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VTMM® – Virtual Team Maturity Model

for virtual team performance improvement development

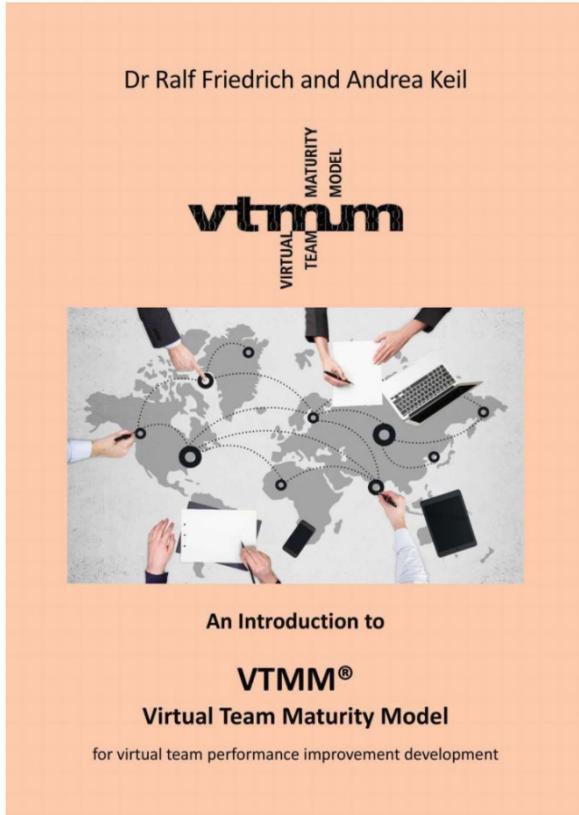
An Introduction to

VTMM®

Virtual Team Maturity Model

for virtual team performance improvement development

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The screenshot shows the Kindle Cloud Reader application window. At the top, there's a blue header bar with the 'Kindle Cloud Reader' logo and standard window controls (minimize, maximize, close). Below it is a toolbar with icons for back, forward, search, and other functions. The main area displays a document page. On the left, there's a sidebar with a 'Bibliothek' tab and various navigation icons. The main content area has a dark background with white text. A large section title '1 Introduction' is at the top. Below it is a paragraph about virtual teams. To the right of the text, there's a block of text followed by a larger block of text. At the bottom, there's a progress bar and page navigation controls.

1 Introduction

Virtual teams play a key role in business productivity as more and more activity is dispersed across geographically distributed teams^[1]. Teams are established in organizations to achieve specific tasks, which cannot be carried out by individuals alone. These tasks need to be completed within budget, meet stakeholders' expectations and frequently have tough deadlines to meet^[2]. Experts from different locations are required to work together through computer-mediated communication. Organizations expect these experts to perform efficiently on virtual teams to achieve task completion as described above.

Research on virtual teamwork practices has shown that different competencies and skills are required from team members^[3]. It has been observed by Nemiro^[4] that a virtual team should manage external factors (distance, time and technology) and actively address internal ones (culture, trust and leadership). Zofii^[5] confirmed that business executives perceived challenges of virtual teamwork mainly by virtual communication, new technology and different languages and cultures. Piccoli and Ives^[6] showed evidence that successful management principles of co-located teams lead to negative results regarding trust in virtual teams. They also proved that leaders are facing a dilemma, when applying behaviour control in virtual teams^[7].

All these challenges cannot be captured in a single function and as the challenges address completely different elements and disciplines, Nemiro^[8] suggests a process model as a promising approach to successful virtual team performance. Therefore, the Virtual Team Maturity Model (VTMM®) was developed to provide a reference model against which virtual teams can be assessed, so that performance gaps can be identified and closed.

The VTMM® tool sets about enhancing the efficiency of virtual teams by assessing and improving performance across 11 different dimensions. The model focuses on internal project team processes, which are necessary to compensate for critical factors, such as lack of face-to-face interactions in virtual teams, challenges in imparting tacit communication, building trust, giving feedback, establishing work rules and offering rewards and recognition^[9].

Besides its thorough and academically proven theoretical foundation^[10], VTMM® was tested in a real work environment. In 2015, a case study was carried out, applying the concept of VTMM® to a multinational virtual team by assessing the team's maturity level and deducting corresponding measure to improve the team's maturity. The case study shows how a VTMM® treatment leads to positive results on team performance^[11].

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2 Benefits of VTMM®

The 11 processes of VTMM® were tested in a Delphi study in 2015^[12] and were acknowledged to play an important part in improving virtual team performance. The same study revealed that despite being considered important, not many of these processes were actually implemented in actual projects (see Figure 1). While the more commonly known processes of “Perform Task Management” (56%), “Organize Decision Making” (50%), “Conduct Meeting Management” (54%) and “Define Information-Management” (59%) were present in at least half of the projects, the “softer” processes were neglected in about two thirds of the projects.

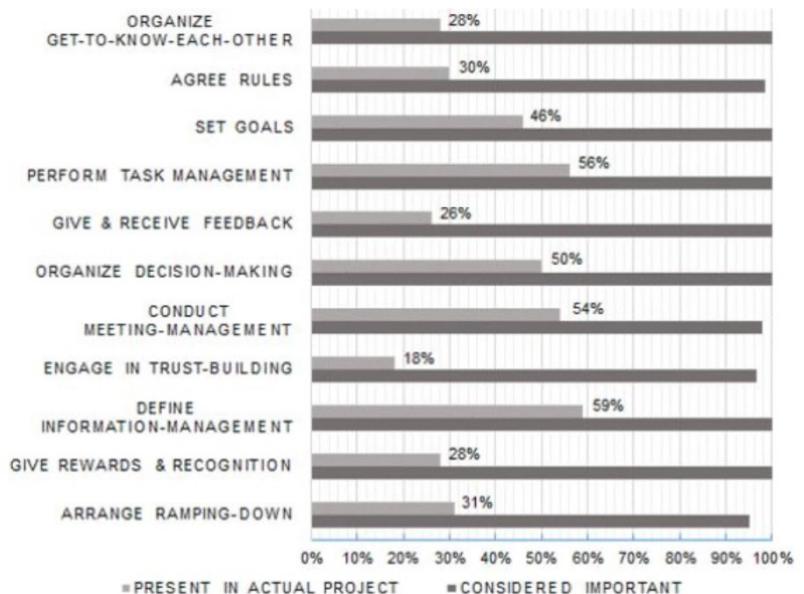


Figure 1: VTMM® processes and their implementation (Friedrich, 2017)

The case study, which is described later in this book, will show how the synergetic effects of a “softer” process such as “Give and Receive Feedback” influences virtual team maturity and overall performance (see chapter 6.5 Results of the VTMM® Assessment).

The Delphi Study also inquired project managers to give reasons for their

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hesitation in implementing acknowledged processes and measures for improvement of their actual projects. Figure 2 shows the results, striking “lack of formal process and leadership” (63%), “lack of personal and communication skill” (52%), “process not understood” (51%) and “no time” (49%) as the most frequent explanations.

VTMM® offers such formal processes and provides an assessment that does not depend on personal and leadership skills. The case study will also reveal how the tested virtual team welcomed the recommended measures for improvement, because they did not consume too much time and resources.

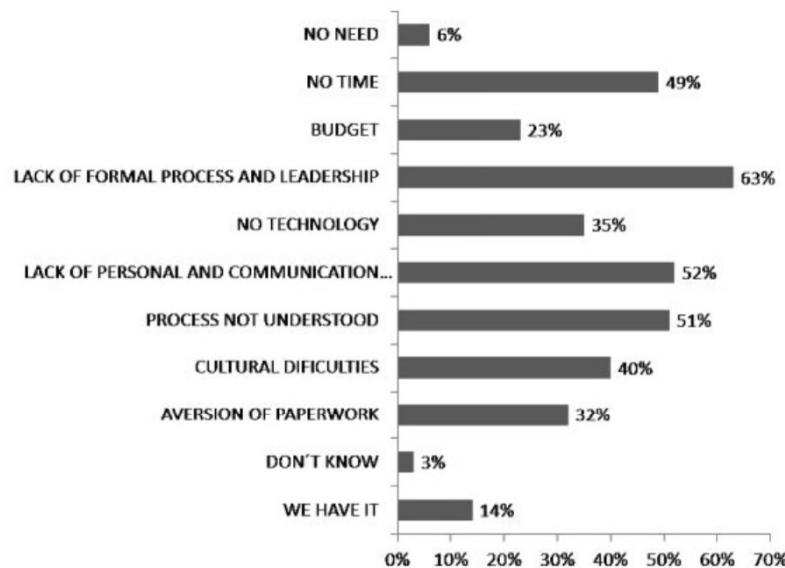


Figure 2: Reasons for not implementing an acknowledged process (Friedrich, 2017)

The screenshot shows the Kindle Cloud Reader application window. At the top, there's a blue header bar with the Kindle logo and 'Kindle Cloud Reader'. Below it is a toolbar with icons for back, forward, search, and other functions. The main content area displays a document with the following text:

3 Virtual Team Maturity Model - VTMM®

Maturity Models provide a set of best practices that address productivity, performance, costs and stakeholder satisfaction^[13]. They provide a valuable analysis framework to assess team performance^[14]. Assessments on team performance are vital to predict successful virtual team collaboration^[15]. The VTMM® is designed to assess the current maturity of a virtual team and propose clear steps to improve virtual team performance quickly.

The 11 processes of VTMM® follow the lifecycle of virtual project work and include aspects ranging from fact-oriented management of task and information over workflow-oriented procedures like meetings and decisions to soft factors concerning feedback and social interaction^[16]. The number of processes is comparable with the findings of other researchers^[17]. Following the recommendation of PMI^[18], each process is described by inputs, methods and outputs. These are measured by key performance indicators (KPIs) to gauge how well a process is executed. The presence of these KPIs is investigated during an assessment in which the whole team participates. The results of the assessment highlight issues that limit effectiveness in virtual project team environments. To alleviate these limits, VTMM® introduces a set

of methods to gauge the level of competence in the identified areas.

3.1 Key Performance Indicators (KPIs)

An organization uses key performance indicators (KPIs) as a business metric to evaluate critical success factors (CSF) that are crucial in achieving key business objectives^[19]. They choose KPIs to focus their attention on tasks and processes that are most significant for making progress and reaching declared goals and targets^[20]. Each VTMM® process is defined by KPIs, which have a different quality for each of the four maturity levels^[21]. The maturity levels follow the description of the CMMI® at its staged representation, where they represent an organization's overall maturity, which is achieved by a set of improvements for a process^[22]. Similarly a VTMM® maturity level is defined by manifestations of KPIs for a process. Referring to other process models^[23], the deliverables of the process' outcomes are used as KPIs. To capture the complexity of circumstances involved in virtual teamwork, KPIs serve as critical success factors for virtual team performance improvement and include all possible perspectives on performance, as different perceptions of successful projects should be captured^[24]. This comprises the organisational capabilities for innovation as well as stakeholders' influence on corporate beliefs system and the choice of internal performance indicators^[25].

VTMM® aims to be applicable to a multitude of different virtual team

The screenshot shows the Kindle Cloud Reader application window. At the top, there's a blue header bar with the 'Kindle Cloud Reader' logo and standard window controls. Below it is a toolbar with icons for navigating through the document, including back, forward, and search functions. The main content area displays a page from a document. The page title is 'Bibliothek'. The text on the page discusses KPIs and their validation through the Delphi experiment and pilot implementation. It also introduces the four maturity levels of the VTMM®. On the right side of the page, there's a sidebar with a search bar labeled 'Suchen'.

situations. Therefore, distinct KPIs are designed to represent an in-depth evaluation of core business processes. From a practical point of view the KPIs also should be self-explanatory and easily applicable to reduce team members expense on time and effort during an assessment. The KPIs used in VTMM® capture not only deliverable of a process but the interaction and identification of team members within a team or organization.

The KPIs and their assignment to the four maturity levels have been validated during the Delphi experiment and during the pilot implementation^[26]. The Delphi experiment confirmed the KPIs to be meaningful and applicable. The pilot implementation affirmed the KPIs to be simple and unambiguously assessable. The KPIs will be further refined as VTMM® is rolled out in 2017.

3.2 Maturity Levels

The VTMM® has the following four maturity levels^[27]:

- At the **undefined level**, there are many gaps compared to the reference model. The success of the team cannot be traced back to conformance with virtual team processes. Many of the processes, tools or cultural elements are missing and most likely also unknown to the virtual team members, leaders and sponsors. Virtual teams at this level can be successful, but rely on individual strengths and

charisma of the leader and/or its team members. Therefore, the virtual team does not know what to do to improve its performance.

- At the **basic level**, the virtual team is aware of the requirements to increase its performance. All quick wins have been implemented. The team performance and productivity has increased, while the level of conflict has decreased and the team members have developed trust and deepened their relationships.
- At the **advanced level**, all elements of the VTMM® are present. The virtual team has a positive culture. Different tools are used for different tasks and virtual team processes are fully implemented or decisions for not implementing them have been well documented. Level of conflict is low and performance is high. The team invests time into the relationship with other team members. Complex tasks are managed successfully and issues are tabled early and dealt with efficiently.
- At the **mastery level**, all elements are present at the needed levels. The team is in a state of “flow” and the performance is very high. The team has implemented knowledge management processes and works on the optimization of the virtual team processes, tools and its

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culture. Team members enjoy being on the team and the project progresses according to schedule, budget and scope, including the right quality. The team will maintain this level of performance, even if there are changes (members leaving or entering the team).

4 The 11 Processes

The following 11 processes of the VTMM® have been validated separately by several authors for virtual teamwork performance improvement^[28], but have not yet been incorporated into a comprehensive maturity model.

4.1 Organize Get-to-know-each-other

This process provides a first introduction and standard orientation for new team members^[29]. It follows the forming phase of project teams^[30] to identify boundaries and establish interpersonal relationships, which is important for good collaboration^[31]. It supports the creation of a team identity to share work preferences and establish communication norms^[32]. At later project phases, the process intensifies perception and recognition of team members by maintaining courtesy, respect and encouragement^[33]. This is important when working in a virtual environment, where every team member is defined by virtual interaction, attitudes towards virtual teamwork and a professional identity created through virtual clues^[34].

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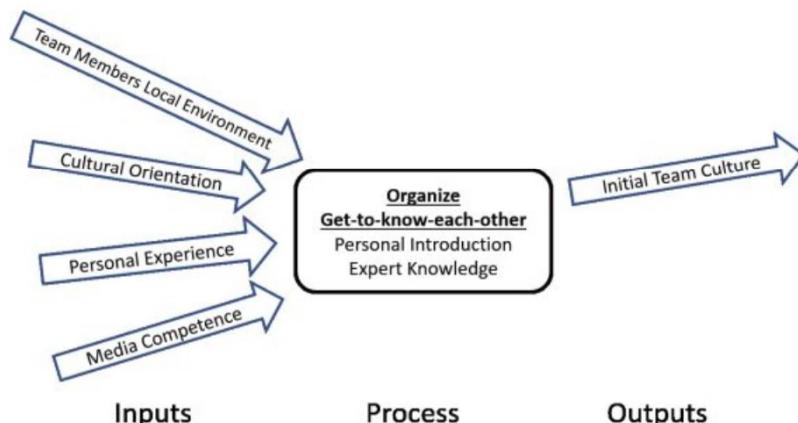


Figure 3: inputs, methods and outputs of the process “Organize Get-to-know-each-other”

Team members' local environment can range from an individual office to a cubicle or a home. It provides team members with the required infrastructure, such as virtual collaboration tools, Internet band width, webcams and video rooms or just a telephone. It can have a huge impact on the performance of a team member.

Cultural Orientation has an impact on virtual team performance^[25] as the team members come from different cultures (nations and companies) and

bring hidden values, customs, beliefs and behaviours to the team. Leadership approach, communication processes and addressing different needs of team members can be adapted, if collectively known.

Personal Experience, positive or negative, varies among the team members^[26]. It is important to know personal strengths of team members to allocate the team's resources most efficiently. Previous experience shapes the team members' attitude towards a team and brings expectations and work habits into the team. It is important to identify the highs and lows and incorporate them into the team.

Media Competence of the team members influences the application and efficiency of computer-mediated communication (CMC). Team members have different skills and attitudes towards CMC. Incorrect or hesitant usage of applications will result in loss of information of a team member's contribution as well as negative motivation and engagement of the team member towards the project^[27]. The composition of the team members from different cultural background influences the selection of communication media^[28]. It is the responsibility of the team leader to develop media competence among team members so that everybody can work professionally with the tools used.

The following methods are recommended to process the inputs given above:

Personal Introductions are important to get information about the other team members, particularly when starting a virtual team. In some cultures, it is enough to share only professional information; other cultures

The screenshot shows a Kindle Cloud Reader interface within a web browser. The address bar reads "Sicher | https://lesen.amazon.de". The main content area displays a section of text about team development, followed by a sidebar with navigation icons like back, forward, and search, and a "Suchen" (Search) button. The top right of the browser window has standard control buttons for minimize, maximize, and close.

require sharing private information to be perceived as a trustworthy colleague. It is important that everybody can participate actively in this phase. Sharing cultural orientations can help the team development process, as the team members develop an understanding of the needs of the other members. The more team members know about each other, the likelier they will create a working atmosphere of trust and cohesion, which is needed in rough times.

Expert Knowledge in form of experience with virtual and multinational teams and teambuilding is required to design virtual team workshops and chose team building activities^[39]. It is also required in the interpretation of cultural assessments and the use of the collaboration tools and social media applications.

The following output is expected to derive from these inputs and methods:

Initial Team Culture will appear after the first workshop. It can take the form of cultural dominance by one sub-group, or the team will create its own culture, integrating the best of all their team members cultures^[40]. Culturally integrated teams perform better than culturally dominated teams^[41]. It is therefore important that the team leader creates a team culture, where all members can contribute positively and integration takes place^[42]. Team culture forms a basis of virtual teamwork and is interrelated to all other processes^[43]. Based on a good initial team culture, the other processes are easier to implement.

4.2 Agree Rules

This process provides the agreement for the team's virtual collaboration, which defines standards and procedures to meet deadlines and quality standards^[44]. Clarifying roles, ground rules, duties and responsibilities, it creates a shared work culture, that bridges differences and increases clarity and productivity for the team members to operate within clearly defined boundaries^[45]. Therewith, it offers an orientation for any new team member and serves as an arbitrary document in case the team gets into conflict^[46]. It provides the virtual team with approved operating guidelines, reducing potential of conflict from the beginning^[47].

4.3 Set Goals

The process of defining goals together with the team facilitates emotional and personal attachment^[48], working as a group to serve a common purpose^[49]. It can also resolve issues in case of confusion or disagreement^[50]. Making the creation and measurement of goals accessible to all, it helps virtual teams members to track the results of their efforts^[51]. Especially for virtual teams, where team members work from a distance, it is important to know and value the individual's own and others contribution to the group^[52].

The screenshot shows the Kindle Cloud Reader interface. At the top, there's a blue header bar with the Kindle logo and 'Kindle Cloud Reader'. Below it is a toolbar with icons for back, forward, search, and other functions. The main area has a dark background with white text. On the left, there's a sidebar with a 'Bibliothek' tab and several document icons. A search bar with the placeholder 'Suchen' is at the top right. The main content area contains sections of text.

4.4 Perform Task Management

This process channels the energy of the team into tasks to be done^[53]. It gathers information and defines, reviews and prioritises tasks. In a virtual team, work processes are usually supported by a previously defined workflow management, which is used by all team members^[54]. It allows to distribute tasks, track the progress of the project, review current projects and list potential future projects^[55].

4.5 Give and Receive Feedback

In a virtual team, due to its high degree of non-verbal communication, regular formal feedback is necessary for leaders and team members to develop a sense of where the team is and prevent conflict before it happens^[56]. A mechanism for feedback should be institutionalised to avoid hurting feelings^[57]. Once a team has established a culture focusing on learning and positive encouragement, their members will thrive to the opportunity to participate and improve^[58]. They will also appreciate feedback on how they are perceived virtually by other members of the team^[59].

4.6 Organize Decision-Making

To share commitment, a team should always be aware of different ways to reach decisions and communicate how they are made^[60]. In virtual teams, where face-to-face discussions are not always possible, it is important to select activities that require collaboration across the virtual team and make decision-making transparent to the rest of the team^[61]. It is part of the process to establish roles and accountability for decision making^[62]. Formal decision-making is necessary, so that all team members have access to information, power and resources, which are needed to achieve the team's objectives^[63].

4.7 Conduct Meeting Management

In virtual teams, interaction with team members takes place in virtual meetings. Due to technological and intercultural issues, challenges of virtual team communication and interaction demand these meetings to be prepared, executed and followed-up correctly to keep up the effectiveness and motivation in the virtual team^[64]. This process not only includes establishing ground rules, but the necessity for all team members to develop virtual meeting skills and awareness of the group process as well as individual comfort with the technology used^[65].

4.8 Engage in Trust-Building

The screenshot shows a Kindle Cloud Reader browser window. The address bar displays 'Sicher | https://lesen.amazon.de'. The page content includes a navigation bar with icons for library, font size, and refresh, and a search bar labeled 'Suchen'. The main text area contains a paragraph about trust building in virtual teams.

This process compensates the missing face-to-face interaction (e.g. coffee breaks) through institutionalised emphasis on social interactions and team building in the virtual world^[66]. Every virtual team needs a culture of trust and identity to operate efficiently^[67], enhancing communication and collaboration, shared responsibility and accountability, employee satisfaction and effective team relationship^[68]. With differing cultural backgrounds, expectations and missing social interaction, trust building is a very sensitive process in need of a visible structure and explained rationales^[69]. Personal communication, which complements task communication, reinforces trust in virtual teams and helps to perceive the partner of interaction as a person, consequently transporting the strength of face-to-face communication into the virtual world^[70].

4.9 Define Information Management

This process organises how information is collected, managed and distributed among members and stakeholders. It ensures that all team members have access to relevant information and share it proactively. Information Management facilitates to find relevant information and provides the necessary applications and instructions to use and interpret it^[71]. Virtual teams rely on transparent information management to keep all team

members informed. Working with up-to date and relevant information maintains efficient communication and enduring trust^[72].

4.10 Give Rewards & Recognitions

This process appraises positive behaviours and discourages undesired ones. It defines a system to personally acknowledge team success and reward ideas^[73], get feedback from stakeholders and experience organizational support^[74]. It enhances the team culture, as it expresses and acknowledges the team members' contribution to the team and the team objectives^[75].

4.11 Arrange Ramping-Down

This process manages how the virtual team is dissolved. It deals with team members leaving the team, interpersonal feeling and separation^[76]. It also conveys accumulated experience in virtual cooperation and communication into practical knowledge to be transferred into new contexts and to be deployed actively in future projects^[77].

The screenshot shows a Kindle Cloud Reader interface within a web browser. The address bar indicates the page is 'Sicher | https://lesen.amazon.de'. The main content area displays a section titled 'The Assessment Process' from a document. The browser's toolbar includes icons for back, forward, search, and various extensions.

5 The Assessment Process

A virtual team assessment includes all team members to evaluate the state of the team as perceived individually. Nevertheless, it occupies a minimum of time and effort and produces instant results, reflecting the team's maturity.

5.1 The Assessment Procedure

A VTMM® assessment follows Deming's Plan-Do-Check-Act (PDCA) cycle^[7-8] and contains the following steps:

1. **VTMM® assessment of all processes with all team members**

Online questionnaires are distributed by email and filled out by team members.

2. **Presentation of the assessment results**

An automatically generated report of the results is sent to team leader and members. It contains results on team maturity on all processes as well as recommendations for further improvement.

3. **Agreement on choice of improvement initiatives and their implementation**
Team leader and/or team decide on improvement activities recommended by the report and initiate concrete measures for their implementation.
4. **Re-assessment after agreed time with all team members**
After the team has worked with the chosen measures for some time another online questionnaire is filled out by the team.
5. **Interpretation of results**
Another automatically generated report reveals change in team maturity and recommends further steps.
6. **Repetition of steps 3 to 5 until desired team performance has been reached**
If the reached outcome is not satisfactorily, the team discusses and implements further improvement activities.

In current business environments, the available budgets for internal improvement activities are low. A maturity assessment of any kind needs to be cost-conscious. VTMM® reduces the efforts and durations of an assessment and allows for fast iterations in team performance improvements. The efforts of a VTMM® assessment requires a low investment from the team, compared to the potential increase of team performance:

- Completion of assessment questionnaire takes about 15

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- minutes per team member.
- Presentation of results and development of action plan requires 2 hours of the team leader's time.
- Implementation of action plan demands 1-2 hours/week per team member over 4 weeks.
- Re-assessment and presentation of results repeat the steps of the initial assessment.

5.2 Calculation of Maturity Levels

Each team member rates the presence of a process by choosing appropriate KPIs. The KPIs of each level of the VTMM® processes have a point value, according to the maturity level they are assigned to:

- 0 Point: Undefined Level
- 1 Point: Basic Level
- 2 Points: Advanced Level
- 3 Points: Mastery Level

The level is calculated by the sum of points for each process, which is divided by the number of team members. A full number needs to be achieved for the level, e.g. 1.8 is still level 1 and not level 2.

As seen in Table 1, the KPIs for the process "Organize Get-to-know-each-

other" indicate that there is just little information available about other team members on the basic level. Besides work related aspects, team members have limited interactions with each other. On the advanced level, the team members share more information about each other, which allows them to engage in personal interaction and to learn about their personal background. At the mastery level, the team members engage in deep social interactions and show their appreciation, because they care about the team members. This state and evolution of the interactions between the team members is subject to the assessment.

Basic Level	Advanced Level	Mastery Level
Team members have pictures from each other, as profile pictures	Team members have pictures of each other, as profile pictures	All team members maintain their social media profiles and connect to each other
Team members seldom chat with each other; seldom share private information to learn more about each other	Team members sometimes chat with each other; sometimes share private information to learn more about each other	All team members use the same platform and share information outside work
Team members sometimes chat with each other; sometimes share private information to learn	Team members know a bit about the family situation of the other team members	Team members celebrate their birthdays informally
	Team members know much about the family situation of the other team members	Team members frequently chat about everything with each other; frequently share private information using individual and team chats
		Team members know details about the family situation of the other team members

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Table 1: The VTMM® KPI's of the “Organize Get-to-know-each-other”-process

This example of KPIs shows that VTMM® KPIs are not simple yes/no measurements on executed tasks, but capture social interactions and inherent dynamics to create a specific team culture.

Figure 4 shows an example of a VTMM assessment for the process “Organize Get-to-know-each-other”. Chosen KPIs of the undefined level are shown in normal print, the basic level answers are shown in *italics*, the advance level answers are shown in **bold** and the mastery level answers are shown in ***italics and bold*** print.

Member A	Member B	Member C	Member D	Points
Do the team members have a social media profile such as LinkedIn or Facebook?				
I don't know.	I don't know.	I don't know.	I don't know.	0
Do team members celebrate their birthdays?				
I don't know.	No	<i>Team members celebrate their birthdays informally.</i>	<i>Team members celebrate their birthdays informally.</i>	6
Do the team members share private information through chat and other means to learn more about each other?				
Team members sometimes chat with each other, sometimes sharing private information	Team members sometimes chat with each other, sharing private information	Team members sometimes chat with each other, sharing private information	Team members sometimes chat with each other, sharing private information	8
Do the team members have pictures of the other team members?				
KPI is not applicable for my team	Team members do not have pictures from each other	Team members do not have pictures from each other	<i>Team members have pictures from each other as profile pictures</i>	1
Do team members know about the family situations of the other team members?				
KPI is not applicable for my team	Team members know much about the family situation of the other team members	<i>Team members know details about the family situation of the other team members</i>	Team members know a bit about the family situation of the other team members	7
Team's maturity level for the process of Get-to-know-each-other:				

Figure 4: Results of the initial assessment for the process “Organize Get-to-know-

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each-other”

In total, the team achieved 23 points from 60 possible points ($n=20$ replies). Dividing the points through the number of replies results in 1,15 which corresponds to level 1: Basic of VTMM®.

5.3 Interpretation of Results

The result of an assessment also illustrated how much the processes are consistently present within the team. The result of an assessment can be a diverse opinion about the team's performance on this process, which indicates that sub-teams have different perceptions about the team's performance. This assessment (see Figure 1) shows a significant difference between Member A and Member D. This is an indication that the perception on the team's performance about this process is very different. In that case, improvement activities will aim to align all team members on a common team maturity level.

6 A Case Study

In a control group study with two virtual multinational teams of a globally active industrial company, the performance of both teams was measured over a period of 7 months, during which one team was being treated to the virtual team assessment and implementation of improvement measurements. Analysis of the comparison of both teams' development proved the VTMM® to add true value to virtual project teams (Friedrich and Keil, 2016).

6.1 Method

The pilot implementation was performed as a static group comparison design. Two groups of comparable size and composition were identified: an experimental group receiving special treatment and a control group operating business as usual. Measurements of team performance were taken before and after the experiment of both groups to investigate the influence made by VTMM® and on both the level of maturity and the overall team performance.

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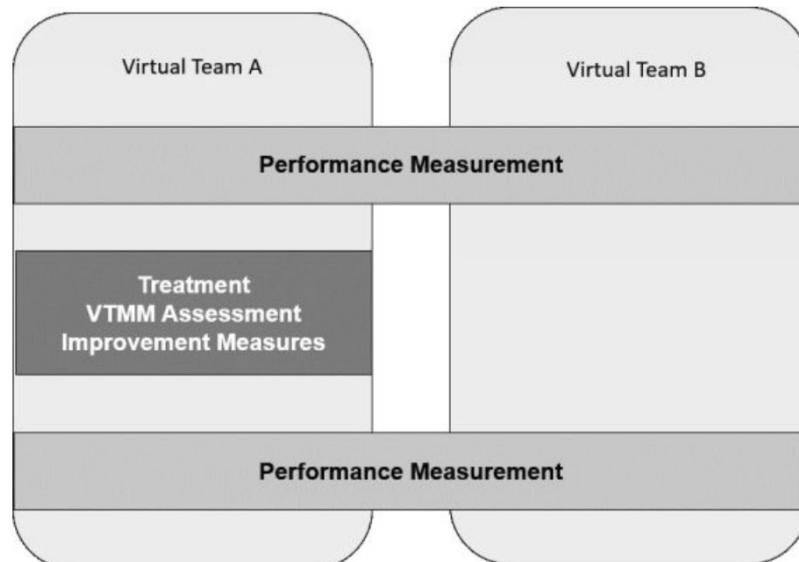


Figure 5: Control Group Experiment with VTMM® Treatment

According to St-Amant^[79], performance in virtual groups can be measured best through participants' self-assessments. Together with the two companies volunteering in this case study, a list of indicators had been developed, reflecting team performance over a defined past period. These indicators were required to allow reproducible estimates by team leaders or could be ascertained, based on daily business without consuming too much

time.

6.2 Procedure

For performance measurements before and after the treatment with VTMM®, a questionnaire with a mix of open-ended questions and multiple-choice questions on productivity, work progress, time estimates, meeting management, quality control and team motivation was presented to the team leaders of both teams. Answers were coded into numbers, reflecting comparative change between the first and the second measurement, to indicate a trend in performance development and to identify areas of unchanged performance and most striking results of improvement.

The first VTMM® self-assessment was planned and agreed with the team leader and the questionnaire was rolled out to all team members. After the results were presented, an improvement plan was agreed by the team and implemented by the team leader. According to the agreed schedule, a re-assessment was carried-out three months after implementing the improvement measures, checking the performance improvement made by the team.

6.3 Participants

The screenshot shows the Kindle Cloud Reader interface. At the top, there's a blue header bar with the Kindle logo and the text "Kindle Cloud Reader". Below it is a toolbar with icons for back, forward, search, and other functions. The main content area has a dark background with white text. On the left, there's a sidebar with a "Bibliothek" tab and several document icons. The main text area contains a paragraph about a case study company and its team members. At the bottom, there's a search bar with the word "Suchen" and a magnifying glass icon.

The case study's company offers products and services for complex IT projects and has a typical business unit structure. Within this company, two teams were selected for this longitudinal case study, while working virtually on real world projects. Both teams consisted of 8 team members, male and female, working together from three international locations. Most of the team members were between 36 and 50 years old.

6.4 Material

The questionnaire for the VTMM® assessment was circulated as an online link to provide individual access to the questionnaire and allow the participants to complete the questionnaires asynchronously, according to their personal schedule. The manifestations of KPIs for a process (see Table 1) were presented as multiple-choice questions and coded into numerical value to calculate the maturity level.

The indicators on **team performance** were collected by using a mix of open-ended and multiple-choice questions. Multiple choice answers were coded into numerical value, as followed:

Question: Where your meetings efficient / satisfactory within the last 30 days?

Answers: not at all (0); seldom (1); sometimes (2); often (3); always (4)

Open-ended questions were filled with values practical for the estimation

of team performance. It aimed to identify variation in performance between the first and the second measurement to detect a direction of change, not to isolate a quantitative value. According to the desirable outcome of reducing inefficiency or enhancing effectiveness, these values can be positive or negative numbers to indicate improvement (see Table 2).

Task	Before	After	Change	Comments
How many tasks were fulfilled by team members self-reliantly in time during the last 30 days?	12	14	2	Positive result. More tasks have been completed after the improvements.
How long did it take to clarify a task description not fully understood by team within last 30 days in h?	15	3	-12	Positive result. The time to resolve issues has been reduced significantly.
How long did it take to straighten out a misunderstanding between team members within the last 30 days in h?	3	1	-2	Positive result. The time to fix misunderstandings is reduced.

Table 2: Extract of presentation of performance measurement results



6.5 Results of the VTMM® Assessment

The results of the **initial assessment** (see Figure, dark colouring) show that the team had good results on the VTMM® processes “Organize Decision-Management”, “Perform Task Management” and “Define Information Management” (see Figure 6). The process “Give and receive Feedback”, “Give Rewards & Recognitions” and “Engage in Trust building” were less present on the team. There also was a strong and diverse understanding within the processes of “Agree Rules” and “Set Goals” on their presence within the team.

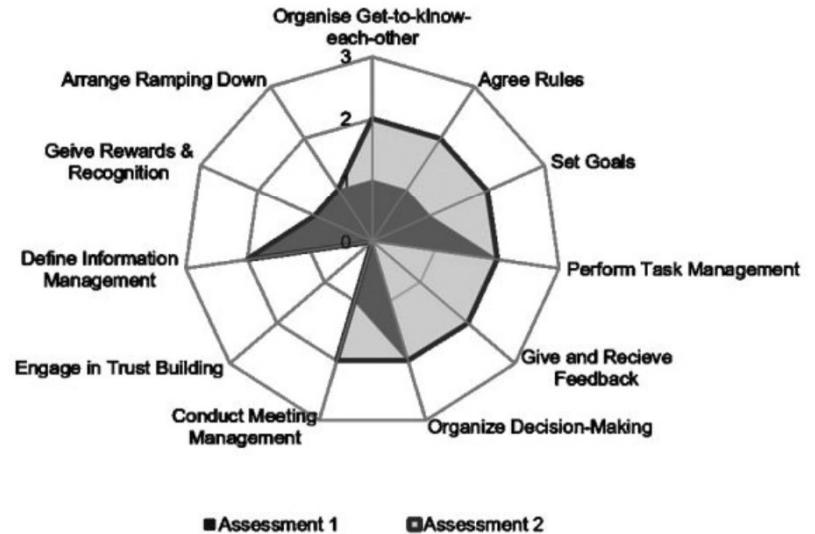


Figure 6: Results of the 1st and 2nd VTMM® Assessment

An **improvement plan** was developed following the results of the initial assessment, which was presented to the team along with recommendations of improvement activities for each process. They were deducted directly from the methods of the VTMM®, that had not been fully implemented yet. It focussed on the three least developed processes to stimulate improvement:

The screenshot shows a Kindle Cloud Reader window with a blue header bar. The title bar says "Kindle Cloud Reader". The address bar shows "Sicher | https://lesen.amazon.de". The main content area displays a list of measures under the heading "Bibliothek". The list includes:

- to establish a virtual feedback procedure, with feedback meetings, feedback polls and feedback surveys (Process of "Give & Receive Feedback")
- to engage in some virtual Socialising, use profiles, interactive virtual media and virtual Smalltalk activities (Process of "Engage in Trust Building")
- to implement a system of Reward & Recognition, specifically designed to match your virtual team (Process of "Give Rewards & Recognition")

Below this list, there is a paragraph of text. At the bottom of the page, there are navigation arrows and a progress bar.

- to establish a virtual feedback procedure, with feedback meetings, feedback polls and feedback surveys (Process of "Give & Receive Feedback")
- to engage in some virtual Socialising, use profiles, interactive virtual media and virtual Smalltalk activities (Process of "Engage in Trust Building")
- to implement a system of Reward & Recognition, specifically designed to match your virtual team (Process of "Give Rewards & Recognition")

After a team discussion, the team decided that the VTMM® processes "Engage in Trust-Building" and "Arrange Ramping-Down" were not classified as relevant and contributing factors for the team performance and they wanted to focus on other processes for improvement initiatives. As the team members have worked for several years together and there was no change planned, this was a valid approach for this self-assessment is based on the steady environment that the team operates in.

The team decided upon a set of four concrete measures for adjustment:

- deployment of a designated application for virtual meetings, allowing more interaction during presentations
- feedback polls at the end of every virtual team meeting
- publishing of profiles of all team member on internal project platform
- annual survey on teamwork for all team members

These measures had been recommended in the assessment report for the

processes of "Give and Receive Feedback", "Conduct Meeting Management" and "Organise Get-to-know-each-other". The recommendations for improvement were welcomed by the team because they could be implemented without consuming too much resources and time.

The **follow-up assessment** was conducted, after the team had worked for three months with the improved processes. It showed enhanced team maturity in five of the eleven processes (see Figure 3, light colouring) and resulted in a higher overall team maturity (advanced team maturity instead of basic team maturity).

When **interpreting the results**, it showed that the improvement measures had had direct impact on the results of the follow-up assessment for the processes of "Give & Receive Feedback" and "Conduct Meeting Management", where the choice of the KPIs reflected the team's knowledge and acceptance of the process. For the processes of "Agree Rules" and "Set Goals", no new measures were implemented, but the existing measure were communicated more thoroughly. Interestingly, the newly introduced measures could be implemented without additional expenses, as the installed application for virtual communication already included these features. It improved the quality and efficiency of virtual meetings, as several indicators of the performance measurement confirmed. The usage of a common collaboration tool also increased the possibilities of virtual communication and participation, as the used tool allowed more interaction of all team members during presentations. The results were clearly visible in the follow-up assessment with much less variance among the answers, revealing a broad

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understanding of the process among the team^[80].

6.6 Results of the Performance Measurement

The results of the case study show how the improvement of the processes “Give & Receive Feedback”, “Conduct Meeting Management” and “Organise Get-to-know-each-other” have resulted in better working atmosphere, leading to higher satisfaction and motivation and less potential for conflicts^[81]. This advanced team maturity was also represented by the results of the performance measurements taken before and after the treatment with VTMM®.

Key Result Indicator	Before	After	Change	Comments
How long did it take to clarify a task description not fully understood by team within last 30 days in h?	15	3	-12	Positive result. The time to resolve issues has been reduced significantly.
How long did it take to straighten out a misunderstanding between team members within the last 30 days in h?	3	1	-2	Positive result. The time to fix misunderstandings is reduced
Were your meetings efficient / satisfactorily within the last 30 days?	seldom	always	3	Positive result. The meeting culture changed significantly within the team.
Number of regular / schedules meetings within the last 30 days?	10	5	-5	Positive results. The total number of meetings has been reduced.
Number of ad hoc meetings within the last 30 days?	2	5	3	Negative result. The number of unscheduled meetings increased. In total the overall number of meetings has been reduced.

Table 3: Most striking results of the performance measurement

The results of the performance measurement (see Table 3) show that the general focus of assessing the team performance by the likelihood of meeting deadlines can be too vague to reflect the whole situation and fails to reveal underlying potential of conflict. A full assessment, which covers all possible

The screenshot shows the Kindle Cloud Reader application window. At the top, there's a blue header bar with the Kindle logo and the text "Kindle Cloud Reader". Below it is a toolbar with icons for back, forward, search, and other functions. The main content area displays a page from a document. The page has a dark background with white text. At the top left of the page content, there's a "Bibliothek" button. The main text on the page discusses aspects influencing teamwork, mentioning performance measurement and its impact on time and resources. To the right of the main text, there's a summary or conclusion. At the bottom of the page, there are navigation arrows and a progress bar indicating "68 % · Position 584 von 859".

aspects influencing teamwork, exposes not only potential conflicts but also potential to save time and resources. In the case study, the likelihood of meeting the deadline remained the same in both the initial and follow-up measurement of performance^[82]. Other indicators of the performance measurement revealed that a considerable amount of time and resources could be saved after the assessment and implementation of improvement measures, by less repetition of instructions, conflict resolution and more efficient and satisfactory meetings.

6.7 Conclusion

The case study confirmed the important approach of VTMM® to have all team members participate in a VTMM® assessment, obtaining information on the individual perception of the teamwork and the team procedures. The case study exposed a divergence in the perception of existing measures for some processes^[83]. With little effort, the procedures and information were communicated more thoroughly and the team reached a higher maturity and performance.

As revealed in the Delphi Study of 2015, the most common obstacles for virtual team development activities were lack of formal processes, leadership, personal and communication skills, along with lack of time to consider all those elements. The case study confirmed VTMM® to address these obstacles by offering formal processes and providing an assessment, that can be

conducted without relying on personal and leadership effort. The case study also emphasized the team's willingness to implement the recommended measures for improvement because they did not consume too much time and resources.

Altogether, this case study confirms the potential of VTMM® to improve virtual team maturity, as it detects team inherent structures of possible conflict or ineffectiveness. At the same time, it indicates increasing virtual team performance in saving time and resources as a direct outcome of the VTMM® treatment.

The screenshot shows the Kindle Cloud Reader application window. The title bar reads "Kindle Cloud Reader". The address bar says "Sicher | https://lesen.amazon.de". The toolbar includes icons for back, forward, search, and other reading options. The main content area displays a section titled "Summary" with the following text:

7 Summary

The VTMM® tool sets about enhancing the efficiency of virtual teams by assessing and improving performance across 11 different dimensions. The objective of the case study was to validate the VTMM® assessment processes within a real virtual team.

The results of the case study showed the impact, which a virtual team assessment and the introduction of improvement measures had on virtual team performance. Though the team had spent some time working together and had its operational business processes up to an advanced standard, the assessment pointed out areas of teamwork that had been neglected. Those were the “softer” processes, less likely to show an immediate measurable result, but also highly interconnected with the performance of the team in all other areas.

The case study’s team agreed on improvement measures in the processes of “Organize Get-to-know-each-other”, “Give and Receive Feedback” and “Conduct Meeting Management”. Together with the participatory process of a VTMM® assessment and a thorough communication of existing rules and measures, the whole VTMM® treatment effected more than the three intended processes and resulted in reaching a higher maturity level within the team in five of the eleven processes, according to VTMM®. Additionally,

performance measurements confirmed a more efficient teamwork with a better team culture and less potential of conflict.

The case study confirmed the importance of an overall model to assess virtual team maturity, as perception of team leaders and team members on maturity and performance differ and need to be assessed in participation of all team members.

It also proved that VTMM® has a huge impact on virtual team performance without consuming too much time and resources, as feared by about half of the contestants of the Delphi survey. Those had revealed that the main reasons for not implementing acknowledged processes were lack of time and general lack of formal process and personal and communication skills. The case study’s example showed that these obstacles were overcome by using simple, efficient measures. Virtual team maturity assessments and performance measurements confirmed the improvement, which was gained by the chosen measures. The VTMM® not only provides a procedure to identify key elements of virtual team performance, but also delivers cost-efficient applicable solutions to enhance them.

The results show a positive trend in virtual team maturity and confirm that the assessment principles of VTMM® and the KPI’s are applicable to industry-based virtual teams.

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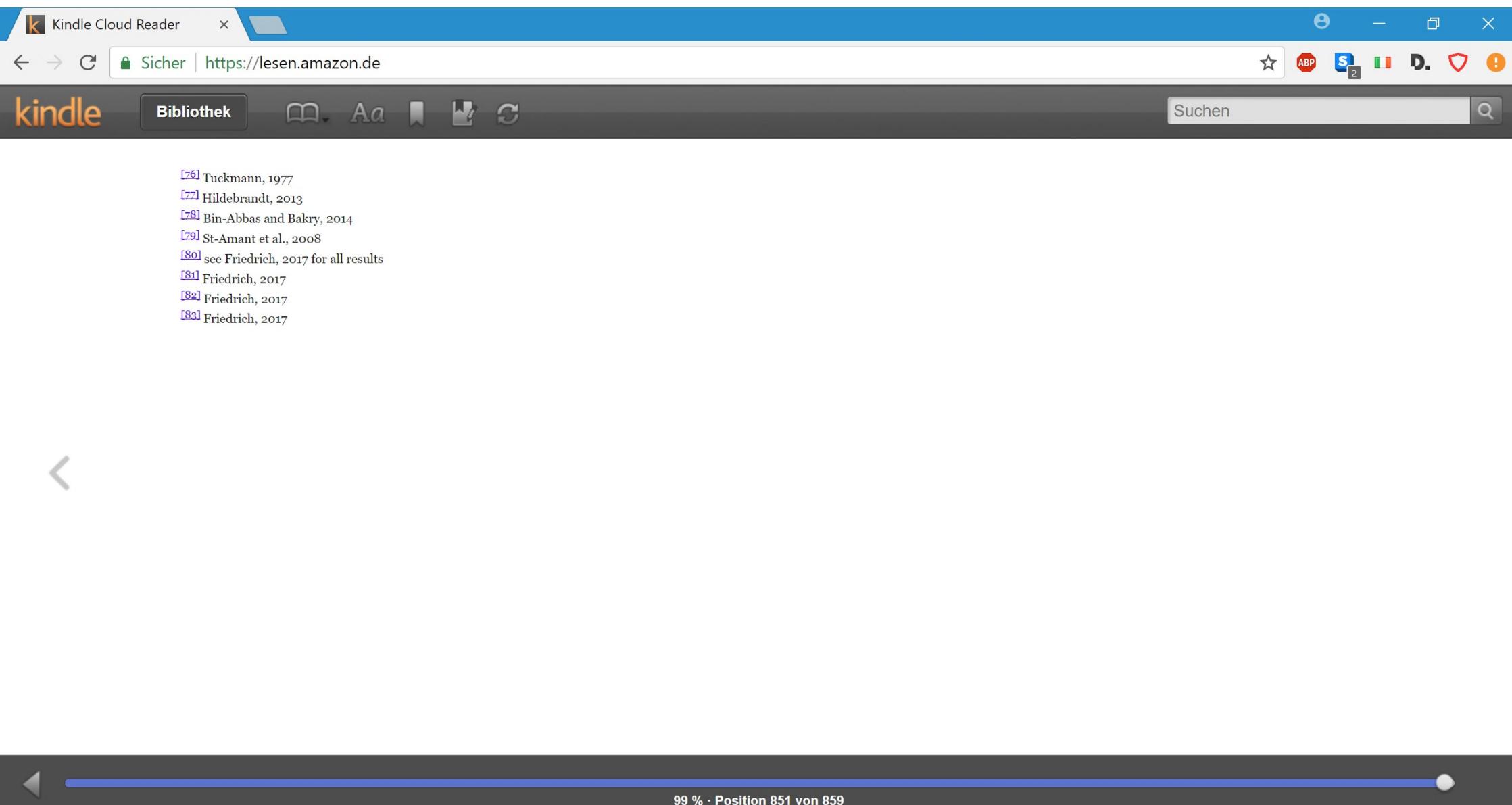
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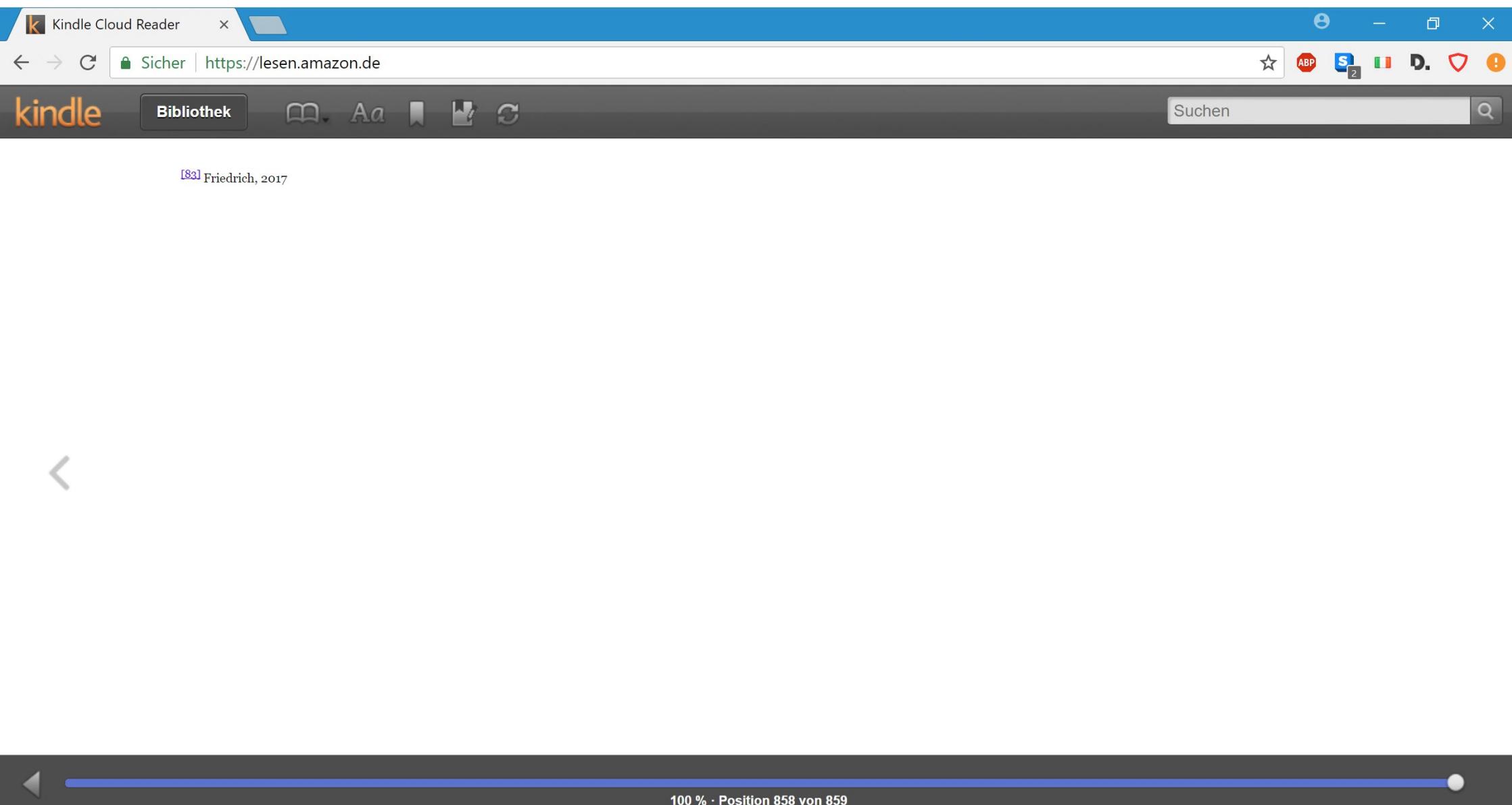
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