

# Employee Well-being and Organisational Performance: a Serious Game for Investigating Perceived Social Impacts of Digital Technologies

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**Abstract.** The rapid spread of digital technologies is changing work systems and how people do their work. The positive and negative impacts of these technologies have heatedly discussed by researchers and practitioners. However, there is little research on how people perceive the impacts of digital technologies from both individual and organisational perspectives. To contribute to this issue, the present study aims to develop a serious game for collecting data about players' perceptions and decisions in virtual organisational activities. The characteristics of the developed game are that players select their criteria for impact assessment and that they solve organisational problems by traditional or technological solutions. This paper proposes the game rules and processes and demonstrates an analysis of collected data.

**Keywords:** Serious game, Digital technologies, Well-being, Organisational performance, Social impact, Data collection

## 1. Introduction

The rapid evolution of digital technologies and their uptake by society have spurred a debate on their impact on human beings (Burr et al. 2020; Floridi et al. 2018). There are praises for their potentials to transform business processes and improve productivity in manufacturing and service industries. For example, AI applications may eliminate a lot of unproductive jobs; and VR-based training is expected to enhance workers' capabilities effectively. In contrast, there are concerns about the dark side, such as ethical issues in data governance, jobs at risk, and excessive surveillance. The positive and negative social impacts of digital technologies have become an emerging topic to be studied.

Work systems and workers' capabilities have been significantly influenced by technologies (Cascio & Montealegre 2016). Recently, scholars have examined the impacts of digital technologies on creativity, learning, and business relationships (e.g., Oldham & Da Silva 2015). From a managerial perspective, these studies provide helpful implications to justify the adoption of new technologies. However, there is little research on how people perceive the impacts of digital technologies from a multi-level perspective.

In the work context, this question is meaningful because it has an innate dilemma between individual preferences and organisational behaviours (Taris & Schaufeli 2014). For example, digital surveillance technology seems to increase organisational performance by identifying unproductive behaviours of workers. Simultaneously, it must be stressful for individual workers, and the organisation may be distrusted. Given such a dilemma, how people assess the impact of the technology and whether they adopt it or not are promising questions that will contribute to the discussions.

To address these questions, we aim to develop a serious game regarding the adoption of digital technologies at the workplace and their impacts on individual employee well-being and organisational performance. Serious games are games designed to acquire knowledge or skills through playful applications (Dörner et al. 2016) but can be used for collecting data from collective activities of people playing the game. Our serious game, named “Fridge Factory”, was designed to acquire data about the players’ perceptions and decisions in virtual organisational activities. In this paper, we propose the game rules and process and provide a case study that demonstrates data collection and analysis through the game.

## 2. Literature background

### 2.1 *Technology and social impacts*

Although digital technologies have been becoming an infrastructure, there are few studies about how it is altering work systems (Cascio and Montealegre, 2016). Ball (2010) studied workplace surveillance practices ranging from traditional to technological ways. Cascio and Montealegre (2016) reviewed the positive and negative effects of the four digital technologies: electronic monitoring systems, robots, teleconferencing, and wearable computing devices. Their review implied that what technologies affect can be classified into individual well-being (e.g., stress, autonomy) and organisational performance (e.g., productivity, time allocation).

Well-being means a good state and functioning life. Psychological studies have highlighted the multi-faceted nature of well-being and developed various theories and measurement scales. For instance, self-determination theory explains that fulfillment of the fundamental psychological needs (autonomy, competence, and relatedness) predicts higher subjective well-being (Ryan and Deci, 2000). Since worker well-being and worker performance are strongly related to an individual level (Nielsen et al., 2017; Taris and Schaufeli, 2014), well-being has been applied to workplace assessments for recent years. On the other hand, the rapid spread of digital technologies calls for concerns about its negative impacts on well-being discussed as “digital well-being” (Burr et al., 2020).

The performance of an organization or company is not merely the sum of individual workers’ performance (Taris and Schaufeli, 2014). This is because organizational performance is measured not only by drivers (e.g., time-related, cost-related, and process performance) but also by outcomes (e.g., financial, customer, and society/environmental performance) (Hubbard, 2009; Van Looy and Shafagatova, 2016). The relations between organizational performance and individual well-being are not simple. As Taris and Schaufeli argued, “increasing organizational performance may sometimes require that much effort is invested in maximizing employee well-being, whereas in other cases organizational performance is promoted by restricting employee autonomy in order to

increase efficiency” (Taris and Schaufeli, 2014, p. 28).

## 2.2 *Serious gaming*

Gamification of non-game content has already found its way into various disciplines. In the area of training and simulation, for example, games in single or multiplayer mode are used. Furthermore, Serious Games are used in various service areas. A large field of application of serious games is in education, which is similar to the area of training and simulation. The general purpose of gamification is to acquire knowledge, skills, or competencies in different areas through playful applications (Dörner et al., 2016). These games are aimed at teaching people and generating a recognizable added value, which also has a benefit outside the artificial world (Harteveld et al., 2010). Furthermore, there is another feature of serious games, which will be used in combination with the educational benefit. Games can be used for collecting data from players. These specific types of serious games are called “games with a purpose” (von Ahn, 2006). Games with a purpose can make use of the collective activity of people playing the game to collect data, information on common sense, or to solve problems by combining the knowledge of several players.

## 3. **Fridge Factory: Game description**

### 3.1 *Method*

The procedure of developing a game can be divided into the following basic steps: development of the game idea, the game design, game architecture, and the production of the game (Dörner et al., 2016, pp. 17-20). Our development process is therefore based on the models of Harteveld et al. Harteveld et al. and Strahinger and Leyh (2017). Harteveld et al. (2010) do describe an important specialty regarding the development of serious games. According to them, the content of a design process for serious games needs to be based on merging three components: game, reality, and meaning. This includes the used technology for the game, the learning procedure, and acquisition of competencies as well as the relationship between the game content and issues relevant to reality (Harteveld et al., 2010, p. 324). The practical implementation of the development process is based on the methodology of Strahinger and Leyh (2017) and consists of these six steps: exploration, analysis, idea, design, production, and go live.

### 3.2 *Game structure and process*

Referring to the development process, we designed and prototyped our serious game named “Fridge Factory“. A play of this game requires 4 players and 1 game master. The basic setting of this game is as follows. Players are working for the same company that produces, sells, and distributes refrigerators. The company has a lot of problems regarding production, management, employee health, sustainability, etc. The managing director of the company has put players into charge to find the underlying cause of these problems and to support them with the necessary resources. The goal of players is to adopt the best solutions that solve the problems and bring greater employee well-being and organisational performance.

The game components include the following five types of game cards (Figure 1):

- 24 criteria cards: consist of 12 individual well-being and 12 organisational performance, identified in the authors' literature review. These cards represent different indicators to measure the impacts of solutions.
- 16 problem cards: describe various problems that occurred in the company.
- 16 solution cards: include 8 technological solutions and 8 traditional solutions. Every technological solution has a substantive traditional card. The solution cards have a predefined positive/negative impact on every criterion and problem card, but players are not allowed to know it.
- 8 event cards and 5 cooperation cards: are not essential but introduced to make the game exciting.

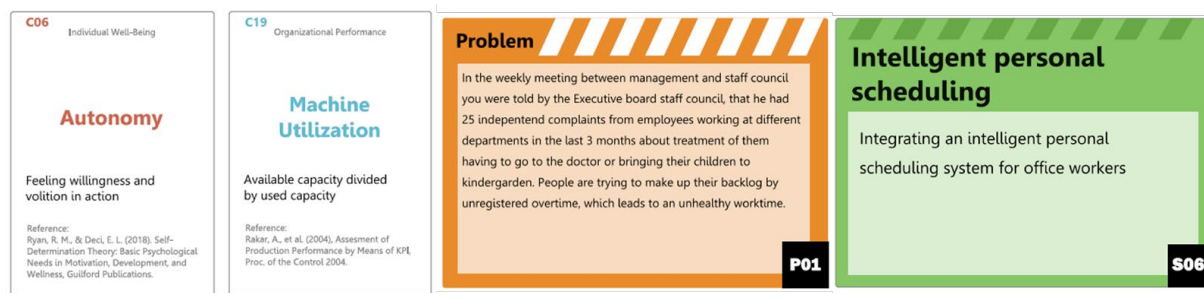


Figure 1. Game components

The game process can be divided into three phases:

- **Preparation.** Every player selects 3 from individual well-being cards and 3 from organisational performance cards and then allocates weights to them (1, 3, or 5). The weighted 6 cards form the player's criteria to measure the impact of solutions. Besides, the game leader lays out all the solution cards face up, and makes up the deck of problem cards.
- **Game round.** Every player has to pick up a problem card from the deck. To solve the problems, each player introduces a solution. The solution has to fit with the picked problem as well as with the criteria. It has to be chosen rationally, otherwise, it can be beneficial for the individual well-being criteria but detrimental for the organisational performance criteria and vice versa. To make a careful choice, players have to take the impacts of solutions in consideration. After every player chose a solution, the score of each round is calculated from the weighted sum of predefined impacts of the chosen solution. At the end of specific rounds, players draw event or cooperation cards.
- **Ending of the game.** The game ends after repeating four rounds. The winner is determined by the sum of round scores.

Through this game process, a variety of data can be collected. Table 1 summarises the data and relevant game design. Some of the data are directly connected to the purpose of this paper, and others are indirectly related to the subject of this study.

**Table 1.** Collectable data

Collectable data	Relevant game design
Perceived impact of digital technology	Impact assessment by individual players
	Pairwise technological and traditional solution cards
Belief and preference for well-being	Criteria selection by individual players
Belief and preference for organisational performance	Criteria selection by individual players
Preference for technological and traditional solutions	Pairwise technological and traditional solution cards
	Choice of solution cards
Priority of individual and organisational perspectives	Choice of solution cards
	Impact assessment by individual players
Player attributes	-

#### 4. Case study

The serious game was played in twelve individual games from the 30th of November until the 11th of December 2020 with 43 German students of the lecture Production Planning and Control at the University of Applied Sciences and Arts in Lemgo, Germany. Due to the global pandemic COVID-19 during 2020, the game was played online. Instead of picking cards from stacks, the criteria and solutions cards were provided in a PDF file. Additionally, four problem sets with problems in a random order have been prepared. During a game, the problems of one problem set were sent to each player in a private chat provided by the employed web conference tool. 72% of players were male and 28% female students with an average age of 24 years.

Our data analysis addresses two research questions: (1) Do players show a preference when selecting between well-being and performance criteria and, if yes, which criteria do players prefer? (2) Do players decide indifferently when choosing between traditional or technological solutions, or do they tend to choose one category over the other? To answer the first research question, we counted the frequencies the players picked each well-being criterion. A one-way Pearson Chi-Square test rejects the null hypothesis that each criterion was selected with the same frequency ( $\alpha = 0.05$ ). That result indicates that the players more often select some criteria over others. The three most commonly chosen criteria for individual well-being were Health, Work-Life-Balance, Personal Growth, and organizational performance: Employee Motivation, Waste, and On-time Delivery.

For answering the second research question, we used the frequencies of players choosing a traditional solution (= 106) or a technological solution (= 66). A two-sided binomial test ( $\alpha = 0.05$ ) rejects the null hypothesis that the probability of a player choosing either a traditional or technological solution equals 50%. That indicates that players tend to tackle the problems given in the game with traditional instead of technological solutions. In a discussion with the players after each game, the players expressed themselves sceptically towards the introduction of technological and thus digital solutions to increase individual well-being since it necessitates accessing sensitive data of the individual.



## 5. Discussion and conclusion

In this paper, we developed a serious game regarding the adoption of digital technologies in workplaces. Players prepare their criteria to assess the impacts of technological and traditional solutions, considering employee well-being and organisational performance. This paper would contribute to theory and practice in two ways. First, the developed game can be used to involve people in a debate on digital technologies. The game could behave as a “boundary object” that facilitates communications among people from different standpoints. For example, it could catalyse dialogues between managers who promote the digitalisation of their business processes and experts who tend to resist the adoption of new technology. Second, the game is useful for researchers collecting data related to the subject of this paper. As shown in Table 1, this game can be used to collect a variety of data including data that are beyond the scope of this paper. In addition to this, by collecting data in different cultural areas, new insights about the intra- and intercultural differences could be induced. This paper also connotes some limitations. Foremost, although we provide a pilot case study in Germany, we have not fully validated the ability of this game to collect data yet. The data gathered by using this game can include biases caused by the game systems. Our future works will address this issue and present findings by statistical data analyses.

## 6. References

- Ball K (2010) Workplace surveillance: An overview. *Labor History* 51(1): 87–106.
- Burr C, Taddeo M, Floridi L (2020) The Ethics of Digital Well-Being: A Thematic Review. *Science and Engineering Ethics* 26: 2313–2343.
- Cascio WF, Montealegre R (2016) How Technology Is Changing Work and Organizations. *Annual Review of Organizational Psychology and Organizational Behavior* 3: 349–375.
- Dörner R, Göbel S, Effelsberg W, et al. (2016) *Serious Games: Foundations, Concepts and Practice*. Heidelberg: Springer Verlag.
- Floridi L, Cows J, Beltrametti M, Chatila R, Chazerand P, Dignum V, Luetge C, Madelin R, Pagallo U, Rossi F, Schfer B, Valcke P, Vayena E (2018) AI4People - An Ethical Framework for a Good AI Soc.: Opportunities, Risks, Principles, and Recommendations. *Minds and Machines* 28(4): 689–707.
- Harteveld C, Guimarães R, Mayer IS, Bidarra R (2010) Balancing Play, Meaning and Reality: The Design Philosophy of LEVEE PATROLLER. *Simulation & Gaming* 41(3): 316–340.
- Hubbard G (2009) Measuring organizational performance: beyond the triple bottom line. *Business Strategy and the Environment* 18(3): 177–191.
- Nielsen K, Nielsen MB, Ogbonnaya C, Käsälä M, Saari E, Isaksson K (2017) Workplace resources to improve both employee well-being and performance: A systematic review and meta-analysis. *Work and Stress* 31(2): 101–120.
- Oldham GR and Da Silva N (2015) The impact of digital technology on the generation and implementation of creative ideas in the workplace. *Computers in Human Behavior* 42: 5–11.
- Ryan RM and Deci EL (2000) Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist* 55(1): 68–78.
- Strahinger S and Leyh C (2017) *Gamification Und Serious Games, Grundlagen, Vorgehen Und Anwendung*. Berlin, Heidelberg: Springer Verlag.
- Taris TW and Schaufeli WB (2014) Individual well-being and performance at work: A conceptual and theoretical overview. In: van Veldhoven M and Peccei R (eds) *Well-Being and Performance at Work: The Role of Context*. London: Psychology Press.
- Van Looy A and Shafagatova A (2016) Business process performance measurement: a structured literature review of indicators, measures and metrics. *SpringerPlus* 5(1): 1–24.
- Von Ahn L (2006) Games with a Purpose. *Computer* 39(6): 92–94.

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