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Robotic Process Automation (RPA) – Study on Characteristics of Successful RPA Implementations

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Background & Objectives

Since 2015/2016 Robotic Process Automation (RPA), also called Robotics, has become an increasingly adopted automation and digitalization technology for back office processes in companies. While surveys and case studies on RPA have been conducted in the recent years, there is only limited empirical research focusing on the **characteristics of successful RPA implementations**. Additionally, more independent, scientific research seems desirable.

The present scientific study contributes to close this gap. It is based on **101 responses from companies** that have **adopted RPA**, coming from various industries, mostly located in Germany and the rest of Europe.

Methodology

A questionnaire covering important dimensions for RPA implementations was designed and also pre-tested with 5 professionals that have a broad experience in the field of RPA.

For the present report the results were mainly evaluated with descriptive statistics. Relationships and differences were analyzed with well-known statistical methods. The data and results presented will further be analyzed for scientific purposes.

Key Results

The majority of respondents (**>60%**) have been using **RPA since 2018** and after reflecting the newness of the technology. Regarding scaling of RPA, the study shows that companies have either **1-5 software robots or more than 20** in place. The results further indicate that companies, which have been using RPA longer, have more robots in place. This indicates that they have scaled RPA.

Today, the RPA market still seems fragmented with a wide range of vendors slowly consolidating. Regarding vendors and their platforms, the results show that the majority of companies use only **one single RPA platform (79%)**. These results hold true irrespective of the year the company introduced RPA.

More than **60%** of the respondents connect RPA with other digitalization technologies towards **intelligence process automation** making robots smarter. With respect to the specific digitalization technologies used together with RPA, the study indicates that **Optical Character Recognition**

(**OCR**) dominates, followed by Machine Learning/Artificial Intelligence and Process Mining.

Although the functional application of RPA ranges from Finance, over HR to Sales & Marketing, the results show that **Finance & Accounting** are **key functions** for the use of RPA. Taking a look inside the processes of Finance & Accounting, the study finds that **Accounts Payable, Accounts Receivable** and **Management Reporting** are central processes for which RPA is implemented. Within these processes, robots perform mostly basic (transactional) tasks such as **data entry** or **data transfer**.

The look at the types of RPA reveals that, overall, **unattended RPA** seems **more prevalent than attended RPA**. However, a main driver seems to be the **complexity level** of the underlying process. An increasing complexity level drives the use of unattended RPA, i.e. the higher the process complexity level, the higher the use of unattended RPA.

Key Results (cont.)

Nearly **70%** of the participating companies make **use of external consultants** for their RPA implementation. Here, most companies view their consultants as highly qualified.

Each implementation of RPA requires the specification of a number of dimensions like governance, testing, communication, change management or process preparation (see section 3). Naturally, within a dimension certain characteristics are regarded more important than others. However, **without taking the success rating of the respondents' RPA implementations into account**, the study finds **no statistically significant differences** between the **average ratings of the dimension**.¹

For a more detailed analysis of the dimensions and characteristics of RPA implementations the success rating of each RPA implementation was computed. Therefore, the 101 responses were split into 2 groups regarding the success rating of their RPA implementation. The success rating for

the RPA implementation was self-reported by the study's participants. When **taking the success rating of the RPA implementations into account**, the analysis reveals that **RPA implementations with high success ratings** show significantly higher levels of

- adequate **RPA trainings** that accompany the RPA implementation.
- **thorough process preparation** (e.g. optimize and standardize processes) before the robots are developed.
- using a **specifically dedicated, central RPA unit** (e.g. Center of Excellence) for development, operating and maintenance of robots.
- detailed and broad **RPA governance** (e.g. access rights for robots).
- monitoring **performance** (e.g. monitor number of robots running) of software robots and the RPA team.

1) Therefore, a Friedman-Test was conducted between the averages of the item batteries used in (19) RPA Training, (20) Preparation of Business Processes, (21) Top Management Support, (22) Project Management, (24) RPA Governance, (25) Communication, (26) Change Management, (27) Testing, (28) IT-Support and (29) Performance Monitoring. This resulted in no statistically significant differences between the dimensions. For the Friedman-Test see for example Sprinthall RC, 2011, *Basic Statistical Analysis*, 9th Edition, Pearson.

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Sample Description

The present section describes the sample of the study in more detail. This covers general descriptions of the companies included in the sample as well as basic aspects of their RPA implementations.

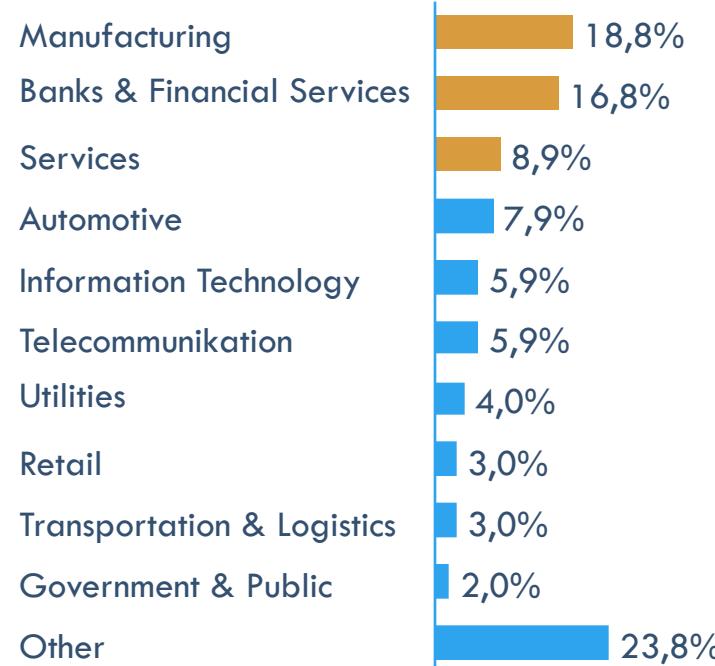
As shown in figure 1, most participants are from the **industries** manufacturing, banks & financial services, and general services. Regarding the country of origin, participants are mostly (**67,3%**) located in **Germany** (fig. 2). Classifications of size of the participating companies reveal that more than **50%** of the respondents are from **larger companies** with more than 500m€ in revenues and have more than 5,000 employees (figs. 3, 4).

Finally, the study looked at the functional area of which the participants are part (fig. 5). Results show that around **40%** of the respondents are part of a **dedicated RPA function**, while the remainder mainly comes from Finance & Accounting (19%) or the IT (18%).

In sum, the description of the sample shows that respondents mainly come from large companies within Germany with a certain industry concentration. This of course, limits the unlimited transfer of results to other settings (e.g. countries, small organizations) and requires further research.

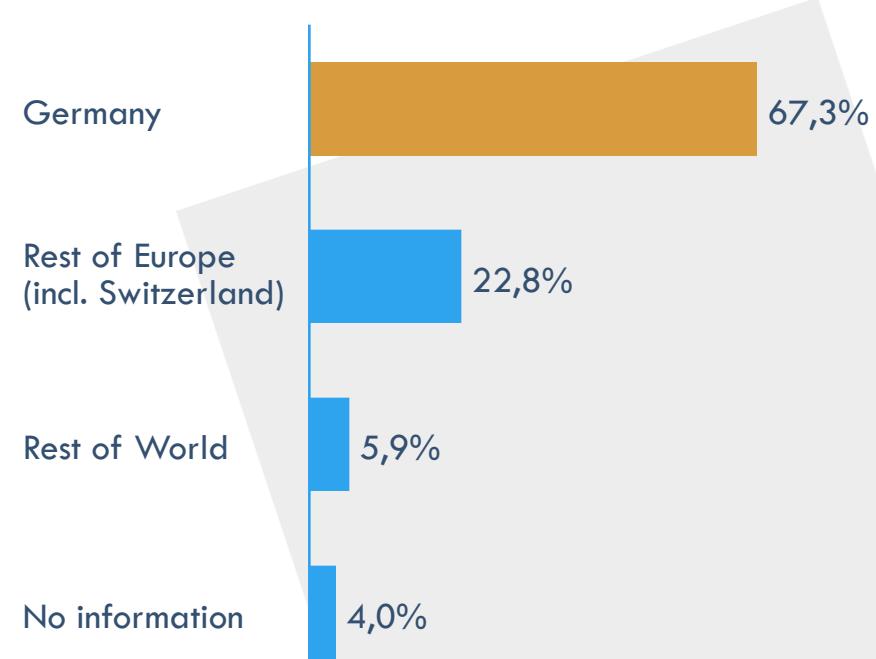
Most participants of the study are located in Germany with a slight industry focus on manufacturing, banks & financial services, and general services.

(1) In which industry is your company primarily active?



N=101

(2) In which country are you located?

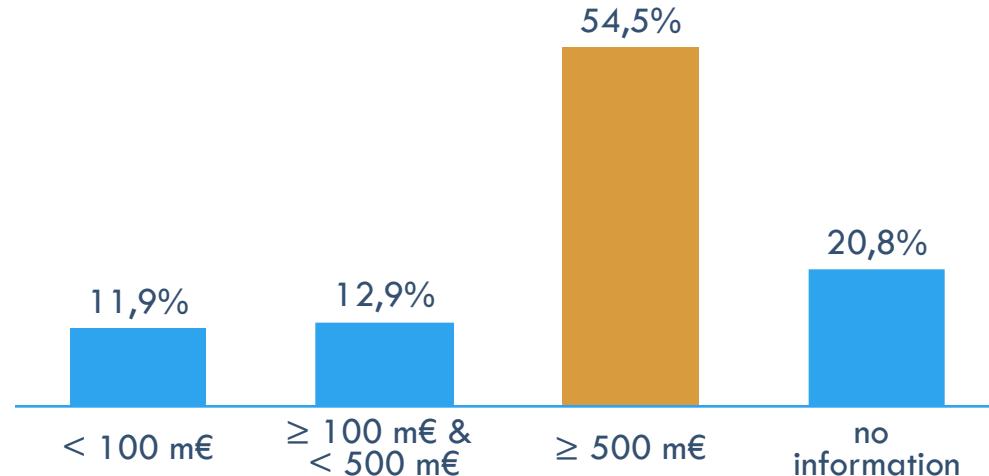


N=101

Company Size

More than 50% of the respondents are from larger companies with more than 500m€ in revenues and more than 5,000 employees.

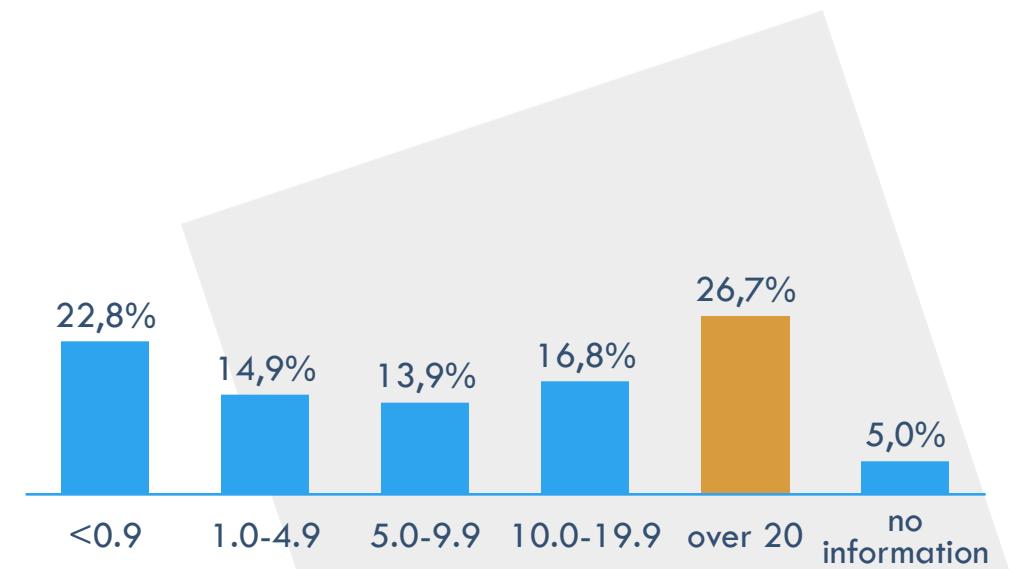
(3) What was your company's revenue of the fiscal year 2019?



N=101

(4) How many employees did your company have in 2019?

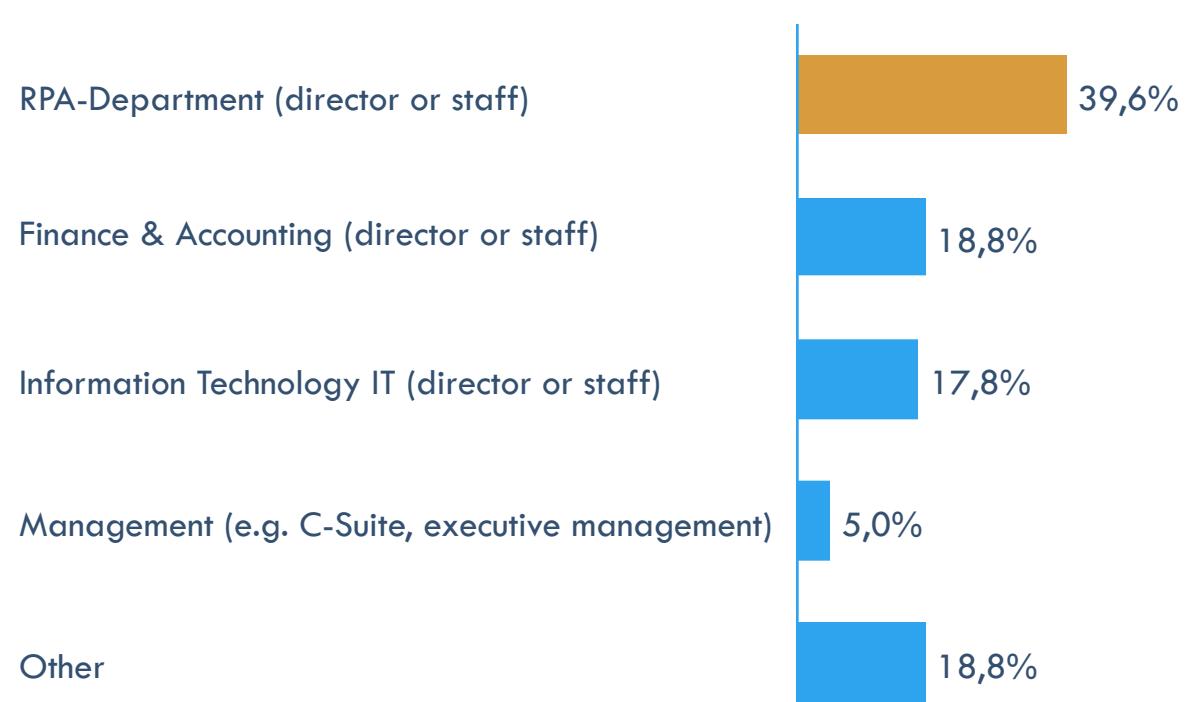
in thousands



N=101

Around 40% of the respondents are part of a dedicated RPA function, while the remainder mainly comes from Finance & Accounting (19%) or the IT (18%).

(5) In which functional area are you active in your company?



N=101

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Analysis of RPA Implementation Characteristics

The present section describes the RPA implementations of the participating companies in detail. The details presented cover a wide number of dimensions relevant for the implementation of RPA. All analyses shown are based on the full sample, if not stated otherwise.

Concerning experience with RPA, the majority of respondents (**>60%**) has been using **RPA since 2018** and after (fig. 7). Experience and scale can also be reflected in the number of robots in place. The data shows that most respondents either have **1-5 software robots** in place or **more than 20** (fig. 6). A more detailed analysis indicates, however, that companies, who have been using RPA longer, have more robots in place (fig. 8). This might reflect a form of **economies of scale** in RPA implementations.

For organizations implementing RPA, the question of single or multiple vendor strategy arises. The study shows that the majority of respondents have **only one platform** (80%) in place (fig. 9). This holds true irrespective of the year the company introduced RPA.

Through the combination of RPA with other innovative digitalization technologies, software robots become smarter and turn into what is labelled Smart or Intelligent Process Automation. More than **60%** of the respondents in the sample **connect RPA with other innovative digitalization technologies**, i.e. make use of Intelligence Process Automation (fig. 10). Within these technologies **Optical Character Recognition (OCR)** clearly dominates, followed by Machine Learning /Artificial Intelligence (fig. 11).

RPA is applied in a wide range of functions in organizations, from Finance, over HR to Sales & Marketing. However, the study finds that **Finance & Accounting is a key function** for the use of RPA (fig. 12). Yet, within Finance & Accounting, the application of RPA focuses on certain processes. According to the respondents, the three **central processes** for the use of RPA in Finance & Accounting are **Accounts Payable, Accounts Receivable and Management Reporting** (fig. 13).

Looking at the specific activities performed by software robots, the study shows that robots **mostly perform basic tasks** such as **data entry** (96%), **data transfer** (92%) or **log-ins** (88%) (fig. 14).

Software robots carrying out such activities may come from two types of RPA: unattended and attended RPA.¹ Overall, the results indicate that **unattended is more prevalent** than attended RPA (fig. 15).

The underlying processes, for which software robots are used, show an **average complexity level** (fig. 16). However, the data shows a positive relationship between process complexity and the use of unattended RPA. An increasing **complexity level leads to a more intensive use of unattended RPA** (figs. 17, 18).

In a next step, the study looked at various dimensions which are typically seen as **important for the implementation** of RPA. Without taking the success ratings of respondents' RPA implementation into account, the data shows the following results:

- Concerning **RPA training**, respondents most strongly agree that RPA training substantially improves users' understanding (fig. 19).
- Regarding **process preparation** in advance of any robot development, the full documentation of processes on click-level was seen most important by the respondents (fig. 20).
- Top **management supports** the adoption and use of RPA, according to the majority of respondents (fig. 21).
- For **project management**, a formal RPA project team and regular status meetings reach highest agreements among respondents (fig. 22).
- RPA **operating models** represent organizational models for development, operations and maintenance of software robots. Possible models are central, decentral or hybrid. Respondents most strongly agree that RPA operations and maintenance are carried out in a central, separate and dedicated unit (fig. 23).

1) Hybrid (between unattended and attended) forms of RPA were not included in the study.

- A dedicated **RPA governance** defines standards, rights, roles and responsibilities regarding the use of software robots. Within the RPA governance, the study's participants regard the definition of access rights for robots most important (fig. 24).
- Most of the respondents in the study agree or strongly agree that **initial and ongoing communication** for RPA implementations has taken place (fig. 25), while **change management** measures reach slightly less agreement (fig. 26).
- Respondents most strongly agree that they conducted **extensive testing** of the software robots before go-live (fig. 27). Similarly, there was a strong **alignment with the IT** (fig. 28).
- To **monitor performance** most respondents agree or strongly agree that they track the number of software robots currently running (fig. 29).

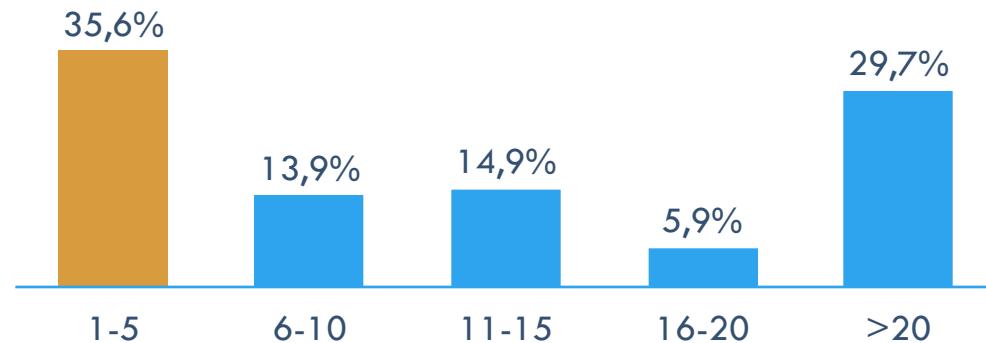
As support for RPA implementations, organizations may make use of external consultants. The data shows that **nearly 70% of the respondents make use of external consultants** for their RPA implementation (figs. 30, 31).

Finally, regarding formal project success and performance impact, respondents most strongly agree that **RPA led to highly satisfied RPA users and improved productivity & process quality** (figs. 32, 33).

Experience and Scale (1/2)

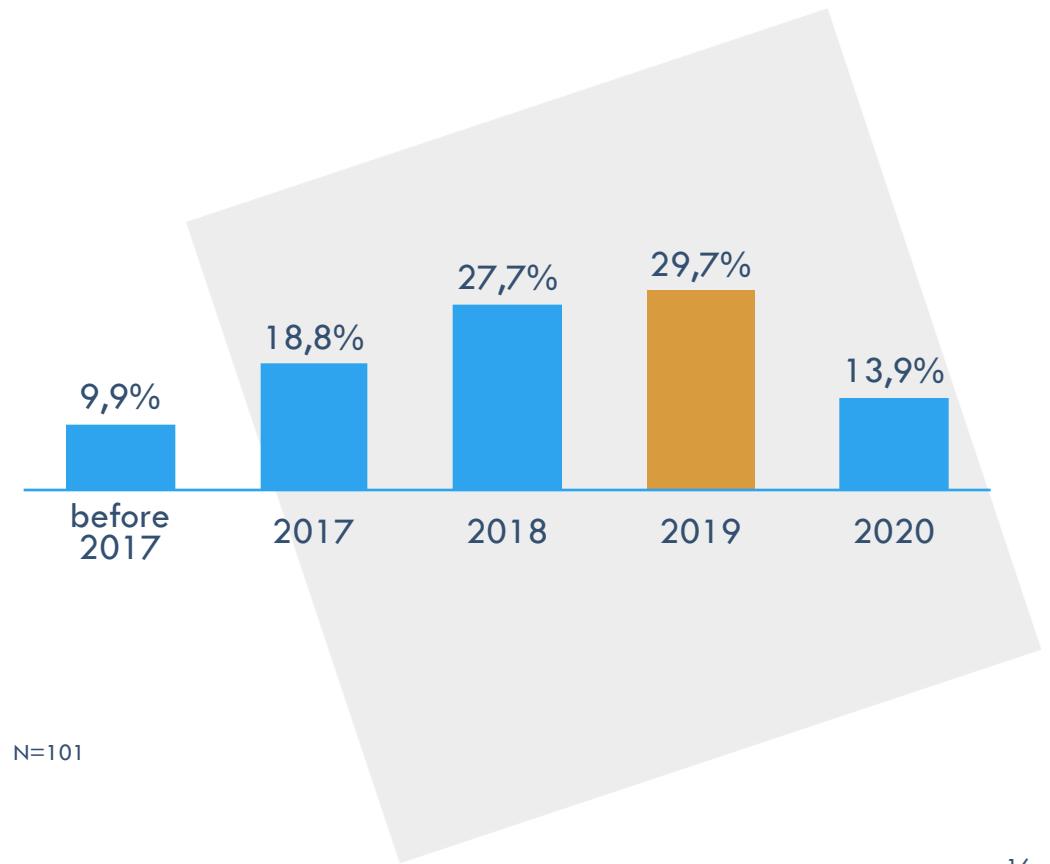
The majority of respondents (>60%) has been using RPA since 2018 and after. Regarding scaling, most of the respondents either have only 1-5 software robots in place or more than 20.

(6) How many software robots are currently running in your organization?



N=101

(7) How long have you been using RPA in your organization?



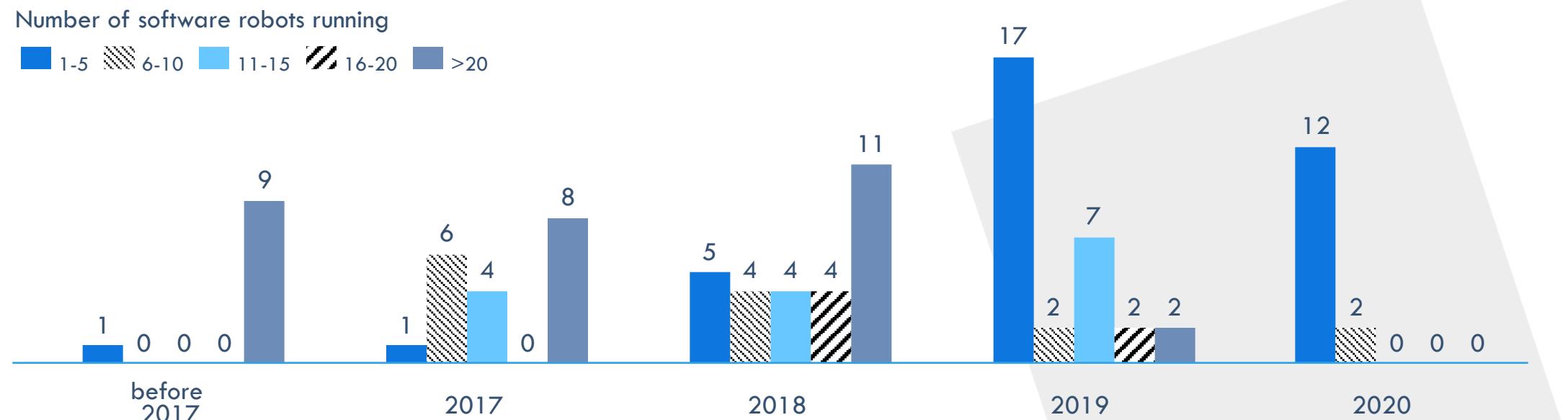
N=101

Experience and Scale (2/2)

The number of software robots currently running in organizations tends to increase with the length of time that organizations use RPA. This reflects the scaling of RPA.

(8) Relationship between number of software robots currently running and how long the participating organizations have been using RPA:

in #

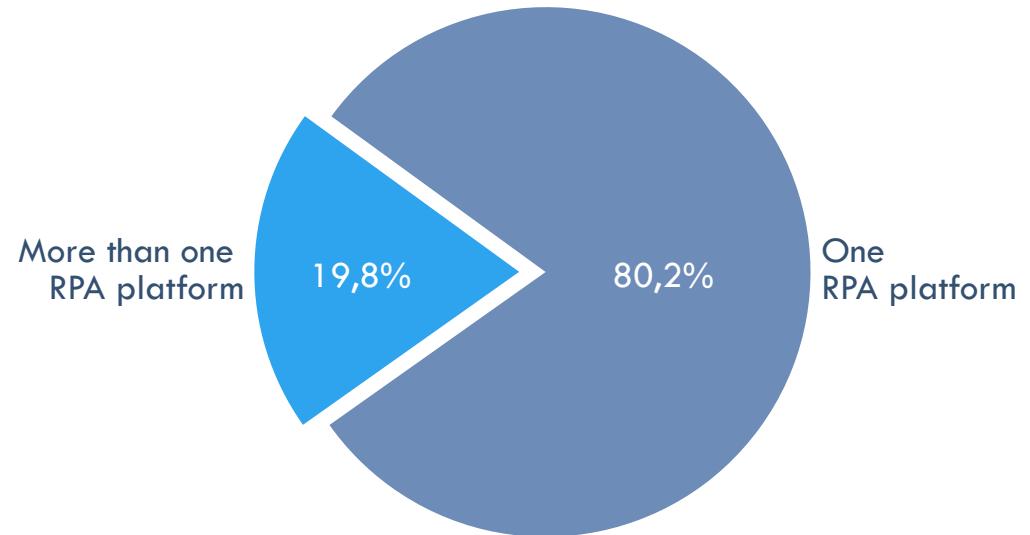


N=101

Single vs Multiple RPA Platforms

The majority of the respondents in the sample have only one single RPA platform (80%) in place.

(9) Percentage of participating companies which have more than one RPA platform in place:

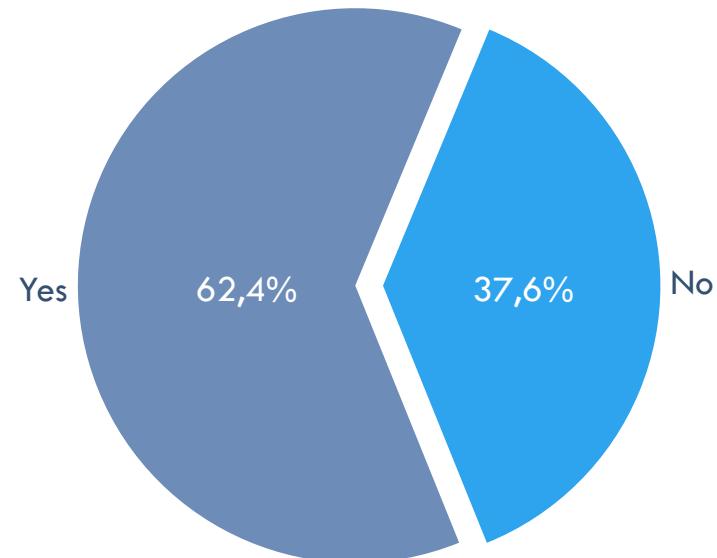


N=101



More than 60% of the respondents connect RPA with other digitalization technologies making robots smarter. Within these technologies Optical Character Recognition (OCR) dominates.

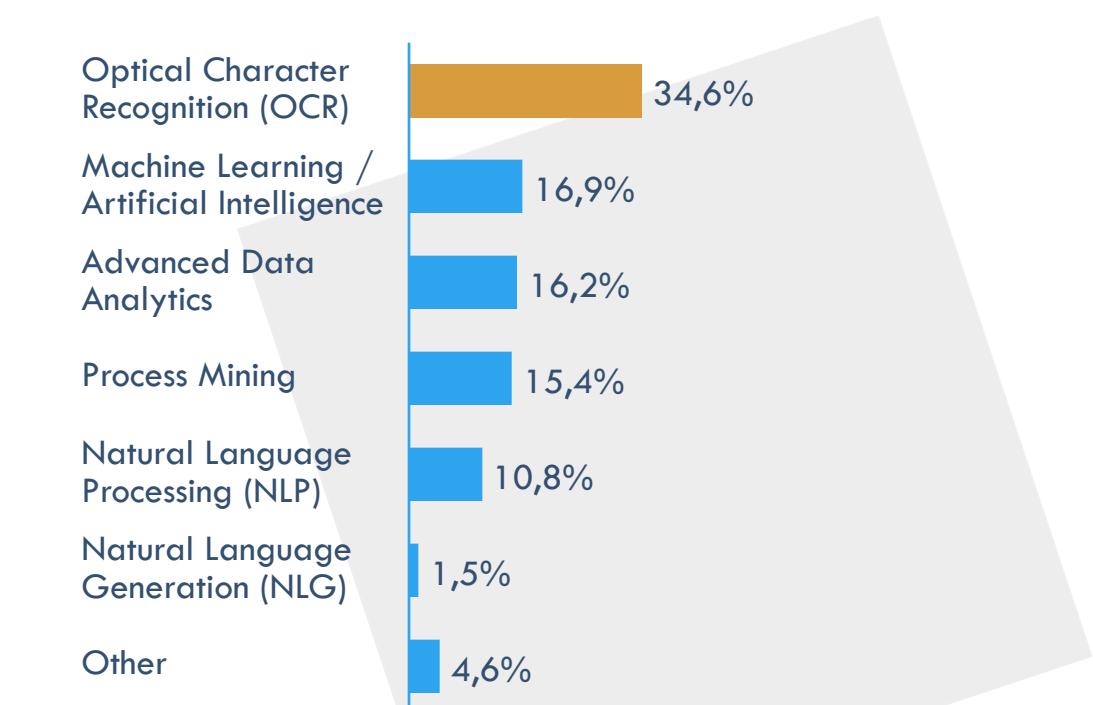
(10) Are you connecting RPA together with other digitalization technologies?



N=101

(11) Concerning RPA & other digitalization technologies, our software robots are connected with...

multiple answers possible



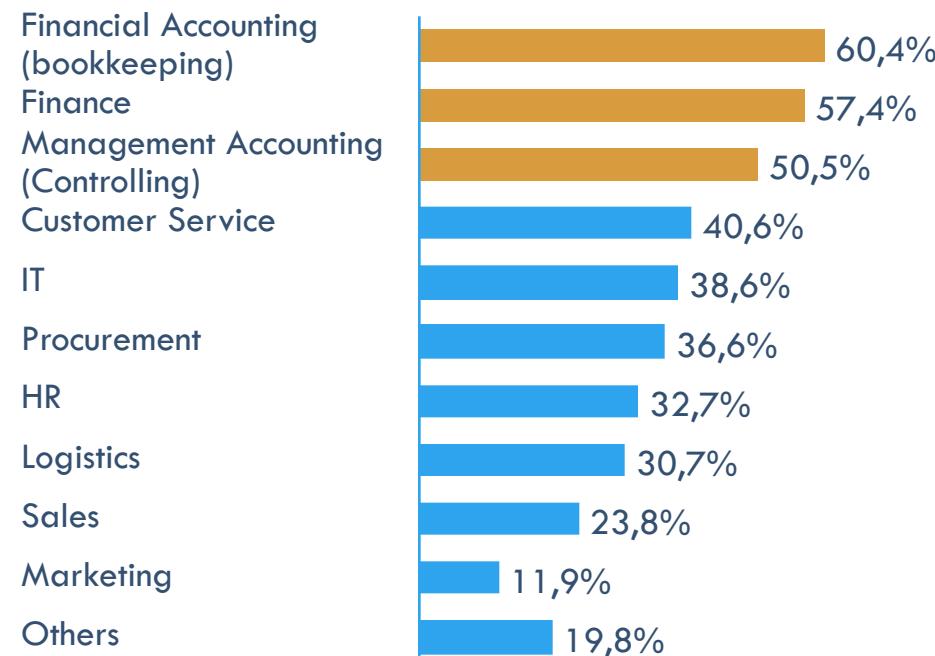
N=63

Functional Application

Finance & Accounting is key within organizations for which RPA is used. Within Finance & Accounting central process, for which RPA is used, are Accounts Payable, Accounts Receivable, and Management Reporting.

(12) In which of your organization's functions are software robots currently in place?

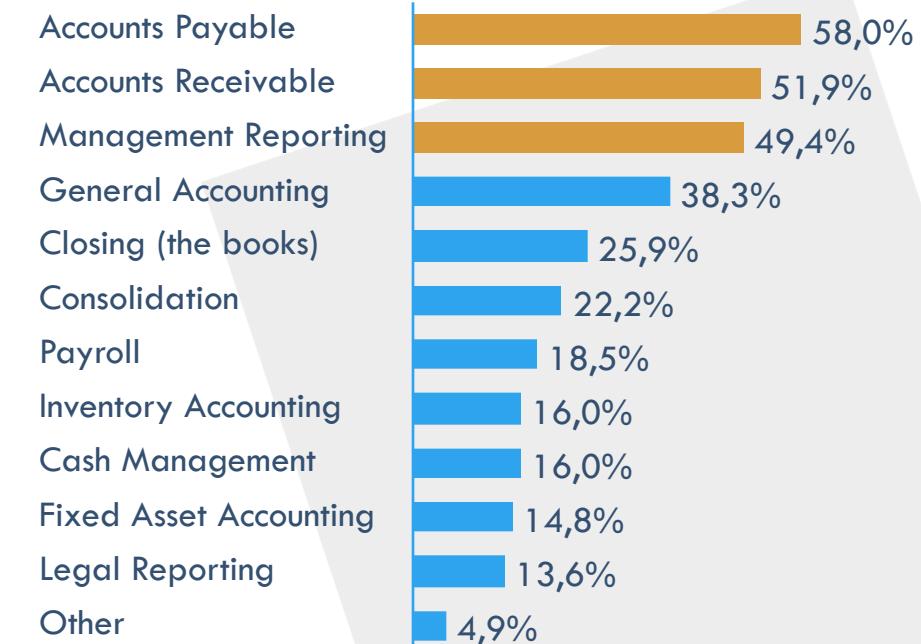
multiple answers possible



N=101

(13) Software robots are supporting in the following Finance & Accounting processes...

multiple answers possible



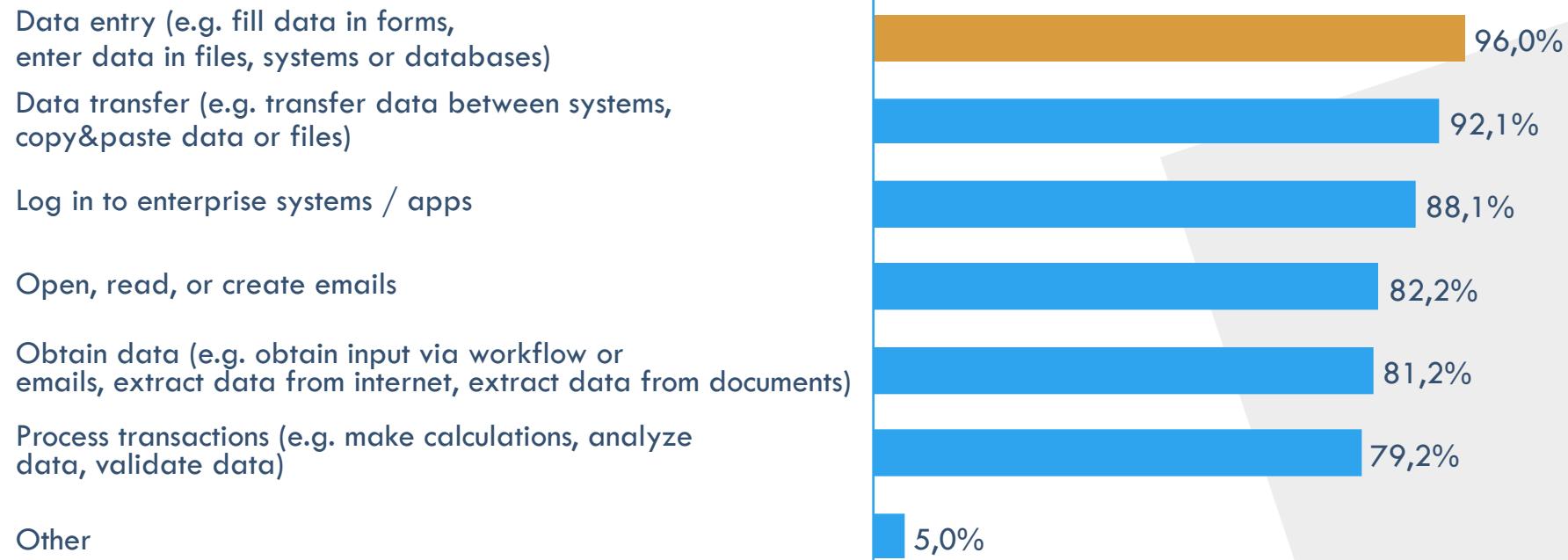
N=81

Activities performed by Software Robots

Software robots are mostly used for basic (transactional) activities such as data entry (96%), data transfer (92%) or log-ins (88%).

(14) Our software robots perform the following tasks:

multiple answers possible

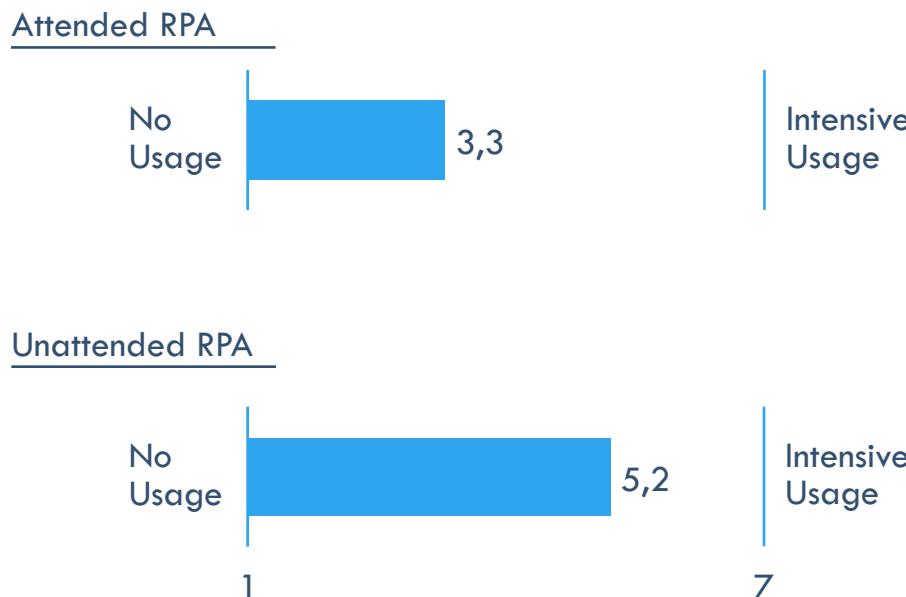


N=101

RPA Types and Processes Complexity (1/2)

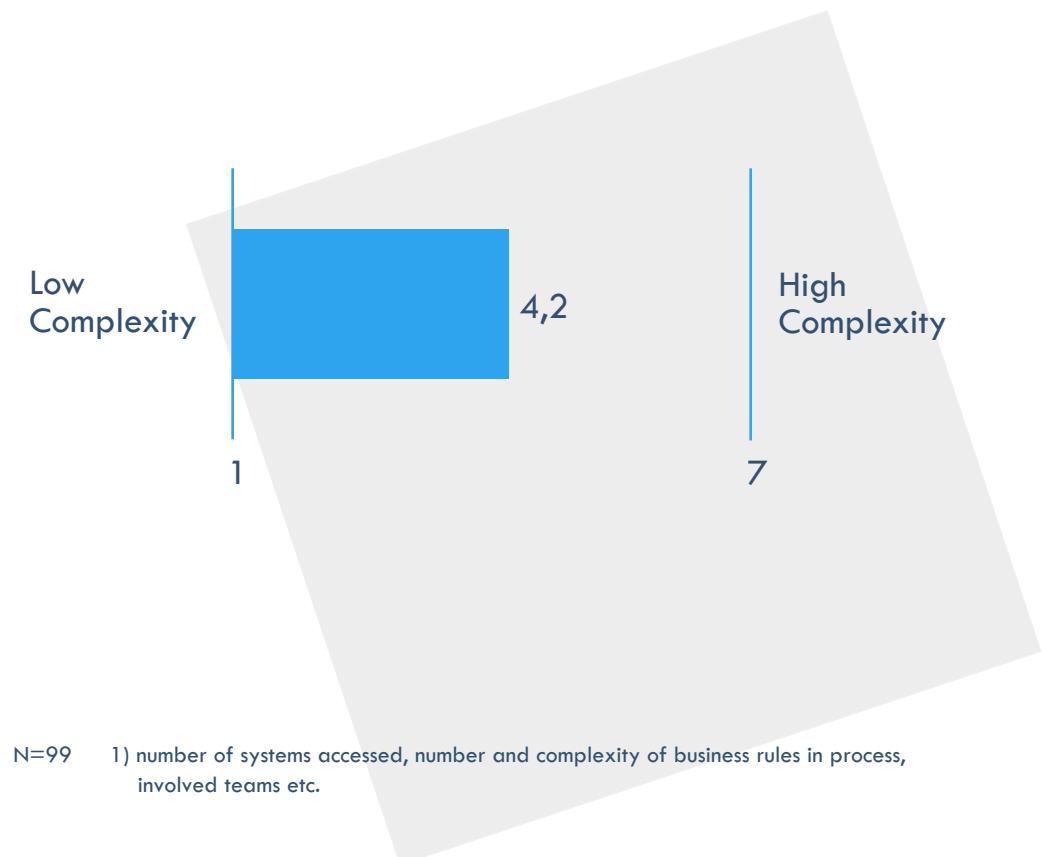
Unattended RPA is more prevalent than attended RPA, while the underlying processes of software robots show an average complexity level.

(15) Which types of RPA are you using in your organization?



N=101

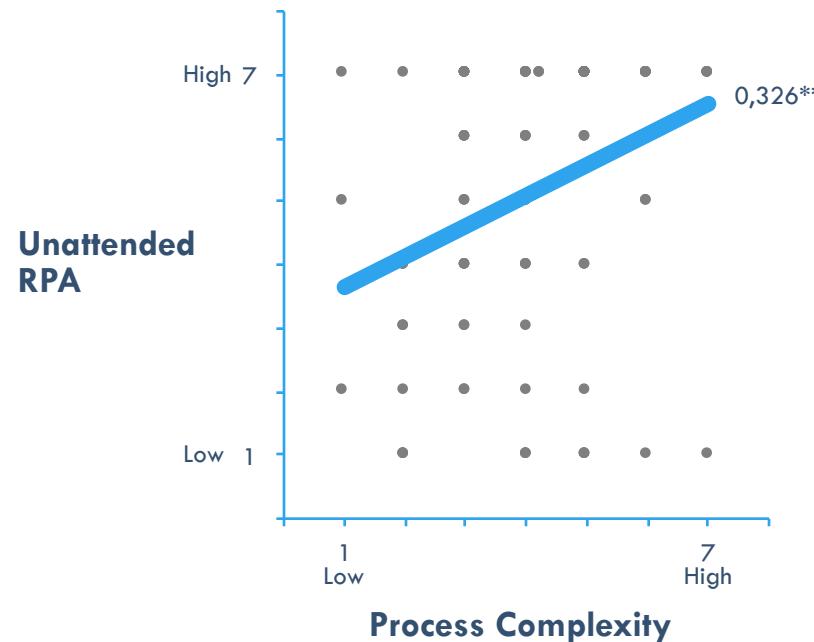
(16) How would you evaluate the process complexity¹ in the processes supported by software robots?



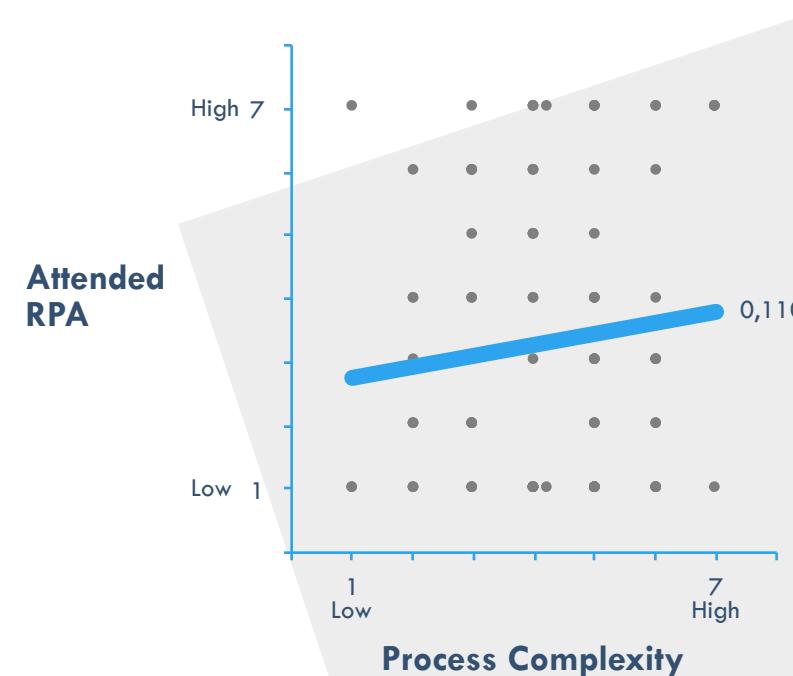
RPA Types and Processes Complexity (2/2)

There is a significant positive relationship between the complexity of underlying processes and the use of unattended RPA.

(17) Relationship between unattended RPA and the complexity of supported processes:¹



(18) Relationship between attended RPA and the complexity of supported processes:¹



N=101 1) The diagrams show a scatter plot. Coefficients 0,326 and 0,110 represent Pearson's correlation coefficient. Results were additionally backed up with nonparametric correlation coefficients (Spearman, Kendall). For correlation coefficients see for example Sprinthall RC, 2011, *Basic Statistical Analysis*, 9th Edition, Pearson.

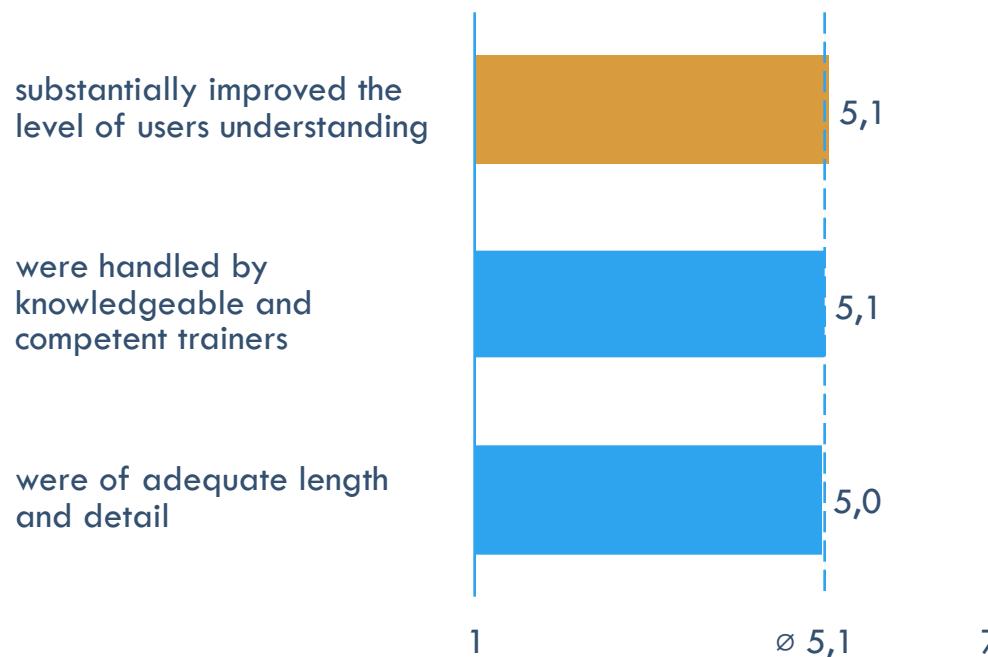
** Stat. significant (based on Pearson's, Spearman's and Kendall's correlation coefficients, p-value ≤ 0,05)

RPA Training and Business Processes Preparation

Respondents most strongly agree that RPA training substantially improves users' understanding. Further, in preparation for development fully documented business processes reach highest agreement.

(19) As part of our RPA implementation trainings & workshops on RPA...

1 = Strongly Disagree | 7 = Strongly Agree



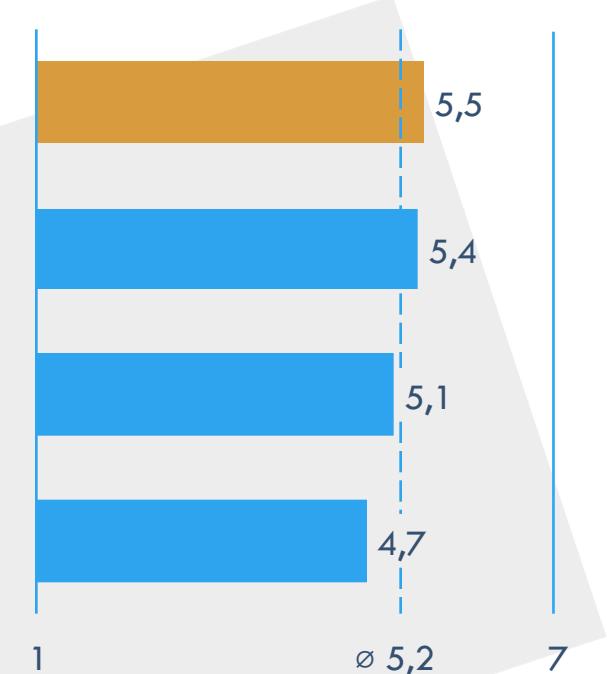
N=100

(20) Before software robots were developed for the selected business processes in our RPA implementation, we...

1 = Strongly Disagree | 7 = Strongly Agree

- fully documented the business processes (on a click-level)
- thoroughly screened and selected the business processes most suitable
- thoroughly compared (automation) technologies and decided to use RPA
- first optimized and standardized the selected business processes

N=99-101

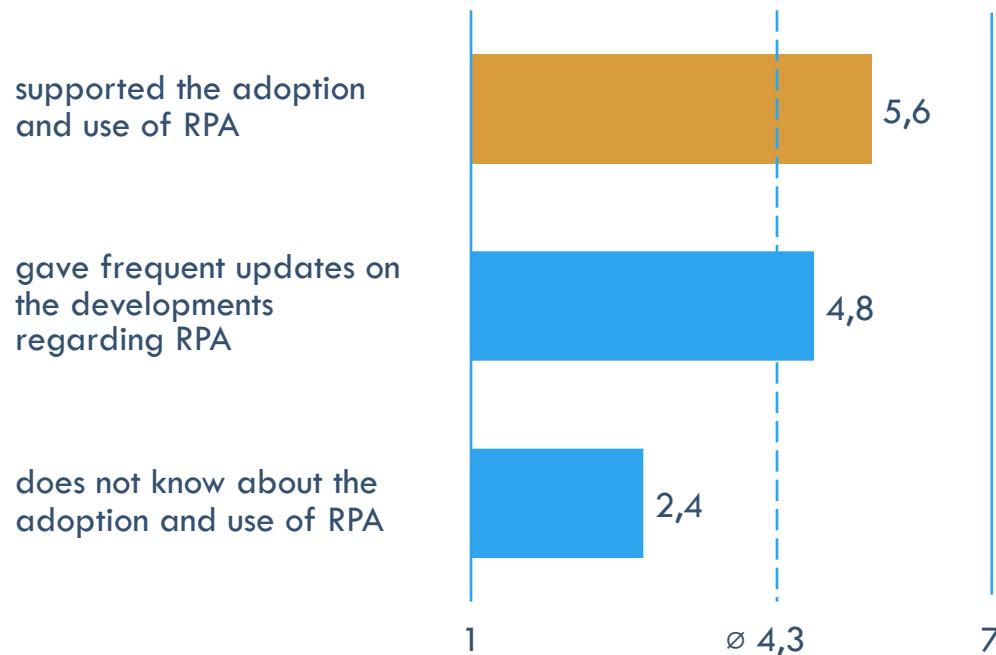


Top Management Support and Project Management

Top Management supported the adoption and use of RPA according to the respondents. Regarding project management, a formal RPA project team and regular status meetings reach highest agreements.

(21) Concerning the RPA implementation our top management...

1 = Strongly Disagree | 7 = Strongly Agree

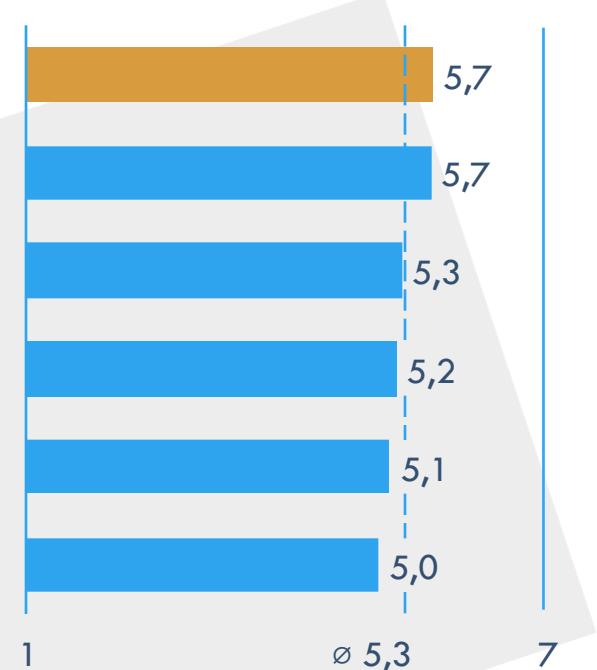


N=100

(22) Regarding project management to support our RPA implementation, we...

1 = Strongly Disagree | 7 = Strongly Agree

- had a formal RPA project team
- had a regular project status meeting
- had a formal RPA project plan
- had a strict monitoring of implementation schedules and costs
- set realistic deadlines
- carefully defined the scope of the project



N=99-101

Concerning operating models, respondents most strongly agree with the statement that operation and maintenance of RPA is mostly carried out in a separate, dedicated unit.

(23) The development of software robots, their operation and maintenance are...

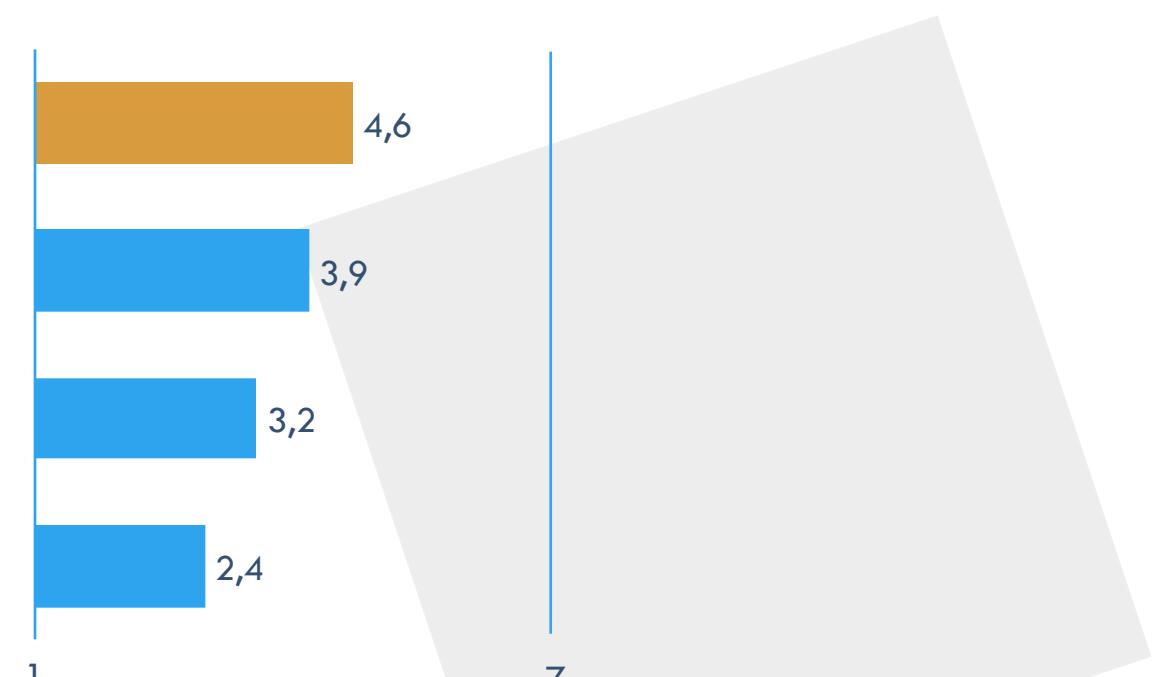
1 = Strongly Disagree | 7 = Strongly Agree

mostly carried out by a separate, dedicated unit (e.g. RPA Center of Excellence)

partly carried out by a separate, dedicated unit and partly by the departments in which the software-robots are running

mostly carried out by each department separately in which the software-robots are running

are carried out by an external software service provider



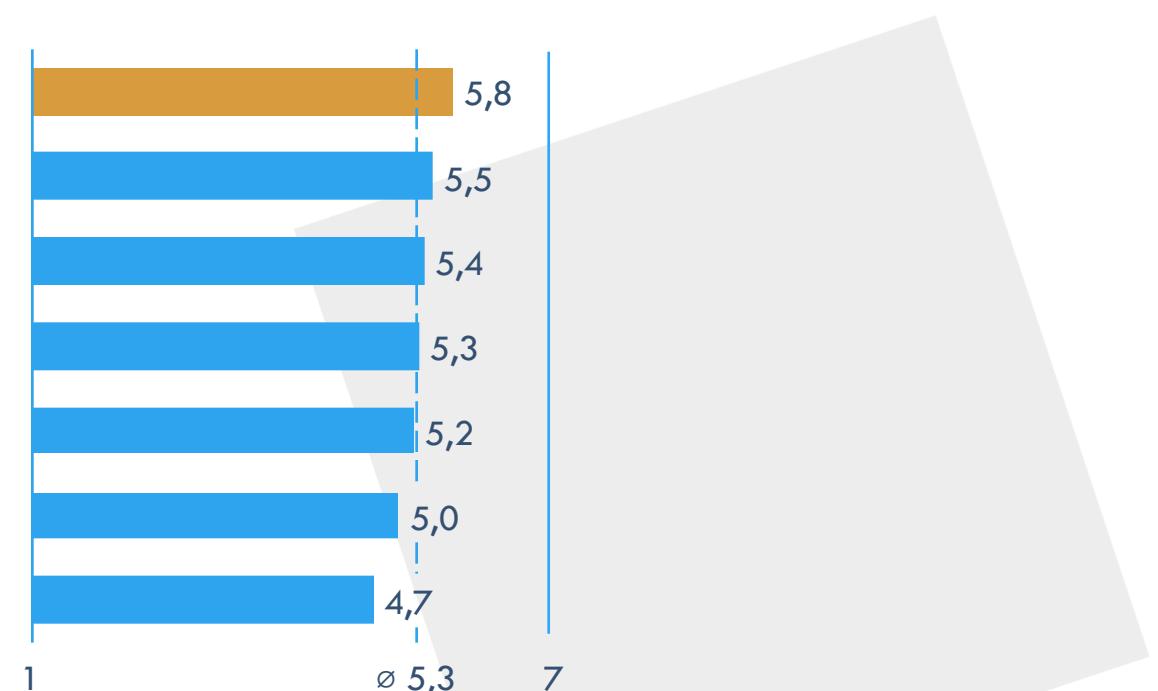
N=101

Respondents most strongly agree with the statement that defined access rights for robots are most prevalent within a dedicated RPA governance.

(24) Together with our RPA implementation we established a dedicated RPA governance which...

1 = Strongly Disagree | 7 = Strongly Agree

- defines access rights for robots
- defines how processes are selected and documented
- includes data protection rules
- defines IT security standards for robots and the RPA-Plattform
- clarifies responsibilities, roles and rights concerning operations, development, maintenance and changes in robots
- includes procedures for change requests for robots
- provides clear instructions how to handle exceptions in robots

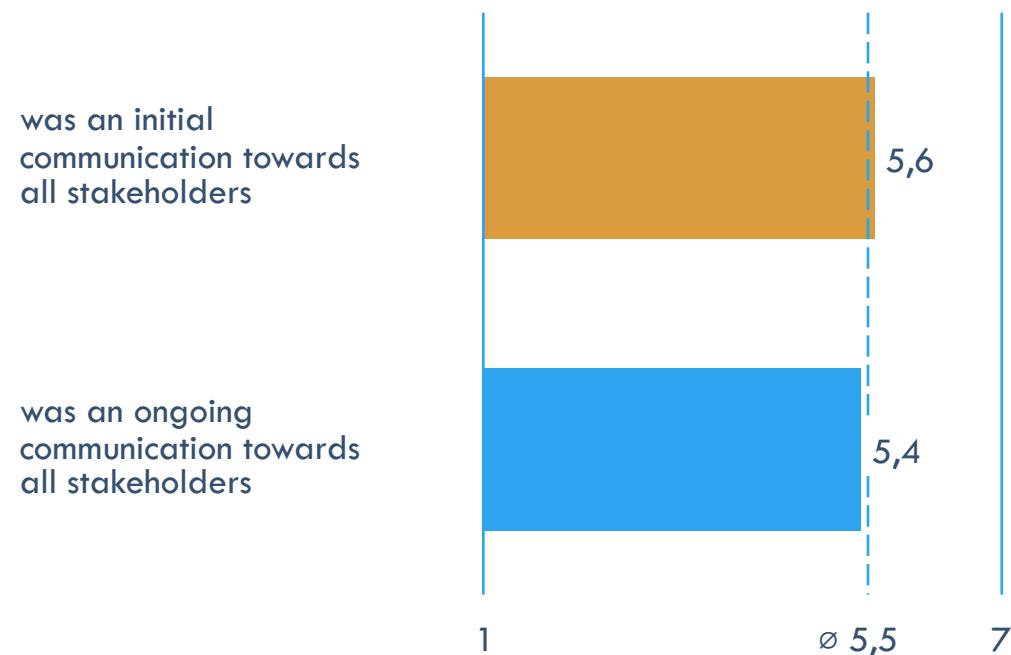


N=100-101

Most of the respondents agree or strongly agree that initial and ongoing communication of RPA implementations has taken place, while change management measures reach slightly less agreement.

(25) Regarding communication of our RPA implementation, there...

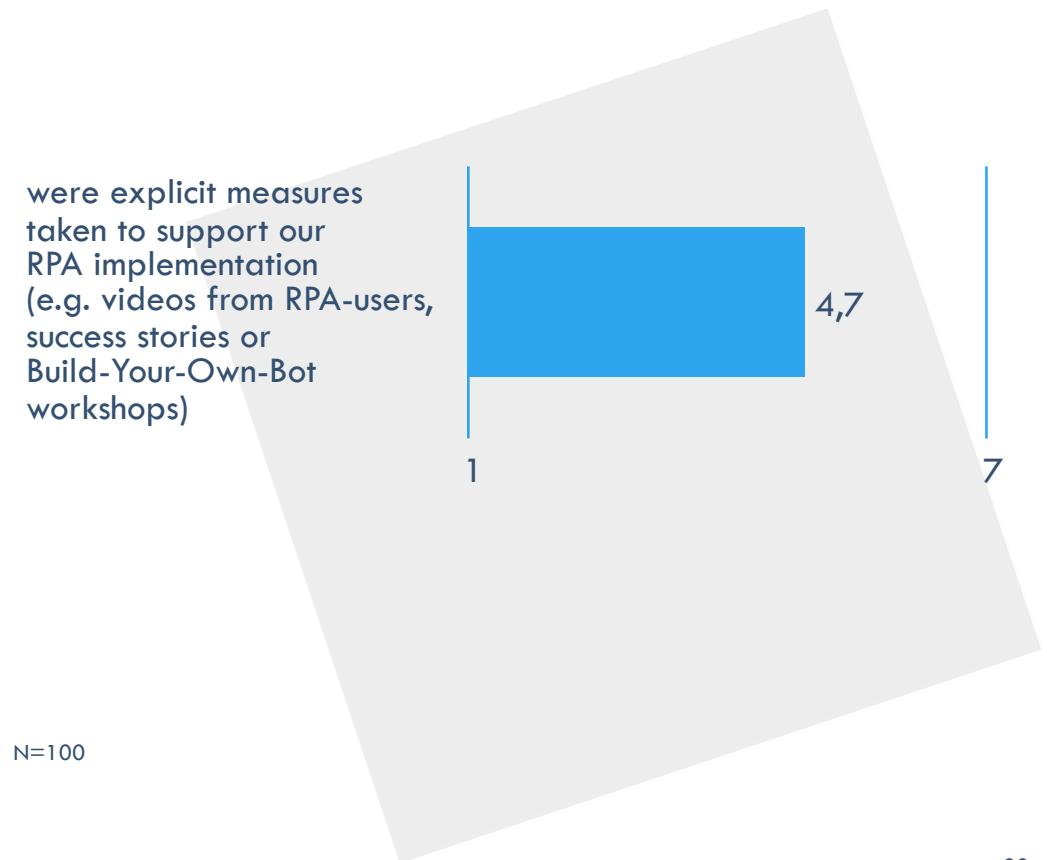
1 = Strongly Disagree | 7 = Strongly Agree



N=101

(26) Regarding change management, there...

1 = Strongly Disagree | 7 = Strongly Agree



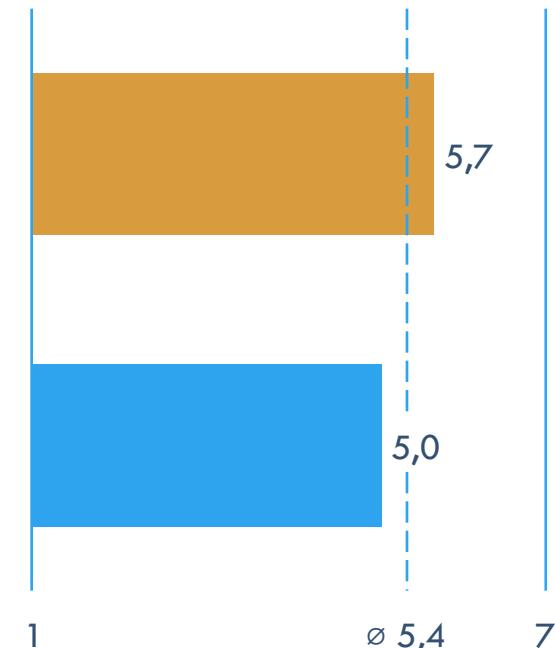
N=100

Respondents mostly agree or strongly agree that they conducted extensive testing of the software robots before go-live. Similarly, there was a strong collaboration with the IT department.

(27) Concerning tests and go-live of our developed software robots,...

1 = Strongly Disagree | 7 = Strongly Agree

extensive functional, technical and integrated tests were conducted before go-live

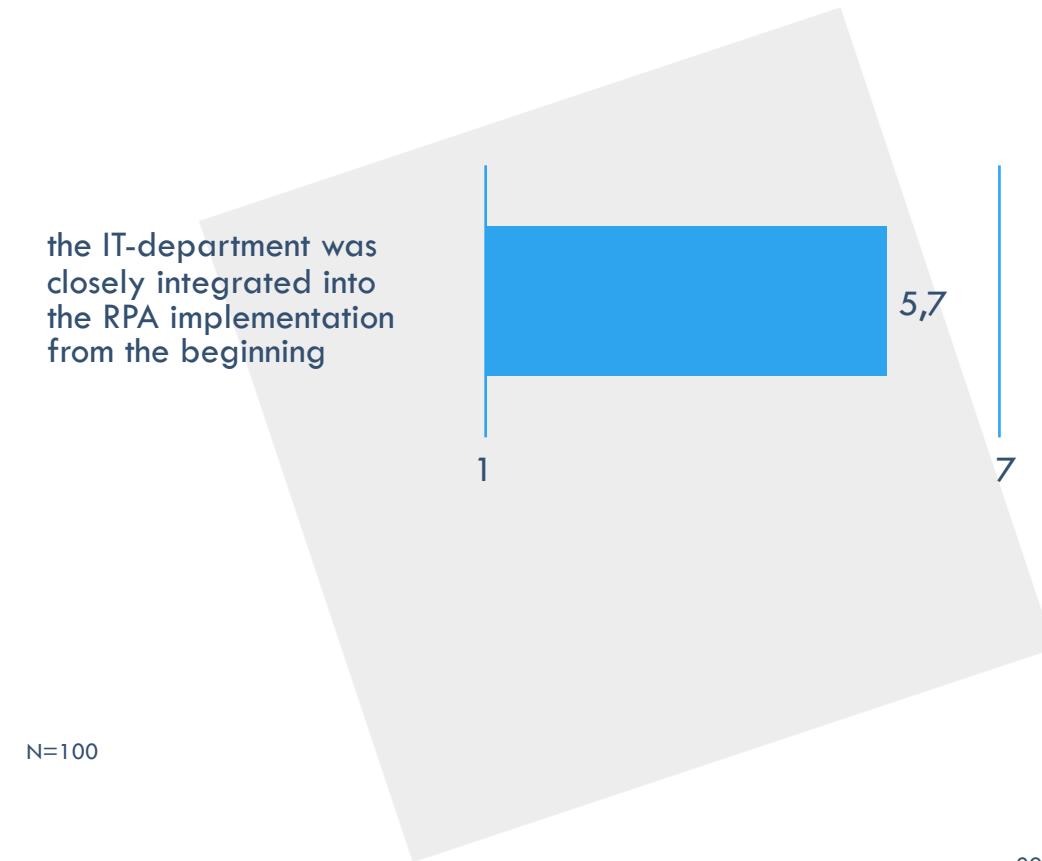


a detailed plan was developed for go-live of the software-robots (e.g. production checklist)

(28) Regarding the collaboration with the IT department for our RPA implementation,...

1 = Strongly Disagree | 7 = Strongly Agree

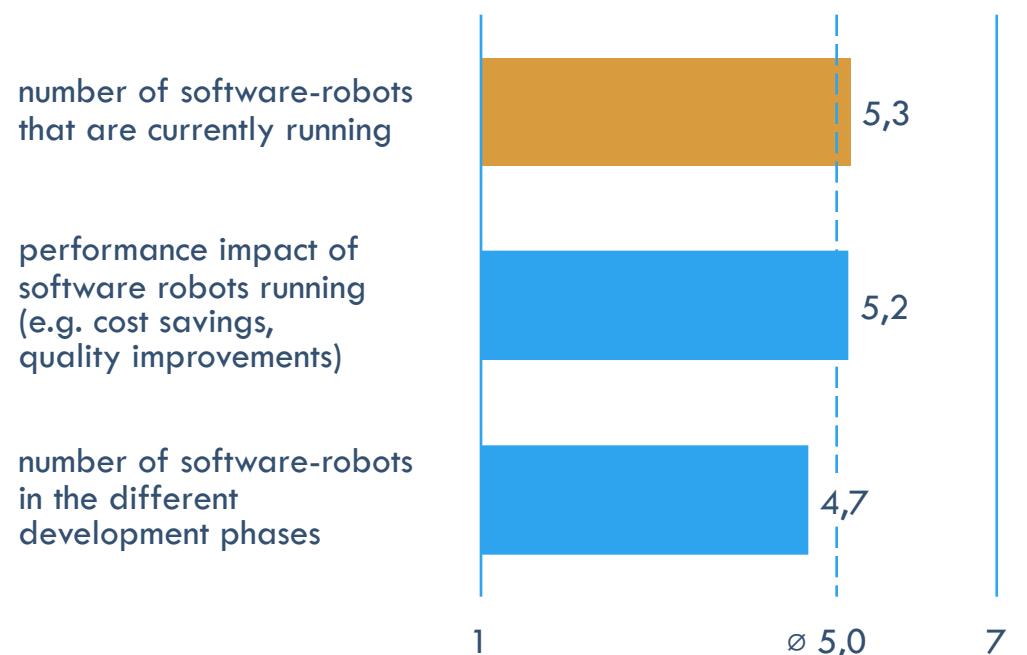
the IT-department was closely integrated into the RPA implementation from the beginning



To monitor performance most respondents agree or strongly agree that they track the number of software robots currently running.

(29) To monitor performance of our software robots and the RPA team, we track the...

1 = Strongly Disagree | 7 = Strongly Agree

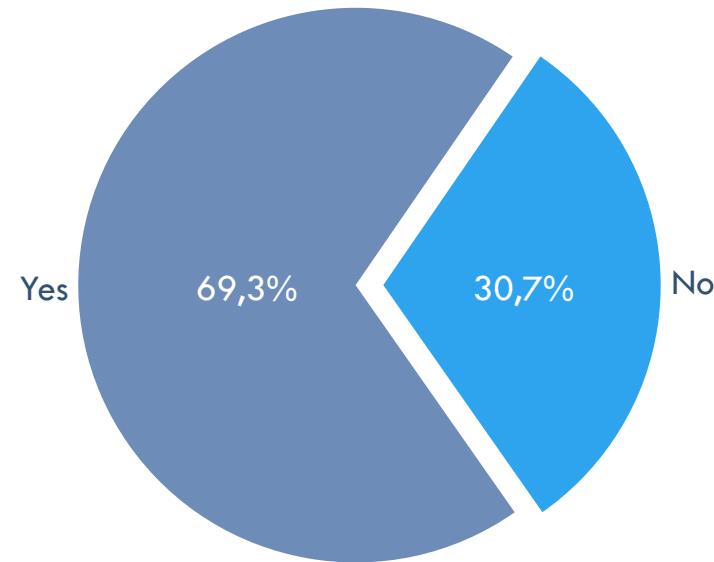


N=101

Consulting Support

Nearly 70% of the respondents make use of external consultants for their RPA implementation. Within this group, respondents regard their consultants as highly qualified.

(30) For our RPA implementation we made use of external consultants:



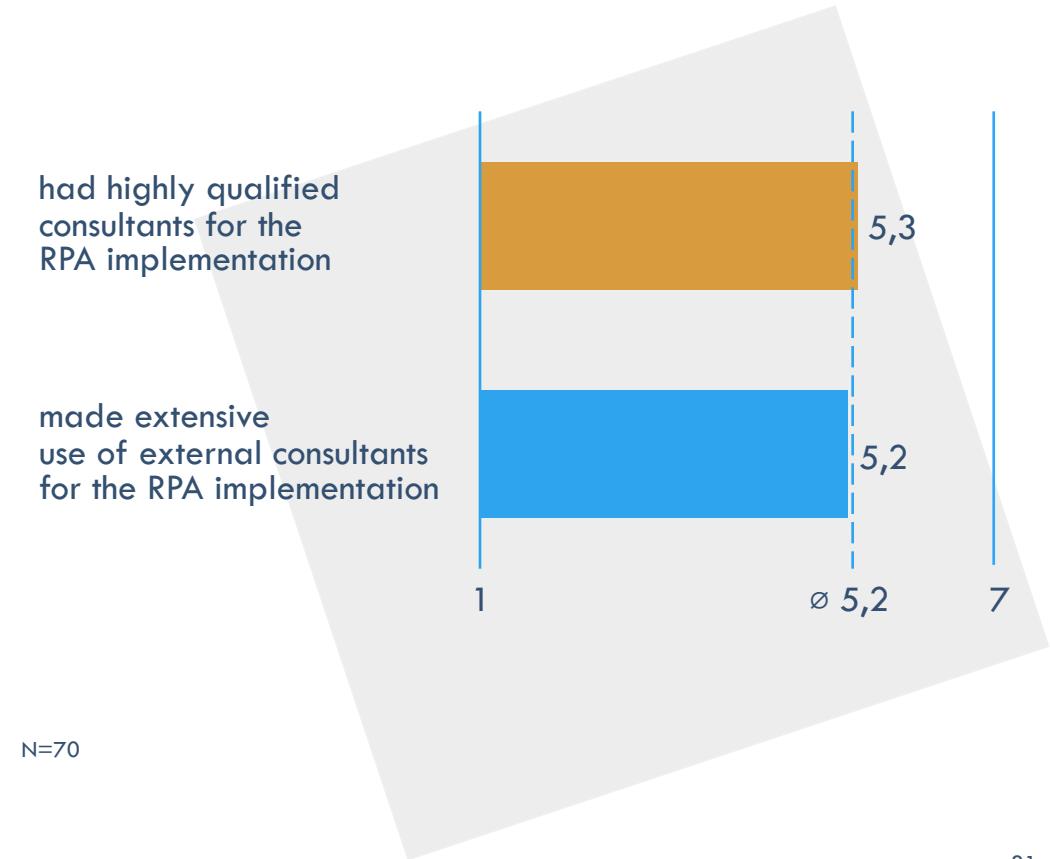
N=101

(31) Concerning external consulting support of our RPA implementation, we...

1 = Strongly Disagree | 7 = Strongly Agree

had highly qualified consultants for the RPA implementation

made extensive use of external consultants for the RPA implementation



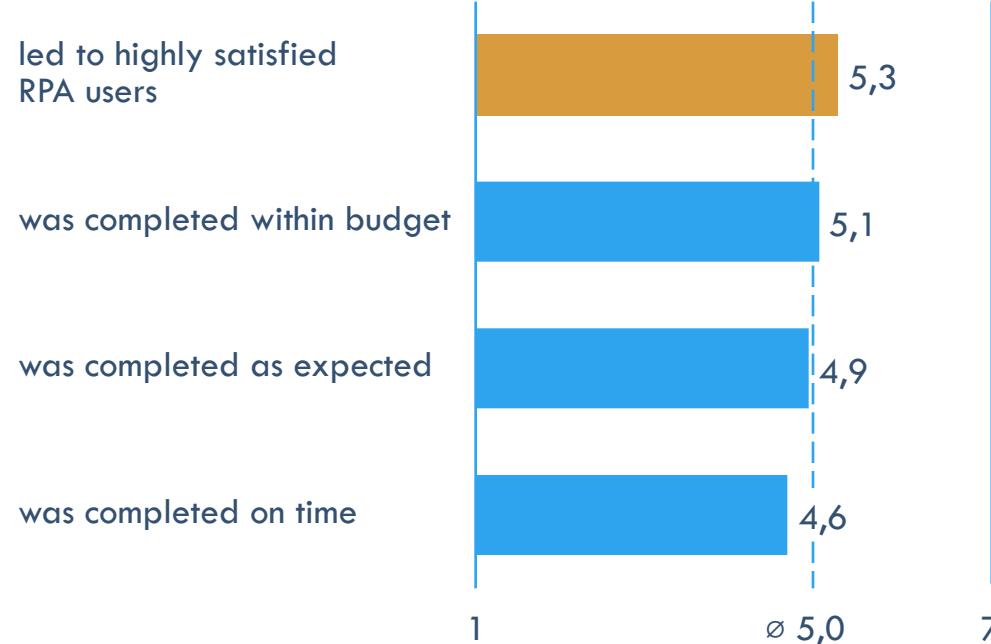
N=70

Implementation Success and Performance Impact

Regarding success, respondents most strongly agree with statements that RPA led to highly satisfied RPA users and improved productivity & process quality.

(32) The RPA implementation...

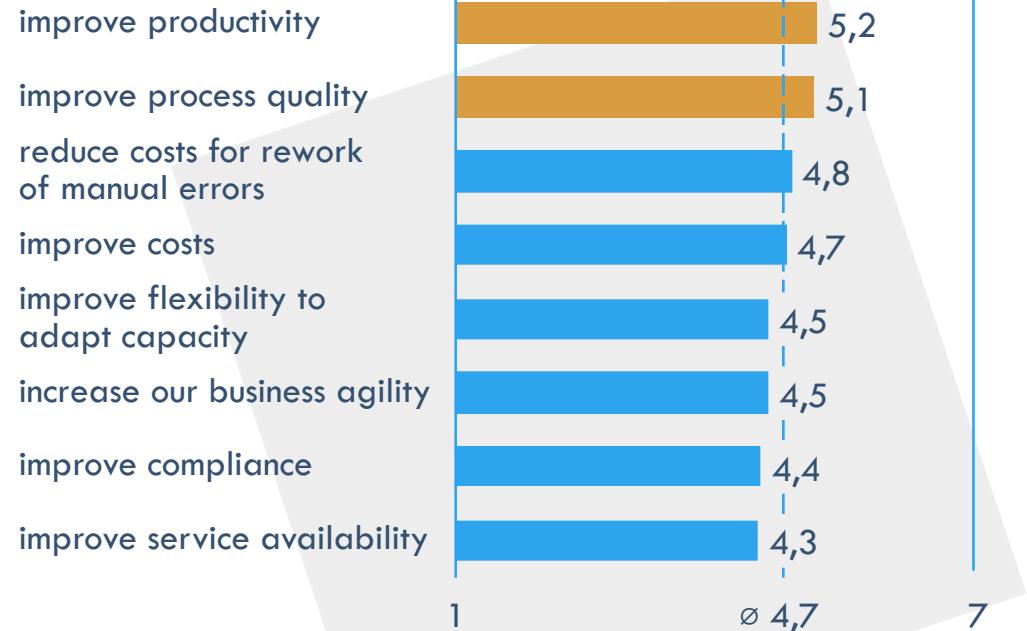
1 = Strongly Disagree | 7 = Strongly Agree



N=101

(33) The implementation of RPA in our organization has contributed significantly to...

1 = Strongly Disagree | 7 = Strongly Agree



N=101

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Split into Groups with High and Low Success

For a more detailed success analysis of RPA implementations, the total sample of 101 responses was split into 2 groups. One group with high success rating regarding their RPA implementation, another group with low success rating regarding their RPA implementation. The success rating for the RPA implementation was self-reported by the study's participants and was computed as sum of the averages from questions (32) and (33). Page 35 describes the procedure in more detail.

The average ratings regarding characteristics of selected dimensions were compared between the two groups. Statistical comparisons were made with a standard t-test and additionally backed with a nonparametric Mann-Whitney-U-Test.

RPA Implementations with High Success Ratings

The analysis of the two groups reveals that RPA implement-

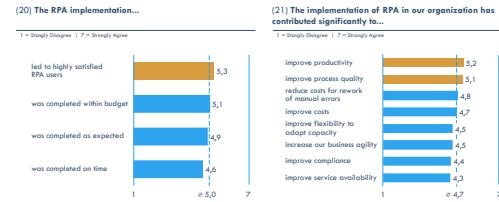
ations with **high success ratings** show a number of specifications:

- Significant higher levels of agreement concerning adequate **RPA trainings** that accompany the RPA implementation.
- Significant higher levels of **process preparation**, especially screening, optimizing and standardizing processes before the robots are developed.
- A **dedicated, central RPA unit** (e.g. Center of Excellence) for development, operating and maintenance of robots is more prevalent. For other operating models the differences between the two groups is statistically not significant.
- Significant higher levels of agreements on a detailed and broad **RPA governance**, e.g. access rights for robots.
- **Monitoring performance** of software robots and the RPA team, e.g. monitor number of robots running, reaches significant higher agreement levels.

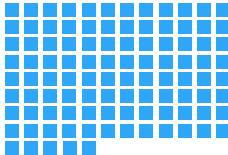
Split of RPA Implementations into High and Low Success Ratings

Based on a combined success rating of each respondent, two groups were created through a median split.
One group represents the combined success ratings above the median, the other one below the median.

Based on responses of question items in (32) & (33) a combined success rating¹ was calculated



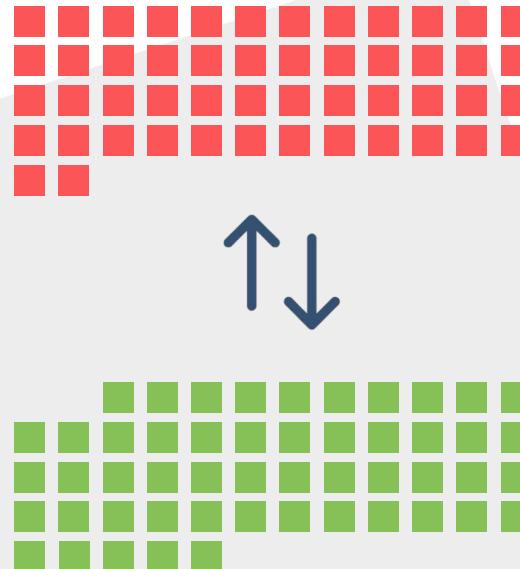
\sum combined success rating for each respondent (N=101)



All combined success ratings were split (via median split²) into high and low success ratings



Statistical comparison³ between groups for selected characteristics of RPA implementations



1) The combined success rating for each respondent was calculated as sum of the averages from the questionnaire items in (32) and (33)

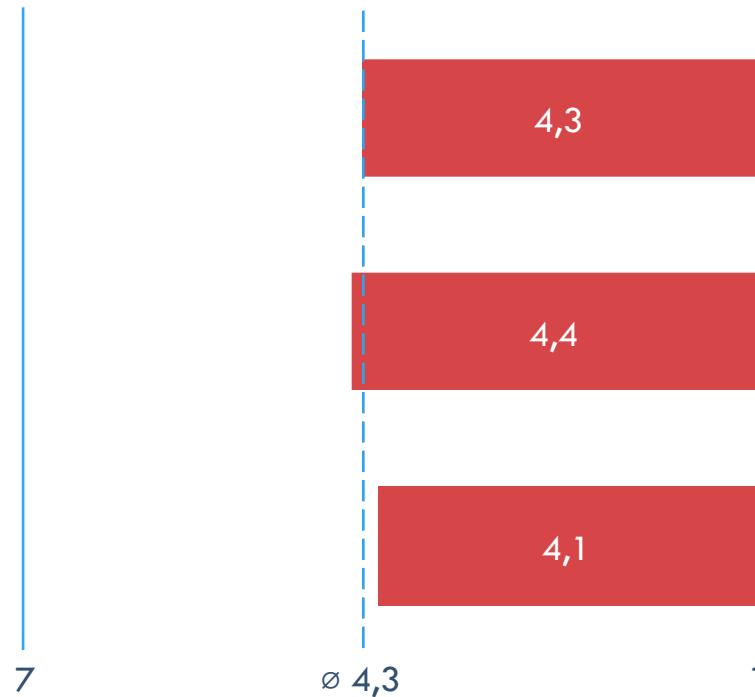
2) For median split procedures see for example Iacobucci D, Posavac SS, Kardes FR, Schneider MJ, Popovichet DL, 2015, The median split: Robust, refined, and revived, *Journal of Consumer Psychology*, Vol 25, 690–704

3) The t-test was applied to statistically compare the means of two groups. All comparison were additionally backed with a nonparametric Mann-Whitney-U-Test. For both test procedures see for example Sprinthall RC, 2011, *Basic Statistical Analysis, 9th Edition*, Pearson. The t-test may be regarded robust towards the violation of assumptions of the underlying data (e.g. Heeren T, D'Agostino R, 1987, robustness of the two independent samples t-test when applied to ordinal scaled data, *Statistics in Medicine*, Vol 6, 79-90)

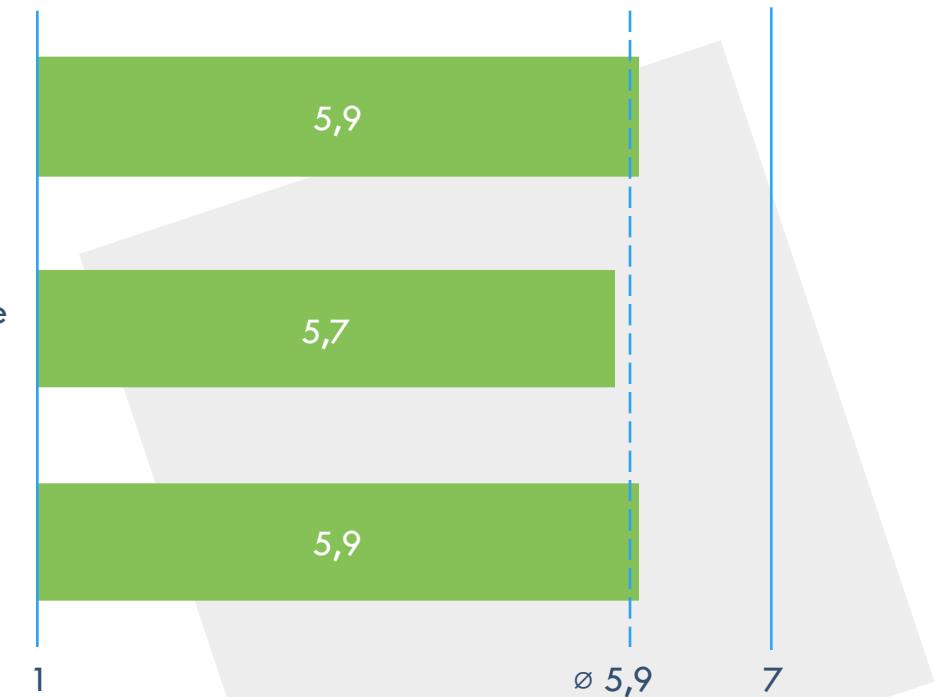
Training in RPA Implementations with Low vs. High Success

Respondents in the group with high success ratings significantly rated all statements on (19) RPA training higher than in the group with low success ratings.

Group of RPA Implementations 'Low Success'



Group of RPA Implementations 'High Success'

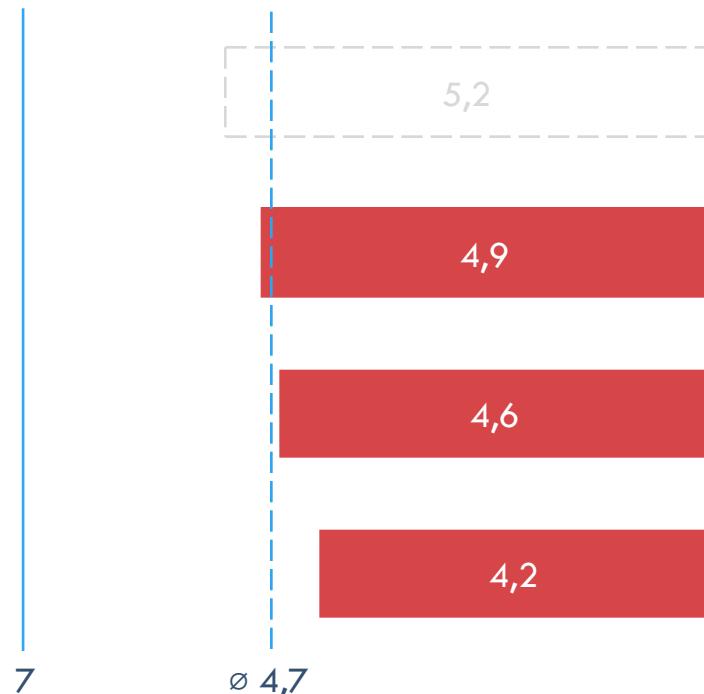


N=101 1 = Strongly Disagree | 7 = Strongly Agree | ** Stat. significant (two-tailed t-test & Mann-Whitney-U-Test, p-value ≤ 0,05)

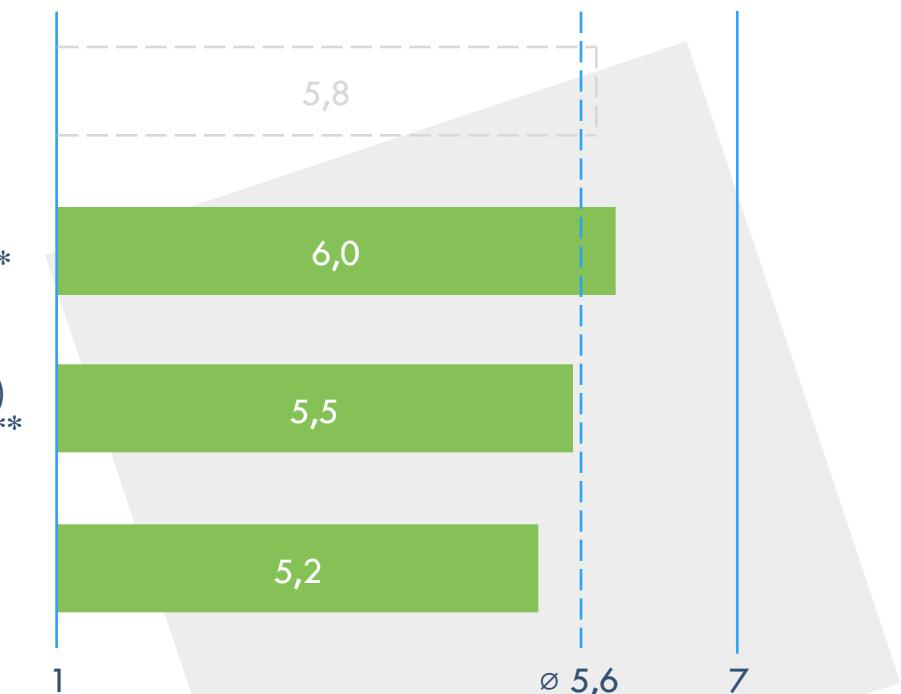
Business Process Preparation in RPA Implementations with Low vs. High Success

Respondents in the group with high success ratings significantly rated most statements on (20) business process preparation higher than in the group with low success ratings.

Group of RPA Implementations 'Low Success'



Group of RPA Implementations 'High Success'

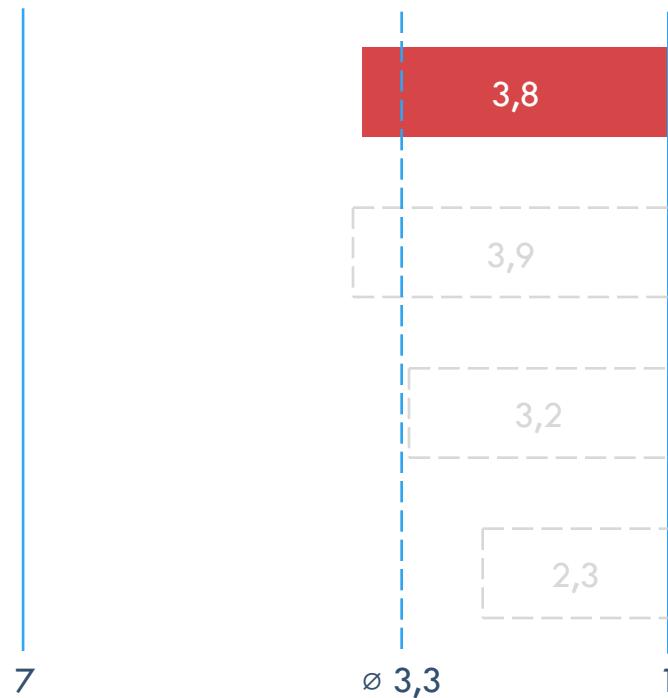


N=101 1 = Strongly Disagree | 7 = Strongly Agree | ** Stat. significant (two-tailed t-test & Mann-Whitney-U-Test, p-value ≤ 0.05)

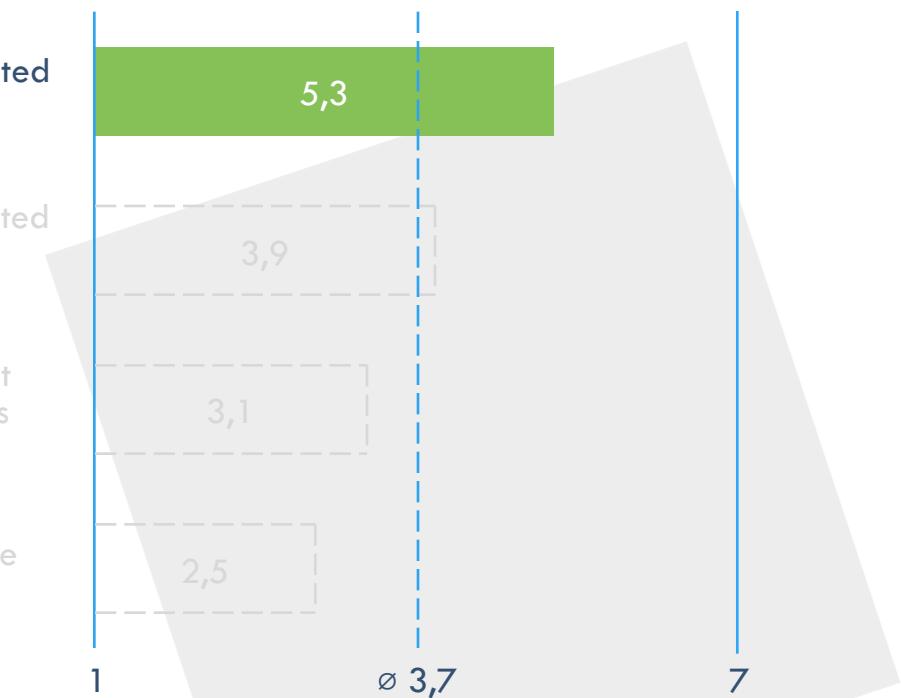
Operating Model in RPA Implementations with Low vs. High Success

Looking at the (23) operating models, respondents in the group with high success ratings rated only the statement on a dedicated RPA unit significantly higher than in the group with low success ratings.

Group of RPA Implementations 'Low Success'



Group of RPA Implementations 'High Success'

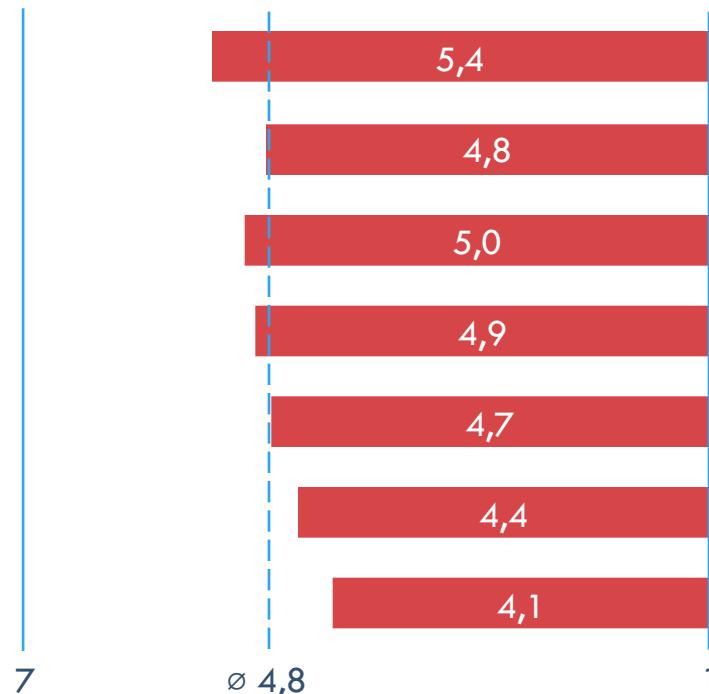


N=101 | 1 = Strongly Disagree | 7 = Strongly Agree | ** Stat. significant (two-tailed t-test & Mann-Whitney-U-Test, p-value ≤ 0,05)

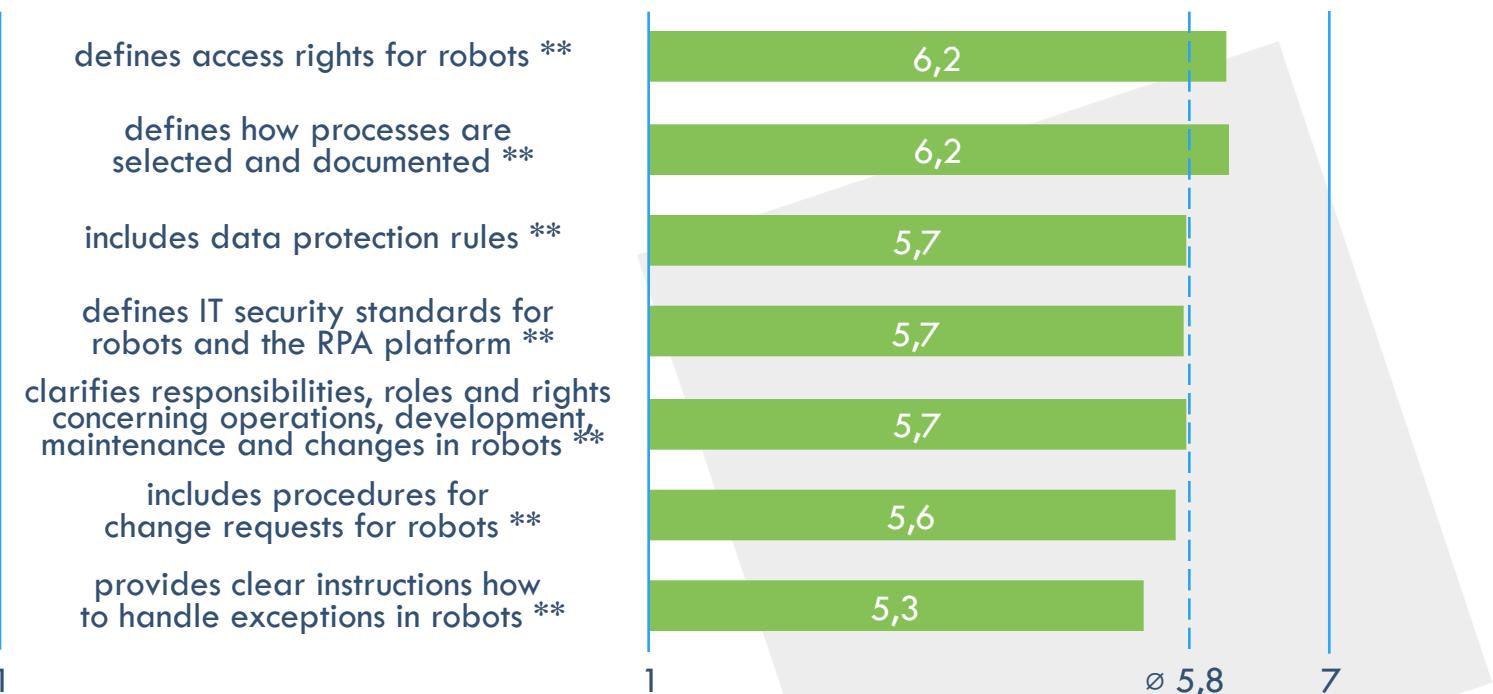
Governance in RPA Implementations with Low vs. High Success

Respondents in the group with high success ratings significantly rated all statements on (24) RPA governance higher than in the group with low success ratings.

Group of RPA Implementations 'Low Success'



Group of RPA Implementations 'High Success'

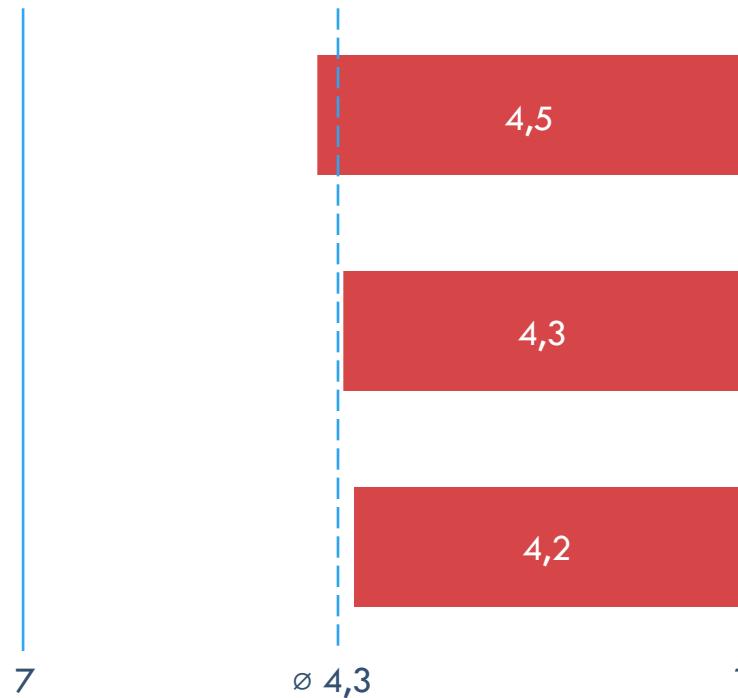


N=101 1 = Strongly Disagree | 7 = Strongly Agree | ** Stat. significant (two-tailed t-test & Mann-Whitney-U-Test, p-value ≤ 0.05)

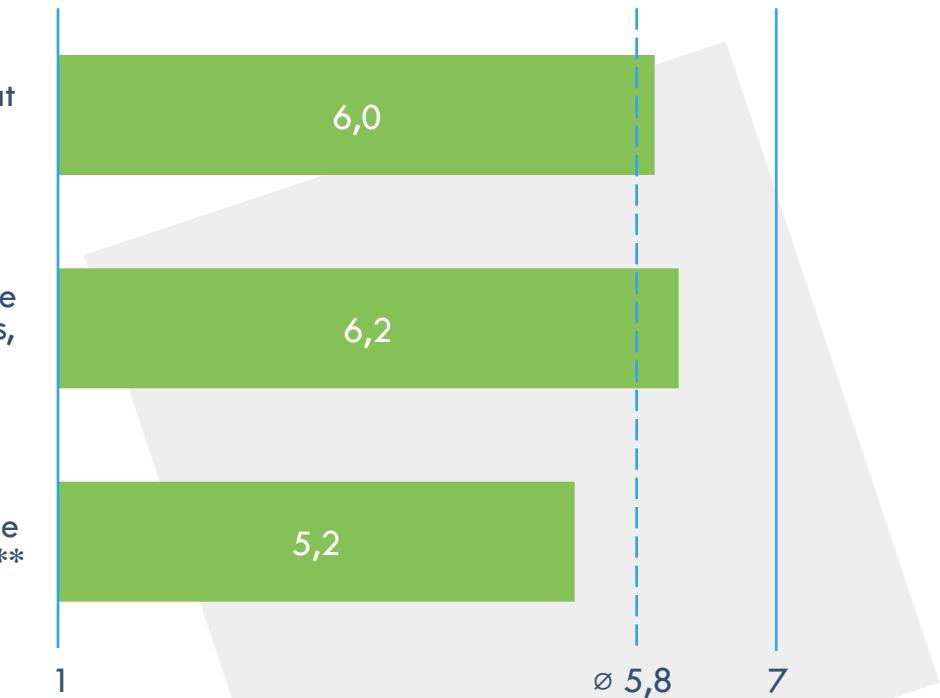
Performance Monitoring in RPA Implementations with Low vs. High Success

Respondents in the group with high success ratings significantly rated all statements on (29) performance monitoring higher than in the group with low success ratings.

Group of RPA Implementations 'Low Success'



Group of RPA Implementations 'High Success'



N=101 | 1 = Strongly Disagree | 7 = Strongly Agree | ** Stat. significant (two-tailed t-test & Mann-Whitney-U-Test, p-value ≤ 0,05)

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Data Collection

Data collection was conducted with a random sampling technique. However, to gain access to experienced RPA professionals the link to the questionnaire (English and German) was distributed in selected social media platforms, such as LinkedIn or groups interested in RPA such as the German Process Automation Association. Online surveys typically carry risks regarding validity, accuracy and reliability of responses. To minimize such risks, the questionnaire was pre-tested (content, length, accessibility etc.) with 5 professionals experienced in the field of RPA. Additionally, the survey required participants to have experience in the implementation of RPA. For participants stating no experience in RPA implementations the survey directly exited. The data collection took place from 01.09 to 01.12.2020. In total, 157 responses were received with 101 usable for analysis.

Within these 101 usable responses, there were only single cases with missing values and, as a result, filled with the average value of the corresponding item for statistical analysis. The characteristics of the final sample is described in section 2 of this report.

Questionnaire & Data Analysis

The questionnaire was designed based upon literature review and prior research concerning relevant factors for RPA implementations. The questionnaire items were, where applicable, drawn from previous studies and adapted to RPA environment. If necessary, new items were created or added to existing item batteries. The questionnaire utilized a 7-point Likert scale to record responses and was technically conducted via Soscisurvey.

Statistical Package for the Social Sciences (SPSS) was used to analyze the collected survey responses.

Limitations

The results of the present study require further research, since the composition of the sample may limit findings due to slight concentrations or accumulations in industry, company size, position of respondents, RPA platforms and location which could distort results.

Further, as mentioned above, some measurement instruments used in the questionnaire are exploratory in nature and also require further validation.¹

1) In preparation for scientific publications the reliability and validity of the measurement instruments were already assessed by looking at the individual-item reliability, the internal consistency, and the convergent and discriminant validity and delivered satisfying results.

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