Adding Intelligent Robots to Business Processes: A Dilemma Analysis of Employees' Attitudes

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Abstract. Given the advancements in artificial intelligence, organizations are increasingly interested in applying robotics to their business processes. Unlike the many technological implications, we focus on the human side of robotics which remains under-investigated for higher-skilled employees. We particularly consider employee acceptance of intelligent robots with cognitive skills. During 48 interviews, hypothetical dilemmas regarding manual work, full- and semi-automation are discussed by office workers, managers and IT consultants. The results show that employees are positive about intelligent robots. The majority are willing to transfer repetitive tasks as long as humans can control outputs for accountability. However, employees prefer keeping tasks with creativity and human interaction. Many tasks can thus already be replaced by robotics, but more attention is needed for the facilitating role of organizations (e.g., training). The findings affect innovation strategies for implementing intelligent robots with reduced social implications. The idea of a step-by-step plan encourages a gradual adoption.

Keywords: Digital process innovation · Intelligent robots · Acceptance · Dilemma analysis

1 Introduction

Process innovation is of all times. The term was mainly used as from the 1990s with the reengineering wave [1]. However, during all industrial revolutions, organizations have paid attention to rethinking their way of working to obtain performance gains (e.g., higher quality, efficiency, effectiveness), and this by also reconsidering the ratio of human-machine cooperation [2, 3]. Nowadays, disruptive technologies are triggering a fourth industrial revolution, called Industry 4.0 [2]. Likewise, Industry 4.0 provides opportunities for process innovation and drastic changes in the job market, among others by artificial intelligence (AI) and robotics [3]. Nonetheless, employees have always been able to adapt their skills and entrepreneurs have created new jobs based on the technological advancements [2]. For instance, in the novel of "Charlie and the Chocolate Factory" from the mid-1960s, [4] already described a visionary leader who replaced employees by robots while Charlie's father was rehired for a new job related to machine maintenance.

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This study focuses on intelligent robots, which are one of the pillars in Industry 4.0 [3]. With the recent AI advancements, robots have become able to conduct cognitive tasks [5], and so affecting the business processes of all employee types. Questions, however, remain which jobs and which business processes (or process tasks) are desired to be replaced by robots while respecting employees' potential. In this regard, our study tackles three gaps in the business process management (BPM) literature.

- First, contemporary studies have mainly focused on job replacements by machine-based robots for manual workers in industrial sectors (i.e., often performed by lower-skilled employees) [6], rather than intelligent robots affecting the jobs of other employee types and in service sectors. For instance, [7] and [8] state that robotics are negatively correlated to the employment rate of low-skilled employees but positively correlated to high-skilled employees (i.e., after being reskilled for new job contents like data analysts). Other authors agree that digital process innovation demands for new job contents focusing on education, support, development and production of such technologies [9, 10].
- Secondly, the BPM discipline recognizes the advantages of robotic process automation (RPA), which aims to innovate repetitive tasks rather than cognitive tasks [11]. More research is needed for process automation by different types of intelligence (i.e., mechanical, analytical, intuitive and empathic), and the extent to which employees should adapt their skills accordingly [5]. Moreover, although robotics are typically associated with performance gains [12], [13] states that automating tasks is still frequently done according to Taylorism (i.e., by dividing business processes into smaller tasks and optimizing them). Nonetheless, this does not necessarily lead to full performance benefits (e.g., because of reducing employees' implicit knowledge).
- Thirdly, the ratio of human-machine collaboration raises ethical discussions and new training needs [14], which have received little attention in the BPM discipline. Some authors are concerned that digitalization will affect prosperity when many jobs disappear [12], and thus impacting on the social security systems [10]. Since employee skills need to be reconsidered, governments should promote lifelong learning and introduce educational programs to better prepare people for human-machine collaboration [7, 15].

Consequently, more knowledge is needed about the adoption of robotics and the psychological reactions of employees [16]. When robots are increasingly seen as colleagues instead of resources, the issue is raised over how people will react. A complementary human-robot cooperation requires new leadership styles, but also a new organizational culture for accepting such major changes [6]. More research is needed about the balance between technology and society for better implementing process innovations by intelligent robots [8]. Hence, our research question is:

- **RQ. Which factors explain why employees would (partly) leave their work practices (i.e., business processes) to intelligent robots?**

Our purpose is to gain insight into the employees' attitudes (e.g., points of view, concerns, needs) for using intelligent robots in daily work, and we verify for which kind

of business processes this digitalization will be more or less accepted. An interview-based research will be presented using on a dilemma analysis about hypothesized situations regarding future job contents. This article focuses on higher-skilled employees (i.e., office workers, managers and IT consultants), as a novel target group. We start from a well-established but generic IT acceptance theory [17] to thematically group a rich set of uncovered sub-factors specific to robotics and digital process innovation. Instead of theory testing, our qualitative research approach aims at distilling refinements or precautions that help organizations. This paper investigates which social problems should be addressed for organizations to adapt their policies. More specifically, by working towards a training curriculum and discussing ethical issues, we intend to derive a step-by-step plan that facilitates the gradual adoption of intelligent robots in organizations during digital process innovations.

The remainder is structured as follows. Section 2 describes related works. The research method is explained in Sect. 3, while results are presented in Sect. 4. A discussion is followed in Sect. 5. The paper concludes with Sect. 6.

2 Research Background

2.1 Digital Process Innovation and Intelligent Robots

Digital process innovation refers to the innovation of business processes by means of emerging technologies like STARA (i.e., smart technology, AI, robotics and algorithms) [18]. This paper targets intelligent robots because their applications will become more extensive given the fast developments in robotics [19]. Intelligent robots are defined as "*a machinery system that has comprehensive improvements in perception, decision-making and performance compared with a traditional robot, and can simulate human behaviors, emotions and thinking*" [40] (p. 525). A regular robot can execute the different tasks for which it is programmed. What makes a robot intelligent is that it can observe and think independently [19]. Based on their application domains, intelligent robots can be industrial robots, service robots and specialized robots [40]. Alternative classifications exist, such as based on the degree of intelligence (e.g., sensor type, interactive, and autonomous robots) [19].

An example of regular robots is RPA. The RPA-compatible tasks were initially time-consuming and with little added value [11]. While RPA remains one the most recent technological developments within BPM to reduce the costs of collecting data [11], future employees will be given more tasks of providing information to intelligent robots [20]. Most studies about the implementation of robotics, however, have been conducted in sectors like manufacturing and healthcare [21]. Among others, more research is needed for the new generation of service robots [22].

2.2 Digital Process Innovation and IT Acceptance Theory

During digital process innovation, organizations are frequently confronted with employees who are not willing to change their working methods [23]. Studies showed that the business value of new technologies can be completely erased by the rejection of

employees [24]. Nonetheless, organizations may still underestimate the importance of employees' attitudes because of the expected performance gains. For instance, [25] showed that organizations are generally positive towards smart robots, and particularly IT organizations are highly positive.

Recent studies have been conducted related to accepting process changes, STARA and robotics. For instance, [26] argued that employees' attitudes towards BPM implementation changes strongly depend on their trust in the organization's management, rather than the hierarchical position or sector. Research related to robotics showed that employees who feel less secure about their job are more likely to deal with intelligent robots in a conservative way [27]. In another study, [18] explained that a higher STARA awareness by employees is linked to a lower job satisfaction and involvement, leading to cynicism, indifference, depression and fear for dismissal. Similarly, [23] argued that employees' attitudes towards innovation primarily depend on internal factors, such as intrinsic motivation and self-confidence. Additionally, [16] showed that employees prefer to see colleagues being replaced by other people. But when it comes to their own job, employees rather choose to be replaced by robots.

Hence, a proper preparation is essential because it gives employees more confidence in robotics and therefore more intention to collaborate with intelligent robots [28]. Also human resource managers play a role for recruiting and training employees who are employable in changing circumstances [29]. However, more research is required to uncover dedicated factors that help the acceptance of intelligent robots.

[30] describe IT acceptance as the degree of users' willingness to use IT for defined tasks (i.e., tasks for which it is designed to support). A large number of models and frameworks have been developed to explain the adoption and acceptance of technologies. These models introduce factors that affect end users [31]. The unified theory of acceptance and use of technology (UTAUT) [17] is still extensively used by researchers to explain the acceptance of new IT in Industry 4.0 [32], and will therefore be used as the common basis for our study. UTAUT identifies four key factors and four moderators [17]. The key factors are: (1) expected performance, (2) expected effort, (3) social influence, and (4) facilitating conditions. The four moderators are: (1) age, (2) gender, (3) experience, and (4) voluntariness. Based on these general parameters, UTAUT can predict the behavioral intention and actual use of a technology. For our RQ, we distill dedicated sub-factors to refine the UTAUT factors and gain insight into those elements facilitating employees' acceptance of intelligent robots.

3 Dilemma Analysis as Research Method

The future-oriented research question calls for a qualitative research approach. More specifically, a dilemma analysis presents hypothetical scenarios to practitioners [33]; in our case office worker, managers and IT consultants. Since a dilemma is seen as a conflicting choice between various alternatives, there are no correct answers so that the focus is placed on the respondents' reasoning [34]. Asking about the willingness of employees to leave certain duties to intelligent robots is situational, and thus an appropriate subject for in-depth interviews. Each respondent was asked about their opinion about a situation different from the current one, and this individually in order to give each interviewee

the opportunity to clarify personal answers and to go to the heart of the hypothetical situation [35].

3.1 Selection of Respondents

Data was collected in 2019. We conducted 49 face-to-face, semi-structured interviews [36] with practitioners belonging to our university network (i.e., working at internship companies for our Master students in IT Management), of which 48 were considered complete. The pre-existing relationships with internship mentors ensured a commitment for making sufficient time available for the in-depth interviews, while simultaneously targeting the intended audience of office workers, managers and IT consultants. The average time per interview was 38 min, with a standard deviation of 13 min. The response rate was 59%, namely a total of 83 practitioners were invited, of which sixteen did not respond and eighteen refused. The main reasons for non-participation were related to a busy period at work or a holiday.

The final sample consisted of five practitioners working on the operational level, 19 working on the supportive level, 14 managers and 10 C-levels. Table 1 shows an equal division among small and medium enterprises (SMEs) and large organizations, as well as among consultancy and non-consultancy firms (i.e., across diverse sectors).

Table 1. Cross tabulation for organization sector by size.

Sector/size	Small and medium-sized enterprises (SMEs)	Large organizations	Total
Manufacturing	6	5	11
Services	3	7	10
Public & social profit	1	2	3
IT consultancy	14	10	24
Total	24	24	48

3.2 Variables

We asked whether intelligent robots can replace the respondents' job in three dilemmas (i.e., about full manual work, full automation and semi-automation). Namely:

> *"The following questions are purely hypothetical. They question your personal opinion or perception, regardless of whether your organization is currently more or less innovative. Suppose that in the future (so within an indefinite period of time) a robot would exist that is so intelligent that it can handle any activity and every process (or every series of activities). With robots, therefore, do not necessarily think of physical machines that can only take over manual labor, but also software that can take over complex thinking processes. This would mean*

that within the dilemmas everything can be achieved with technology, and that you do not have to doubt the technical feasibility. We will deal with three dilemma situations regarding your duties, and start with the first dilemma. Please consider tasks rather as a process or series of individual activities."

- ***[Dilemma 1]*** *Are there core tasks in your current duties (or work package) that you think an intelligent robot could support you with, namely through some form of semi-automation or partial automated support?*
- ***[Dilemma 2]*** *Which core tasks from your current duties (or work package) would you never want to give to an intelligent robot? In other words: you would rather continue to perform these tasks yourself.*
- ***[Dilemma 3]*** *Which core tasks from your current duties (or work package) would you like to leave completely to an intelligent robot? In other words: you can see these tasks perfectly transferable without your input.*
- ***[General attitude]*** *What is your general view of the arrival of intelligent robots that will increasingly perform work-related tasks? Why? With what score on five would you describe your opinion? (1 = negative; 2 = rather negative; 3 = neither negative/nor positive; 4 = rather positive; 5 = positive).*

For each dilemma, we asked five sub questions related to the five UTAUT independent variables (i.e., why do you think robots can be useful, easy to use, affect performance and social influence, and which facilities do you expect?) (Table 2).

Table 2. An overview of the main variables in the dilemma analysis, based on UTAUT [17].

Independent variables	Individual determinants	Organizational determinants	Dependent variable
Expected efforts: usefulness	Gender	Size	General attitude towards intelligent robots
Expected efforts: ease-of-use	Age	Sector	
Expected performance	Experience: education level	Perceived market competition	
Expected social influence	Experience: seniority in current position		
Expected facilitating conditions	Voluntariness: adoption of private IT use [37]		

3.3 Coding

A unique code was assigned per interview question. Based on the interview transcripts, the codes facilitated assigning more specific themes or labels to text excerpts [38]. By

grouping the most important labels from the first coding phases into comparative tables (i.e., analyzing by frequency and coherence with other labels), clear differences and similarities became visible. The identified concepts were thus related to each other and linked to the literature in order to extract patterns for better understanding the explanatory factors about the acceptance of intelligent robots.

We assigned 558 codes, from which 83 themes specific to intelligent robots were uncovered as sub-factors of UTAUT (Table 3). Supplementary documentation: https://drive.google.com/file/d/1Ul6VKPXiG5Ioblkwq41LGqJf8sqa2eVb/view.

Table 3. The number of factors or themes, and the underlying codes.

Main UTAUT-related factors	No. of sub-factors or themes	No. of initial codes
Task names and characteristics	30	203
Expected efforts: usefulness	15	63
Expected efforts: ease-of-use	2	59
Expected performance	15	42
Expected social influence	2	64
Expected facilitating conditions	9	90
General attitude	10	37
Total:	83	558

3.4 Evaluation Criteria

Diversity in organizational and individual characteristics stimulated data triangulation [38]. Credibility was addressed by including the UTAUT factors. Since the interviews were conducted by teams of four to six interviewers and via a semi-structured questionnaire allowing additional sub questions, personal bias was minimized. However, since all respondents were located in Western Europe and about half of them were working in IT consultancy, generalization to all sectors worldwide remained limited [35]. For instance, the public and social profit sector was underrepresented.

4 Results

We present the task names and characteristics per dilemma, before looking at the observed sub-factors underlying UTAUT and the respondents' general attitude.

4.1 Task Names and Characteristics

The work mentioned per dilemma is presented in Table 4. We observed two overlaps. Respondents had mixed opinions about doing accountancy work, namely whether it

should be fully automated or semi-automated. The second overlap related to work planning and matching employees' availability to tasks or projects, with a discussion about semi-automation or no automation.

The work described per dilemma was characterized differently (Table 5). In the "no automation" dilemma, work was seen as social, creative and dealing with sensitive material. While the fully automated work was described as time-consuming and non-value adding, the semi-automated was rather dependent on various factors.

Interestingly, the three dilemmas were characterized by knowledge-intensive tasks but for different purposes, namely data-intensive for "semi-automation", contextual decision-making for "no automation", and processing a large amount of mails or testing for "full automation". Also the non-knowledge-intensive tasks were differently described, namely for computing complex data in "semi-automation" and no-brainer tasks in "full automation" situations. Likewise, the non-creative tasks had a different interpretation, namely for conformance checking with manual interventions in "semi-automation" and merely following well-defined rules in "full automation" situations.

Table 4. Top-5 of frequently mentioned task names per dilemma (N = 48).

	Semi-automation (no. of respondents)	No automation (no. of respondents)	Full automation (no. of respondents)
1	Doing accountancy work (8 respondents)	Managing customer relationships (16 respondents)	Doing accountancy work (9 respondents)
2	Collecting, analyzing and reporting on data (8 respondents)	Coaching and talent reviews (9 respondents)	Doing administrative work (7 respondents)
3	Gathering requirements, modelling and analyzing processes (7 respondents)	Directing employees, delegating tasks (5 respondents)	Programming software and software testing (7 respondents)
4	Managing contracts (2 respondents)	Planning work and matching employee availability to tasks (5 respondents)	Managing timesheets (6 respondents)
5	Planning work and matching employee availability to tasks (2 respondents)	Determining a business strategy (2 respondents)	Managing meetings (5 respondents)

Table 5. Top-5 of task characteristics per dilemma (N = 48).

	Semi-automation (no. of respondents)	No automation (no. of respondents)	Full automation (no. of respondents)
1	Can be knowledge-intensive (e.g., data-intensive) or not knowledge-intensive (e.g., computing complex data) (37 respondents)	Social (e.g., importance of human interaction), also for motivating/convincing (43 respondents)	No-brainer tasks (e.g., repetitive or not-knowledge-intensive tasks) (36 respondents)
2	Repetitive (e.g., generic and/or frequently done) (30 respondents)	Knowledge-intensive (e.g., contextual decisions) (25 respondents)	Non-creative, following well-defined rules (15 respondents)
3	Non-creative (e.g., conformance checking) (14 respondents)	Creative thinking, solution-oriented thinking (23 respondents)	Knowledge-intensive (e.g., processing data such as mails or testing) (15 respondents)
4	Variable input and/or output (11 respondents)	Human language and empathy (15 respondents)	Time-consuming (3 respondents)
5	Dependent on many different factors (9 respondents)	Sensitive or confidential material (14 respondents)	Non-value adding (2 respondents)

4.2 Expected Efforts: Usefulness and Ease-of-Use

The perceived usefulness arguments are given in Table 6. For the "no automation" dilemma, manual work was esteemed useful for human contact (i.e., to support or convince people) as well as for non-factual decision-making. It was raised that people do not like talking to robots and that the elimination of human contact is unethical.

Table 6. Top-5 of usefulness arguments per dilemma (N = 48).

	Semi-automation (no. of respondents)	No automation (no. of respondents)	Full automation (no. of respondents)
1	More time for specialization or value-adding tasks (12 respondents)	Importance of human contact (30 respondents)	Boring tasks do not motivate and are often neglected (15 respondents)
2	Robots have a high computational capacity (7 respondents)	Robots lack empathy and cannot think creatively (30 respondents)	More time for customer interaction and specialization (4 respondents)
3	Robots can provide an overview of suitable alternatives (4 respondents)	For non-factual decision-making (10 respondents)	Robots have a high computational capacity (2 respondents)
4	Decreasing random decisions (2 respondents)	People do not like talking to robots (10 respondents)	Robots are self-learning (2 respondents)
5	Effort savings (2 respondents)	Unethical to stop human contact (5 respondents)	Streamlining business processes (1 respondent)

In the "full automation" dilemma, robots were considered useful for so-called boring tasks to give employees more time for specialization and customer interaction. Robots were also appreciated for their computational and self-learning capacity.

While similar arguments applied to the "semi-automation" dilemma, the focus was also on the specialization opportunities for employees (e.g., regarding creative or managerial tasks, for coaching, for decision-making, for interpretation and customer-related issues), and so making better use of people's full potential.

Regarding ease-of-use, all respondents agreed that the "no automation" dilemma remained difficult to digitalize. This was mainly because: (1) communication and emotions are complex (e.g., underlying meanings, body language, cultural differences) (35 respondents), (2) seeking consensus requires discussion (13 respondents), (3) trustful and respectful human relationships are of high value (10 respondents), (4) external or non-defined factors (e.g., strategy, planning) are to be considered (9 respondents), and (5) tailoring or customization is complex (5 respondents).

Differentiated views were presented in the other dilemmas, albeit with similar arguments. Twenty-nine respondents considered the use of intelligent robots difficult for "semi-automation", while 19 respondents found it simple. For the "full automation" dilemma, 28 respondents agreed with simple while 15 said it would be difficult.

4.3 Expected Performance and Expected Social Influence

The expected performance gains were similar for "semi-automation" and "full automation", namely highly related to time and cost savings, and quality gains (Table 7). The reasons why intelligent robots would not trigger such performance incentives in the "no automation" dilemma involved the personal touch, complex interactions, individual decision-making and accountability for risks.

Interestingly, the performance gains were critically addressed by five respondents in the "semi-automation" dilemma (i.e., because robot set-ups take time and robots cannot prevent errors) and three respondents in the "no automation" dilemma (i.e., because quality and shared ideas outweigh performance) (Table 7).

The expected performance seemed linked to the expected social pressure. Most respondents were expecting positive stimuli for the "no automation" dilemma (44 respondents), followed by 34 respondents for "full automation", and 28 respondents for "semi-automation". Positive stimuli were seen from the Board, shareholders, market and competitors (i.e., for performance gains), but also from employees (i.e., for facilitating jobs), and customers and stakeholders (i.e., for quality). Negative pressures were expected from employees and trade unions because of a fear for job losses, privacy, IT security and ethical concerns (e.g., being accepted as humans).

Table 7. Top-5 of performance arguments per dilemma (N = 48).

	Semi-automation (no. of respondents)	No automation (no. of respondents)	Full automation (no. of respondents)
1	Time savings (40 respondents)	Allowing for a personal touch (18 respondents)	Time savings (34 respondents)
2	Higher quality (13 respondents)	Interpreting complex conversations and body language (18 respondents)	Higher quality (12 respondents)
3	Performance advantages should not be overestimated (5 respondents)	Allowing refinements, not just rational thinking (17 respondents)	More time for core business and value-adding tasks (8 respondents)
4	Less delays (3 respondents)	Taking accountability (8 respondents)	Higher employee satisfaction (5 respondents)
5	Cost savings (3 respondents)	Shared ideas are more important (3 respondents)	Cost savings (5 respondents)

4.4 Expected Facilitating Conditions

Major findings were observed across nine groups of facilitation needs (Table 8).

Table 8. Main needs for facilitation across the dilemmas (N = 48).

Facilitation needs	Number of respondents
Training, coaching, reskilling	48 respondents
Mindset for change	16 respondents
Top management actions	16 respondents
Budget investments	15 respondents
Employee involvement	14 respondents
IT aspects	11 respondents
Reconsideration of work (i.e., business processes and rules)	11 respondents
Ethics and guarantees to employees	13 respondents
Time investments	10 respondents

4.4.1 Training, Coaching and Reskilling

Organizations should consider internal and/or external courses for reskilling employees. Besides training in business knowledge, a new curriculum should include:

- Training in how a robot works (e.g., explaining which data is accessed and why, and which capacity robots have)

- Training in how to interact with, control and correct robots
- Training in new job contents (e.g., estimating which input is needed, monitoring and analyzing master data, interpreting output, and conceptual thinking).
- Training in people interaction and empathy (e.g., coaching).

Such courses should supplement on-the-job learning. Extra facilities should be given during work by means of: (1) instruction manuals on how to use intelligent robots, (2) 24/7 support teams or service desks (e.g., for questions, problems, and to set-up robots), and (3) basic IT support (e.g., for tools like MS Excel, a mailbox). It is important to create a learning organization, not only by providing training but also by stimulating informal contacts (e.g., for networking and asking for advice), and by allowing experts to transfer knowledge to other employees (e.g., to inspire as coaches)

4.4.2 Mindset for Change

Organizations should let their employees think more about innovation by applying change management to facilitate adoption. Most importantly, managers should preach values like efficiency, empowerment, entrepreneurship and team spirit, while employees should also be formally appraised for considering those corporate values. Such values can become tangible by stimulating collaboration between teams or departments. Corporate communication should focus on creating trust in intelligent robots, among others by offering success stories to prove evidence, informing how robots and employees can add value without job losses (i.e., intelligent robots should not be seen as a threat nor intimidation), as well as emphasizing the advantages for employees and customers. Innovation can also be stimulated by alternative work variants like homeworking for a better work-life balance and incentives by self-driving company cars.

4.4.3 Top Management Actions

Top managers should have a clear vision and strategic objectives derived from a business case with related automation projects. By conducting return-on-investment (ROI) calculations, robot performance can be assessed (e.g., possibly switching back to manual work). Also benchmarking is needed, both internal and with competitors.

4.4.4 Budget Investments

Budget investments are not only needed to finance robotics, but also to invest in sufficient resources (i.e., including staff) and more commercial data as input for robots. Budget is needed for an expert to experiment with robotics via trial-and-error.

4.4.5 Employee Involvement

Organizations should consult employees when deciding on the robots' tasks, inputs and outputs. It is essential to ask advice or feedback from all employee types, each with their own competencies. Employees should not only be involved during the preparation and transition period, but also after the robot implementation to stimulate knowledge sharing among colleagues (e.g., sharing customer experiences).

An alternative view on employee involvement is out-of-the-box job counselling to help employees orient themselves to new job positions, including brainstorming about personal wishes and employee participation.

4.4.6 IT Aspects

Organizations should invest in IT infrastructure and excellent Internet connection, as well as continue to support basic IT tools (e.g., MS Excel). They should stay up-to-date about IT trends (e.g., via conferences or training by IT consultants). Before robot implementations can be made, organizations should have workshops with technical people. Both internal developments and IT outsourcing should be considered, and consultants should be hired when extra knowledge is required on a certain topic.

4.4.7 Reconsideration of Work (I.E., Business Processes and Business Rules)

Before considering robotics, business processes and business rules should be rethought first. Well-described business processes and procedures help employees know what is expected from them.

4.4.8 Ethics and Guarantees to Employees

Organizations should create an ethical framework that states what robots are allowed to do, while also analyzing and justifying the human-related side effects (e.g., reskilling needs, downsizing, and burn-outs). Also privacy seems a struggle, which requires organizations to explain which personal data is monitored for what purpose. Employees wish strong employer commitments by means of some guarantees, like:

1. Guarantee that intelligent robots are able to perform the tasks to be automated (i.e., to build up confidence in robotics)
2. Guarantee that employees can control a robot's output for accountability
3. Guarantee that internal expertise of automated processes remains (i.e., having employees who know which process changes can occur)
4. Guarantee that robots are not used for talent management (e.g., not for personal promotions or dismissals)

4.4.9 Time Investments

Organizations should take time for a transition period (i.e., combining the old and new ways of working), and start with a trial or pilot. Experts should get time to make robots smarter, and employees need timeslots to participate in innovation projects.

4.5 General Attitude Towards Intelligent Robots

The vast majority felt positive about intelligent robots. Although multiple respondents added critical reflections, Fig. 1 shows that only 7 out of 48 respondents translated their concerns into a neutral or rather negative attitude (i.e., score 2 and score 3 on a 5-point Likert scale).

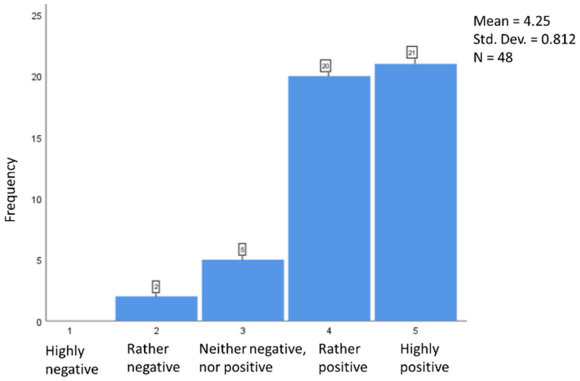

Fig. 1. Histogram of the general attitude towards intelligent robots (N = 48).

The comments are summarized in Table 9. Since the critical comments require extra efforts from organizations or governments, we now elaborate on them.

Table 9. Main comments typifying the respondents' general attitude towards robotics (N = 48).

Tone	Reasoning	Number of respondents
Neutral comments	Natural evolution in society	11 respondents
	Uncertainty (wait-and-see)	7 respondents
	Evolution in IT	3 respondents
Optimistic comments	Changes in and creation of job contents	20 respondents
	Increased job satisfaction	14 respondents
	Solutions to society	2 respondents
Critical comments	Fears of employees	17 respondents
	Inclusion/exclusion in society	11 respondents
	Ethical concerns	9 respondents
	Lack of education and reskilling needs	7 respondents

The fear for job losses should not be underestimated. Besides the need of a mindset that fosters change, businesses should recognize that job variety is important (e.g., repetitive tasks help employees to relax). Repetitive tasks should also exist for employees who are not capable of doing creative work to avoid a social gap. Ethical concerns were repeated regarding the use of medical or privacy data (e.g., robots should not decide about euthanasia) and accountability (e.g., who is responsible when robots cause defects). Governments should control that robots are properly used. Because finding IT-skilled employees remains difficult, governments should also change educational programs for teaching more on creative thinking and logical reasoning.

5 Discussion

Although our next research step is to consider the individual and organizational determinants as well (Table 2), our work has launched a call for not only looking at robotics for acquiring economic sustainability (i.e., performance gains), but also for considering the social sustainability of work (i.e., in organizations and in society).

Our findings attempt to stimulate the integration of intelligent robots in the business world. The overview of tasks that office workers, managers and IT consultants usually want to leave to robots require relatively little persuasiveness when implementing robotics. On the other hand, we clarified which tasks those higher-skilled employees prefer to perform themselves. For the latter, organizations can set a proper innovation strategy to involve their staff. New job contents are likely to focus on robot maintenance and controlling, while training curricula are needed which focus on creativity, exception handling and value-adding tasks (e.g., conceptual thinking and the interpretation of data instead of operational data input).

5.1 Research Agenda

Besides social sustainability, green sustainability deserves attention as well (e.g., the energy consumption or recycling of intelligent robots) [39].

Furthermore, research is needed to investigate how employees deal with the fact that robots are able to show empathy because Sect. 4.1 until Sect. 4.3 focused on empathy-related aspects in the "no automation" dilemma. Scholars can also investigate a more differentiated transition to intelligent robots among different types of higher-skilled employees. This transition might affect the state of mind about team work as well (Sect. 4.4.2).

Since the ethical aspects were only considered to a minor extent in Sect. 4.4.8, additional work can reflect on how far society can go in robotics. For instance, if robots become able to replace business executives and CEOs, to which extent will they take over our human-based economy, and how would robots be taxed in the future? The latter is especially crucial for countries with a budget deficit, and to address societal issues related to inequalities between rich and poor.

Finally, Sect. 4.5 emphasized that the labor market determines the direction of education (i.e., starting in primary and secondary schools). For instance, should governments cancel certain specialization areas while defining more future-proof areas? Perhaps automation can offer training solutions by using more digital platforms.

5.2 Step-by-Step Plan for a Gradual Adoption of Intelligent Robots

Based on the UTAUT facilitation factor and the nine uncovered sub-factors (Sect. 4.4), we have derived a step-by-step plan for organizations to better guide their employees through the implementation of intelligent robots. This roadmap allows organizations to reduce the implementation costs by facilitating employees to follow process innovations with intelligent robots faster and more efficiently (Table 10). Business executives and

managers are advised to timely respond to employees' opinions. Alternatively, technology developers can respond to these needs and particularly employee aversion to intelligent robots.

While Table 10 is derived from our interviews, additional evaluations are required to examine how far this roadmap can lead to the desired goal of digital process innovation by intelligent robots.

Table 10. Roadmap for gradually adopting intelligent robots in process innovation projects.

Facilitation needs	Before implementation	During implementation	After implementation
Training (Subsect. 4.4.1)	• Start reskilling • Also focus on business knowledge	• How robots work • How to interact with robots (input/output)	• Offer a support desk • Learn on-the-job • Share knowledge
Mindset (Subsect. 4.4.2)	• Rethink values • Collaborate	• Apply change management to build trust	• Apply human resource management
Top management (Subsect. 4.4.3)	• Create a vision and business case for innovation projects • Start with quick wins • Calculate pre-ROI	• Check ROI • Possibly readjust the project (with more or fewer robots)	• Calculate post-ROI • Share as success story • Continue benchmarking
Budget (Subsect. 4.4.4)	• Collect data • Buy and experiment with robots (experts)	• Provide sufficient resources (also staff)	• Invest in more data (especially customer-related)
Employee involvement (Subsect. 4.4.5)	• Allow trial-and-error • Stimulate coaching • Job counselling	• Consult for the robots' input and output	• Allow for controlling robots • Talk about customers
IT aspects (Subsect. 4.4.6)	• Start from an IT architecture • Provide 24/7 Internet (Wi-Fi, backups)	• Consider outsourcing and/or internal developments	• Observe IT trends • Invest in IT licenses
Work (Subsect. 4.4.7)	• Rethink work alternatives	• Document innovated work	• Follow business processes
Ethics (Subsect. 4.4.8)	• Be GDPR compliant • Give guarantees	• Explain privacy and security issues	• Conduct periodical conformance audits
Time (Subsect. 4.4.9)	• Free timeslots to innovate (employees)	• Start with a pilot • Use transition periods	• Free timeslots for self-learning (experts)

6 Conclusion

The UTAUT factors have helped us uncover sub-factors for explaining the attitudes of office workers, managers and IT consultants towards adding intelligent robots to business processes. The study concludes that those employee types generally see robots and employees as complementary. While the majority of respondents do not bother leaving administrative and repetitive tasks to intelligent robots, some tasks are preferably not to be replaced because of customer interactions and creativity. In follow-up research, we dig deeper into the individual and organizational determinants.

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