Identifying the Socio-Human Inputs and Implications in Robotic Process Automation (RPA): A Systematic Mapping Study

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Abstract. Recent studies show that the success rate of Robotic Process Automation (RPA) projects is between 50 and 70%. In cases where they are not successful, most failures are caused by organizational factors, i.e., people and their social environment. People in the organization have a significant influence on the success of a RPA project. Likewise, the implementation of RPA will bring some implications to them as well. This research is a preliminary study on visualization socio-human implications (VoSHI) in the RPA projects. As one of the office automation technologies, the application of RPA provides economic benefits and social implications. Unfortunately, most studies highlight the benefits and lack discussions on the impact of RPA on humans. This paper presents a systematic mapping study to analyze the current state-of-the-art on this topic, recognizing the socio-human implications of RPA implementations described in the literature. The research analyzed 56 primary studies selected from both academic digital libraries and grey literature. The results showed 16 positive and 6 negative implications of RPA implementations for humans and their social environment. Furthermore, this research also found 6 positive and 13 negative inputs contributed by humans, which can influence RPA implementations.

Keywords: Robotic Process Automation (RPA) · Human · Social · Input · Implication

1 Introduction

Automation technology and robots have played a significant role in the Industrial Revolution 4.0. They have spanned many sectors, including manufacturing, trade, and services. As a part of automation technology, Robotic Process

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Automation (RPA) allows the software robot to emulate human behavior in carrying out repetitive tasks in the office [37]. Instead of using manual workers, organizations have deployed RPA bots to increase efficiency and shift the workers from mundane tasks to higher-value tasks. Nevertheless, Ernst & Young study shows that 30–50% of RPA projects have failed. Most failures are caused by the organization, not by technology [7]. The people in the organization have a significant influence on the success of the RPA project. Conversely, RPA implementation will bring some implications to people's lives.

Economically, RPA's investment is promising, but its relationship with people in the organization must be explored more deeply to create harmony between people, organizations, and technology. When implementing RPA, organizations sometimes ignore social and human impacts. As a result, a project can be financially viable, but have dire implications for people and their social environment. Therefore, it is crucial to identify all the effects and consequences of implementing RPA for humans. With this knowledge, organizations can comprehensively assess RPA projects and place humans' interests at the center of technology assessment.

In academia, the trend for RPA studies has increased in the last five years [11]. The discussion topics that were presented are also diverse. It ranges from the challenges of RPA implementation [8,36], the benefits of RPA [1,21,36], process selection [4,40], human & RPA collaboration [9,22,30,33], RPA assessment [2, 41] and others. However, there are further areas that have not been exposed properly. For instance, in the area of RPA assessment, most studies still focus on technology & economic perspectives [3,40]. However, the human perspective is scarcely researched and mainly reflects the implications on employees [33], while broader social & human perspectives are still ruled out. In the future (Industrial Revolution 5.0), the success of new technology is seen not only by financial benefit but also by human acceptance and the way technology supports human life [10].

Inspired by the Visualization of Financial Implication (VoFI) framework [13], that has been successfully applied to study the viability of projects from an economic perspective [12,26], we will conduct research series to develop a framework called VoSHI (Visualization of Socio-Human Implication). VoSHI will assist organizations in evaluating projects from the human perspective. The following research steps are considered to implement the whole VoSHI framework (cf. Fig. 1): (1) Identifying VoSHI parameters revealed by the collection of literature, (2) validating & quantifying VoSHI parameters, and (3) developing a tool to measure VoSHI parameters. The current paper focuses on the first step. For this, a systematic mapping study is conducted to analyze the current state of the art, to identify both (1) the human influence on RPA projects and (2) the implications of the project for humans. These will be the parameters of the VOSHI framework. Meanwhile, the validation and quantification and the tool development will be carried out in further research.

The current paper contributes to the RPA field by laying the foundations of an innovative assessment approach that places the human at the center, as introduced in Sect. 2. In addition, Sect. 3 reports the literature review conducted

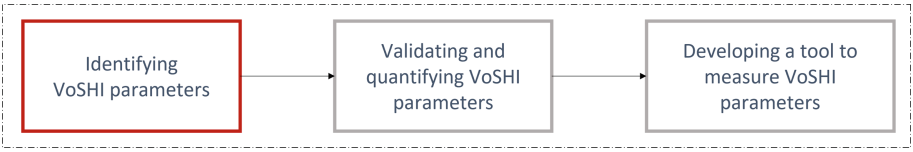

Fig. 1. The series of VoSHI research. The current paper addresses the *identification* phase.

whose implications are discussed in Sect. 4. Finally, Sect. 5 concludes the paper and sets the future research agenda.

2 Background

The automation project failure is characterized by the inability to achieve goals and mitigate risks. It is caused by technology failure [23], human failure [30], and economic failure [3]. Economic failure can be detected by visualizing the financial implications of a project using the VoFI method. The Visualization of Financial Implication (VoFI) is a comprehensive financial plan that considers the economic consequences of an investment project. It includes all cash flows from internal funds, debt & redemption capital, various forms of loans (with various redemption & interest rates), and tax implications investment [12]. VoFI offers accountability, transparency, and a long-term perspective on the quantitative aspects of investment decisions [38].

VoFI was first introduced by Heister in 1962 and explained in more depth by Professor Heinz Lothar Grob in 1993 and 2006 [13]. Over time, the VoFI method has been used in various ways, such as:

- LIVO (Liquiditätplannung VoFI), where the VoFI method is used to measure company liquidity to minimize the risk of bankruptcy [32].
- BSC-VoFI (The Balanced scorecard) measures company performance by modifying the balanced scorecard with VoFi [14].
- TCO-VoFI (Total Cost Ownership-VoFI), which utilizes the VoFI method to correct the weaknesses of traditional TCO (Total Cost Ownership) analysis [12].
- CBA-VoFI (Cost-Benefit Assessment based on VoFI), which was developed by Oesterreich & Teuteberg (2017), to evaluate the application of augmented reality in the construction area [26].

Although VoFI has evolved into various forms, the basic principle has never changed. VoFI always has two sides, adding and deducting factors, that affect the profitability of the investment. In the model of CBA-VoFI, a project is considered financially profitable if the amount of benefits achieved by the organization or company is greater than the incurred costs. On the other hand, a project is financially unprofitable if the benefits outweigh the cost [26]. However, the

financial implication is not the only dimension to measure the success of an RPA project.

Harmoko & Axmann determined the assessment of an RPA project into five dimensions, two financial dimensions (i.e., cost and benefit), two technological dimensions (i.e., technology readiness and usability), and one organizational dimension that involves humans and social environment (i.e., company readiness) [2]. This idea is in line with the principle of Industrial Revolution 5.0, where human implications should be a primary consideration in the implementation of technology [10].

Unfortunately, there is no method to measure the socio-human implications of an RPA project. Whereas RPA and most other automation technologies are met with strong challenges from humans, especially workers [18,23,31]. The issues of losing a job and collaboration failure between humans and robots are still frightening specters for some people [30,33,43]. Therefore, we will develop a method to measure and visualize the socio-human implications of an RPA project through the series of research. The Visualization of Socio-Human Implication (VoSHI) will be designed with the same basic principles as CBA-VoFI. As illustrated in Fig. 2, the balance of VoSHI is influenced by adding factors (i.e., positive inputs and implications) and deducting factors (i.e., negative inputs and implications).

- **Positive Input:** The supporting factors from humans and their social environment to the RPA project, starting from the initiation stage until the project is implemented.
- **Negative Input:** The inhibiting factors from humans and their social environment to the RPA project, starting from the initiation stage until the project is implemented.
- **Positive Implication:** all benefits gained by humans and the environment as a result of RPA implementation.
- **Negative Implication:** all negative consequences suffered by humans and their environment as a result of the RPA implementation.

In the VoSHI method, the project is considered a success if the benefits for people (e.g., workers, management, and other stakeholders) are greater than their struggles and sacrifices for the project or, in other words, if the adding factor (i.e., positive inputs and implications) is greater than deducting factor (i.e., negative inputs and implications).

3 Systematic Mapping Study Method

In this paper, we propose to review the studies related to the socio-human implications of RPA implementation using the Systematic Mapping Study (SMS) method, proposed by Peterson et al. [27]. This method is used to build a structured classification scheme in the software engineering area. Following the guidelines described by Petersen and the procedures suggested by Khanra et al. and Wewerka & Reichert [17,27,41], we design a protocol (cf. Fig. 3) that describes the formulation of research questions and the definition of rules for conducting

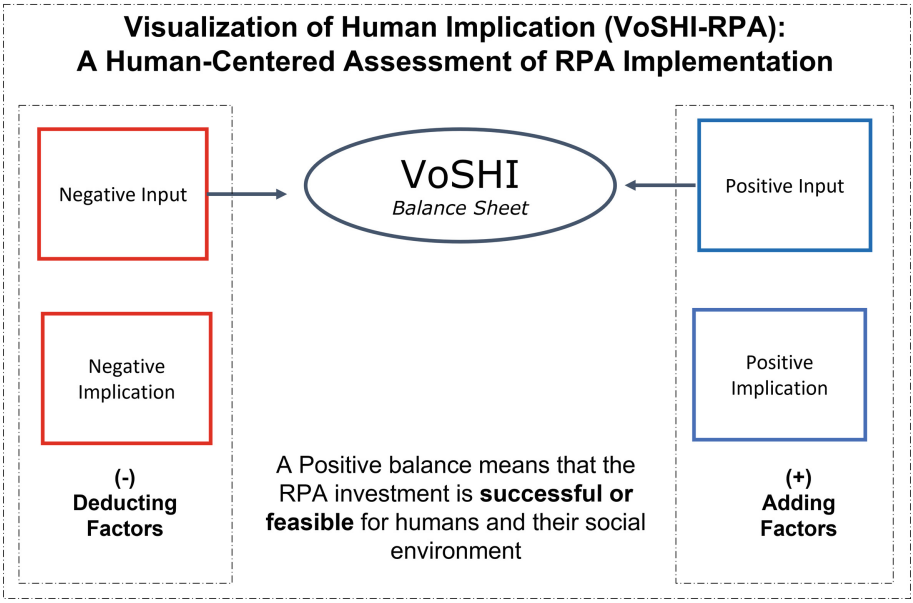

Fig. 2. Pre-illustration of VoSHI model.

the searches (cf. Sect. 3.1), the selection of primary studies (cf. Sect. 3.2), and the data extraction and analysis methods (cf. Sect. 3.3).

3.1 Planning

Before starting the SMS, it is necessary to formulate the research questions (RQ), which guide the search for relevant studies. RQ keeps research focused on topics and predetermined goals. As the initial stage of VoSHI studies, this research will answer the following questions:

- RQ1: What are positive inputs from humans and their social environment that affect the implementation of RPA?
- RQ2: What are the positive implications of RPA implementation for humans and their social environment?
- RQ3: What are negative inputs from humans and their social environment that affect the implementation of RPA?
- RQ4: What are the negative implications of RPA implementation for humans and their social environment?

In addition, two steps have been defined to search the relevant studies: (1) Search relevant literature in both scientific digital libraries and general search engines (i.e., Google). In our study, six digital libraries have been selected, i.e., Scopus, IEEExplore, Web of Science, ACM, ScienceDirect, and AIS eLibrary. (2) Select keywords that can accelerate the searching process. The keywords will

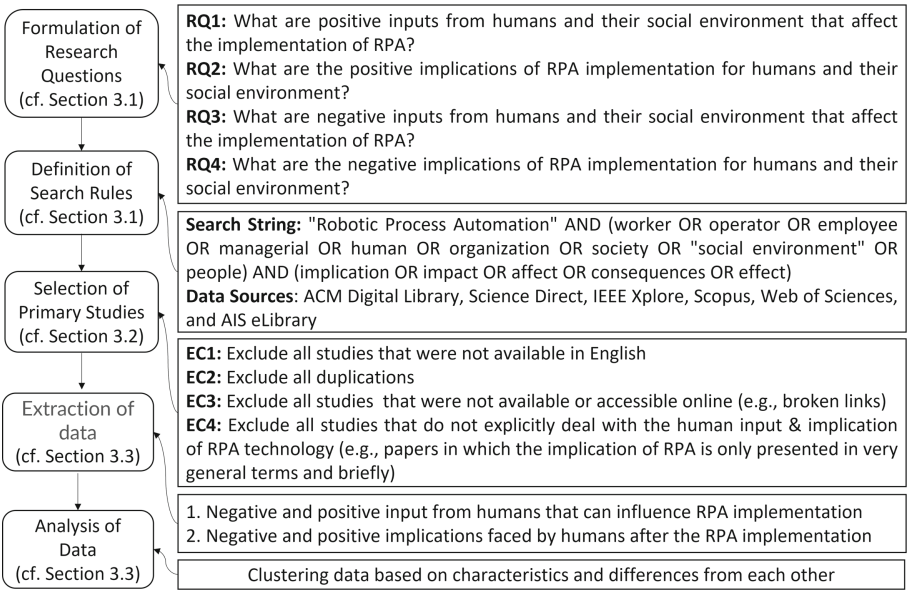

Fig. 3. Protocol for systematic mapping study (inspired by Petersen et al. [27], Khanra et al. [17], and Wewerka and Reichert [41]).

Table 1. Keywords.

Keywords	Similar term
Robotic process automation	RPA
Human	People, worker, operator, employee, managerial, organization, society, social environment
Implication	impact, affect, consequence, effect

help to build queries for digital libraries. Besides that, similar terms of a keyword (e.g., employees, operators, managerial, and social environment), which refer to the "humans", are also used to ensure the relevant studies in the digital library are not missed (cf. Table 1).

After determining the keywords, the authors search for relevant studies with different queries. It is possible to have different queries since each digital library has a different search input form. At this step, authors targeted titles and abstracts directly. In addition, the exclusion criteria are determined to eliminate studies that use non-English language and briefly discuss RPA or beyond the socio-human aspects of RPA (cf. Fig. 3).

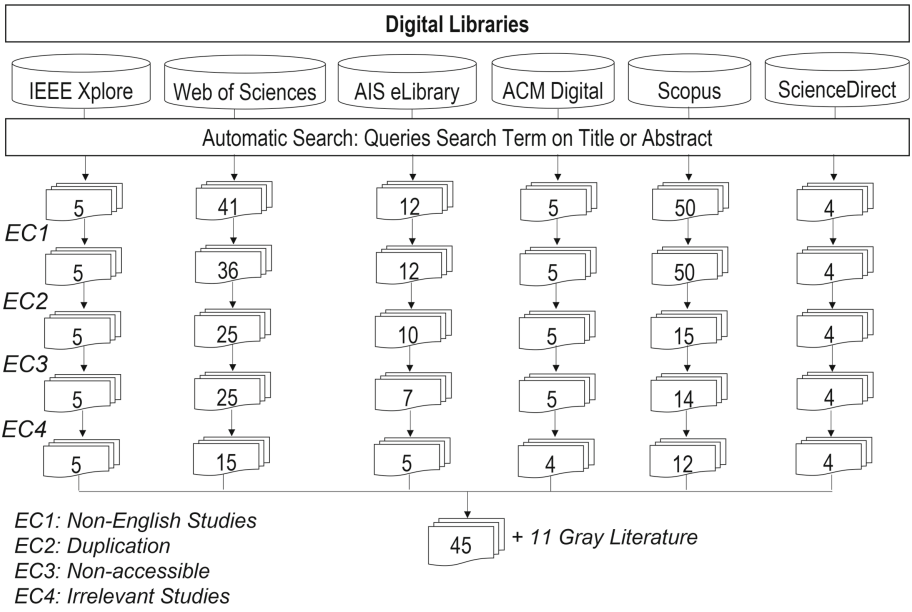

Fig. 4. The primary studies selection process.

3.2 Conducting

The Primary Studies Selection Process is divided into automated searching and detailed review. The automated searching uses queries and targets metadata: title, keywords, and abstract. From this step, 117 studies were selected and screened using the first exclusion criteria (EC1), leaving 112 studies. Of the 112 studies, there are 48 duplications to be excluded (EC2). Consequently, there are 64 studies remaining.

Furthermore, the 64 studies were reviewed manually by the authors, but before that, the authors had to ensure that the studies were accessible based on EC3. In this process, 4 studies cannot be accessed. Thereafter, the authors conducted a "detailed review" of the 60 remaining studies. In a detailed review, the authors read the entire section of the reviewed paper to find information that can answer research questions. In this research, the authors focused on (1) negative and positive input from humans that can influence RPA implementation and (2) negative and positive implications faced by humans after the RPA implementation. From this step, the authors found that 15 studies were irrelevant to the topic of humans and RPA. Therefore, the authors excluded them according to EC4. In the end, there are 45 primary studies (cf. Fig. 4).

In addition, following the recommendations of Wieringa et al. [42], this research also searches and reviews the studies in grey literature. In this paper, the authors reinforce the fact of including this kind of literature. By definition, grey literature consists of publications produced at all levels by government,

academia, business, and industry, whether in print or electronic format, but not controlled by commercial publishing interests, and where publishing is not the organization's primary business activity [24]. The searching process uses the Google search engine with keywords "Robotic Process Automation" and "Human Implication" in PDF format. In the first 10 pages of the results, the authors found 12 titles that pointed to the relationship between humans and RPA. The authors did not find such a title from page 11 onward. Therefore the grey literature search was discontinued. Of the 12 studies selected, the authors reviewed them in detail and excluded one study based on exclusion criteria 4 (EC4). Finally, the authors considered only 11 studies relevant to the research.

3.3 Reporting

The main objective of this research is to find four types of parameters as a basis for further development of the VoSHI method (i.e., positive and negative input and positive and negative implication). The detailed review found that only 56 primary studies, including 11 studies in grey literature, provided the information needed to achieve the research objectives.

The sources for the grey literature have been marked with an * every time they are cited to increase transparency. The authors plan further studies to validate and search the empirical evidence of revealed parameters and statements in the grey literature. In the research, the authors clustered the inputs and implications into four clusters (i.e., worker skill, worker health, company health, and society health). This is because not all identified inputs and implications relate directly to the workers as individuals. Some are more related to the social environment, such as company (company health) and even society (society health). In the context of the individual worker, the authors found the input and implication are not only on worker's pleasure (worker health), but also on the worker's skills (worker skills).

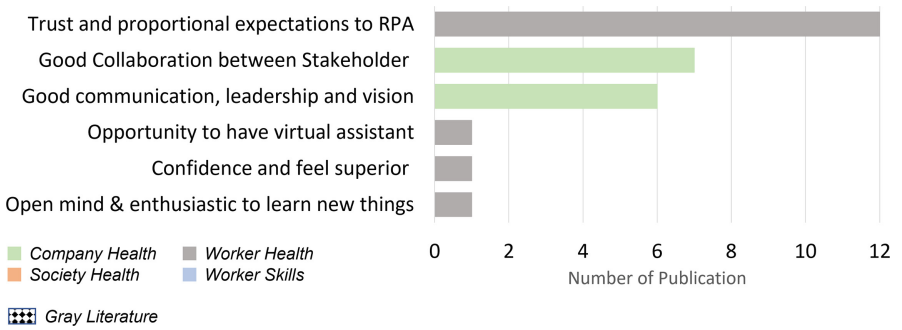

Fig. 5. Positive inputs for RPA projects.

RQ1: ***What are positive inputs from human and their social environment that affect the implementation of RPA?*** Companies and workers may believe that robots can perform repetitive tasks more effectively [25]. Nevertheless, the leading indicator of RPA performance is not the number of fired workers but the number of repetitive tasks that can be delegated to robots [8]. Sometimes not all repetitive tasks can be done by robots. Therefore, workers should not feel inferior [19]*. Companies and workers have to be more realistic and manage their expectations proportionally. The open-mindedness [6], trust, and proportional expectations of workers will positively impact the implementation of RPA [9,30].

The other positive inputs (influences) come not from individual workers, but purely from the social environment (company health): good leadership from top management [44], and good collaboration between stakeholders [28]. Good leadership is reflected in a strong vision, shared knowledge, and good communication from the top to the lowest levels in the organization. The absence of leadership causes uncertainty and anxiety among people within the organization [39] (cf. Fig. 5).

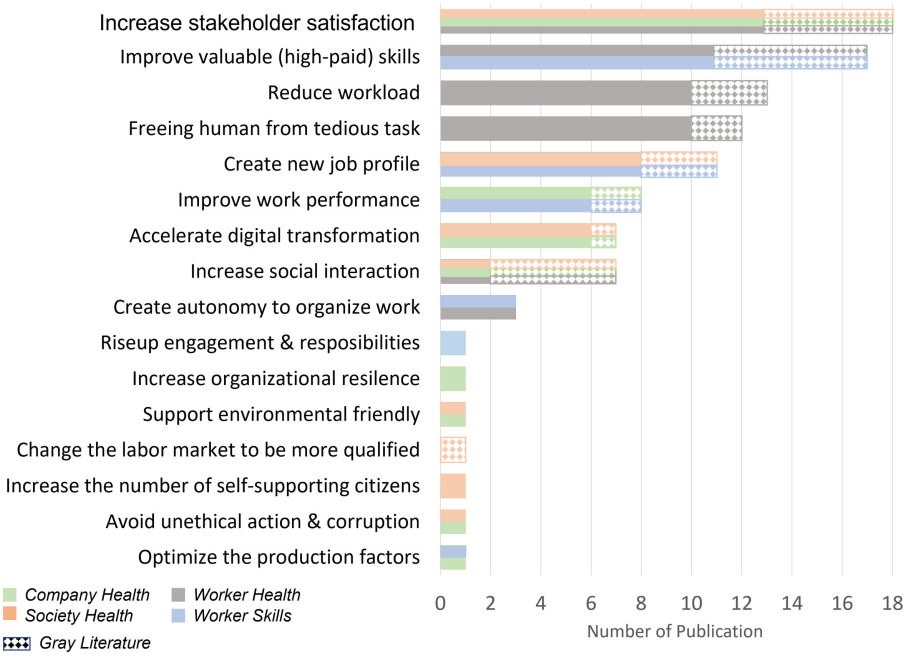

Fig. 6. Positive implications of RPA projects.

RQ2: ***What are the positive implications of RPA implementation for humans and their social environment?*** From the detailed review, the authors found the majority of publications reveal that improvement skills [6], reduction of workload [9], and freeing workers from tedious tasks [19,22], are the positive implication of RPA projects for the worker. By not performing tedious tasks, workers' workload can be reduced [9], so they can focus on value-added tasks that improve working performance [8] and social interactions, especially with customers [16]. The good and intense interactions will make customers feel valued and prioritized [22], and may potentially increase their satisfaction and loyalty. The presence of RPA as a reliable virtual assistant will increase worker satisfaction and motivate them to learn new skills, especially in the field of automation technology and digitization. These skills are essential in a digital working ecosystem, where humans and robots work side by side [30].

Several studies also reveal that the social environment (company & society health) is also affected in the form of organizational resilience [35], changing labor market [34]*, and digital society [35] (cf. Fig. 6). For society, RPA will change the labor market by creating new job profiles that support digital transformation in organizations [34]*. The old low-skilled and low-paid job profile will gradually disappear and be replaced by high-skilled and high-paid jobs, so it indirectly increases the average wage of workers [22]. In a good governance context, RPA indirectly helps workers avoid unlawful practices, such as corruption and bribery, through a transparent and accountable process [29].

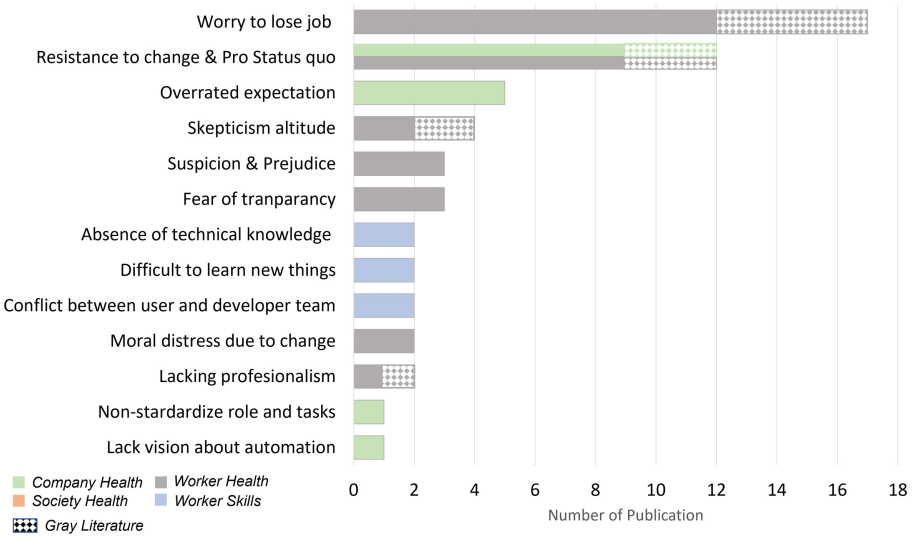

Fig. 7. Negative inputs for the RPA project.

RQ3: ***What are negative inputs from humans and their social environment that affect the implementation of RPA?*** From the detailed review, the authors found that the most negative input comes from the worker. Publications capture job loss concerns, rejection, bad attitude, lack of skill & professionalism, prejudice, and skepticism as obstacles to the RPA project (cf. Fig. 7).

When a RPA project begins, human responses can vary. It is based on different perspectives, skills, and past experiences. Humans tend to feel negative and feel rejected by automation [30]. Negative feelings or prejudices are usually triggered by fear of being unemployed [43] and the inability to meet new job requirements [29]. Another prejudice comes from IT workers or people who will develop RPA. They do not believe that RPA is better than traditional automation [9], and they also doubt whether RPA can adapt easily to any changes in the workflow [43]. The prejudices are generated resistance among people in the organization. Most of them do not want to change their old behavior and working culture [18]*. They are satisfied with the status quo and think they are too old to learn new technology [9]. The reluctance to change will lead people to an unprofessional attitude, while reluctance to learn will make people stuck as low-skilled or low-paid workers.

Several studies explain that negative inputs come not only from humans but also from the social environment (companies). Management that does not design standard workflows and human roles in the organization also slows down the process of implementing RPA [5]. Another negative input is the lack of vision and leadership from top management. Without clear direction from the leader, implementing RPA will trigger confusion and conflict within the organization [9].

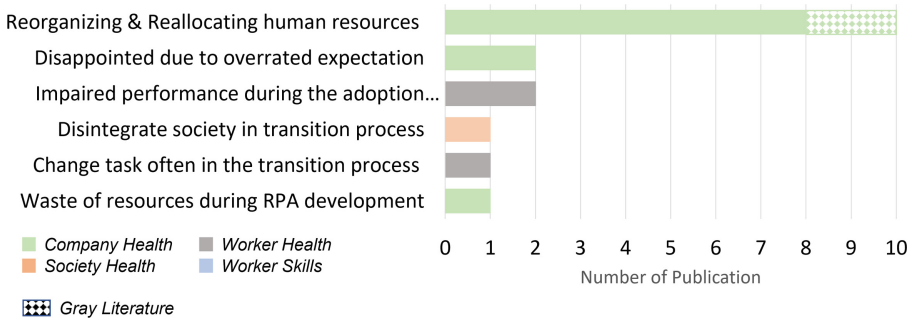

Fig. 8. Negative implications of RPA projects

RQ4: What are the negative implications of RPA implementation for humans and their social environment? Most studies see that the negative implication of RPA implementation is reorganizing and reallocating human resources (cf. Fig. 8). Implementing RPA will change the structure and role of humans in the organization. Unfortunately, it is difficult for individuals to adapt to new roles, systems, and work cultures [23]. The change requires workers to

adjust to new working norms and key performance indicators (KPI). Instead of speeding up the process and helping workers, the adjustments to automation hinder the process and frustrate workers [23]. There will be a disaster if human labor is replaced prematurely without ensuring that humans and robots can work together in a digital environment [20,30]. The shift of human role in the organization can generate internal disputes between workers and management [15]. While for society, implementing RPA will liquidate some familiar jobs such as data entry, administration staff, and others. These are the negative effects of implementing RPA on individuals in the organization and society.

4 Discussion

The VoSHI method is not only limited to RPA implementation but is also open to various technology close to humans and their social environment. To develop VoSHI, the appraiser must be able to define humans' influence (input) on technology implementation and the impact of technology on humans. Therefore, this research result comes with theoretical and practical implications, and limitations.

Theoretical Implications: This research contributes to the visualization of the added value of RPA to humans and their social environment. Although the amount of academic literature is limited, the author's survey on the socio-human implications of the RPA project is the first study on this emerging topic. In addition, the practice reports in the grey literature have enriched and confirmed survey findings. With this combination, the identified socio-human input & implications in RPA projects can be readily used in the subsequent series of the VoSHI study (quantifying and measuring tool development). This research also provides a novel lens through which organizations can consider humans in estimating and evaluating RPA projects.

Practical Implications: The most important finding of this research is that human influence in RPA implementation is essential. Fear, prejudice, and excessive expectations from humans can trigger disruption and reduce humans' interest in the RPA project. On the other hand, enthusiasm, trust, and collaborative spirit among humans can accelerate and expand the implementation of RPA. In addition, the positive implications of RPA for humans will increase productivity and create a healthy and conducive work environment. In contrast, the negative implications will reduce the added value of RPA for those involved (humans) in the organization. In practice, organizations can use the findings of this study to better understand the socio-human perspective of the RPA project.

Limitations: This research is limited to literature research, so that the findings may be just the tip of the iceberg. The grey literature used as a reference also lacks solid empirical evidence. In the future, direct observation is needed to collect new information and to validate and confirm the VoSHI parameters revealed in this study.

5 Conclusion

It is undeniable that humans have an essential role in the success of RPA projects. They are not only users, developers, or decision-makers in the company but also RPA's partners who collaborate in the digital working environment. As the current state of the art scarcely covers how humans influence and have implications from RPA [33], the current paper lays the foundation of the VOSHI framework, which will assist organizations in comprehensively evaluating RPA projects from the human perspective. For this, a systematic mapping study is conducted to review the literature and identify negative and positive influences and implications.

The literature review shows that the positive implications of RPA projects for humans outweigh the negative ones. In contrast, human influence in RPA projects is dominated by negative inputs rather than positive inputs. It means two different things: (1) It is a fact that the RPA project was refused by humans in the initial step and accepted in the end; or (2), most authors are only interested in the negative influence and positive implications on humans. Therefore, this research should not be stopped in the literature review, but must be followed by field observations or case studies. In the future, research should not only continue the VoSHI study (quantifying and developing tools) but also verify the result of today's research.

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