - What does it mean for an organization?
- **Barriers are cultural first, complexity later:**
  - How should Agile handle complex software development?
- **Agile is Stressful:**
  - Why? What can be done?
  - Self-organisation might help

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Please complete study

International Agile Study
2018-2020

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