

# Early detection of human-related risks in an increasingly digitized work environment

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## Abstract

**Purpose** – Human-related risks are practices in a given organization that lead to harmful behaviors that prevent managers and their teams from achieving goals. The purpose of this article is to enable the organization to provide a preventive and simple response to risks in the event that deterioration in employee well-being is detected.

**Design/methodology/approach** – In the literature, many questionnaires based on a variety of metrics have been developed and tested to measure and assess the quality of work life (e.g. stress, commitment, satisfaction, etc.). The approach of this study was to identify the most meaningful items and combine them into a unique score integrated into an effective decision-making module.

**Findings** – A long process of trial and error was necessary to collect confidential information from employees, both anonymously and longitudinally, to measure well-being in the workplace objectively and globally. The unique score generated provides an indication of potential human risk.

**Research limitations/implications** – This research and its practical implementation have demonstrated the importance of personal-data protection and the need to work harder to maintain employees' digital trust while using a digitized tool.

**Practical implications** – Development of a new app that was used for the first time to regularly assess ill-being in several companies.

**Social implications** – The social implication of this research is to contribute to health policies related to well-being in the workplace.

**Originality/value** – To the authors' knowledge, this is the first time that a software module measuring the human risk of an entire company has been embedded in Enterprise Risk Management (ERM).

**Keywords** Human risk, Digital transformation, Digitized work environment, Occupational stress, Workplace well-being, Data protection, Early detection, Personal data protection, Digital trust

**Paper type** Research paper

## 1. Introduction

From a managerial point of view, human risks (or psychosocial risks) include all employee attitudes that lead to behaviors in conflict with company objectives. These risks are no longer considered to be only a matter of individual and public health. Rather, they are viewed as a



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management issue that is all the more crucial business and social interactions are redefined in a context of digital transformation.

The annual costs of workplace stress are quantified in the European Union at 617 billion € (Matrix, 2013). This sum includes the costs supported by the employer due to absenteeism and presenteeism (272 billion), loss of productivity (242 billion), treatment costs (63 billion) and social benefits paid in the form of disability allocations (39 billion). The repercussions of stress are multiple and manifest themselves at different levels that we will see in the following of our research.

So how do we mitigate this problem of human risk? Until now, companies have used long and accurate but partial surveys, carried out at best every year, often less frequently. This leaves ample time for risks to materialize, gain momentum and cause significant damage.

Moreover, according to a study published in *Always Designing for People* (2019), only 30% of respondents would feel comfortable talking about a mental health issue at work, of which only 13% would feel comfortable talking about it to their human resources (HR).

Our research asks how to proceed to an early detection, and thus to be protected from the human risk, in a world where the human is becoming employed to the benefit of its association with the digital? Our paper presents an approach to develop a unique score based on the production of new knowledge translated into a digital tool.

Even if digitalization could be one more stressor, it cannot be avoided and we chose to exploit it to counter its misdeeds. Surveys used by companies are based on scientific studies using precise and complete questionnaires that require a lot of time for the researchers to conduct the study and analyze the results. The objective of this research is to build on proven scientific knowledge to create a new and simple measurement tool implemented in an ergonomic data collection system that can regularly calculate a global human risk score of a given organization. Such objective is based on the belief that it is necessary to detect this type of risk as early as possible before it causes significant damage. Indeed, companies need to identify all factors, such as stress or employee dissatisfaction, leading to harmful behavior that prevents managers and their teams from achieving their objectives. Over the years of our project the research questions we considered were:

- (1) “What are the important and significant dimensions to be measured on a regular basis to capture the essence of human risks?”
- (2) “How can they be integrated into a collection tool that engages employees?”

By aiming for a limited selection of questions, we were fully aware that the responses collected would only generate a preliminary measurement of psychosocial risks rather than a definite diagnosis. To engage employees in answering questions easily and honestly, the objective was therefore to be able to collect this preliminary data in a simple and regular way thanks to an app installed on a tablet or via online access on a company portable computer (PC). Anonymity had to be guaranteed. As is common with all these types of longitudinal “barometers,” we anticipated an attrition rate as a result of survey fatigue. To address this issue, two additional research questions were stated:

- (1) “How to safely collect and protect employee’s sensitive, private and confidential information?”
- (2) “How to create trust and account for distrust between employees and their management, and between employees and the survey creators?”

In summary, the objective of the research project was to obtain a measure of human-related risk in the form of a single score that would be robust enough to identify changes over time as weak but significant signals of a potential deterioration appeared in the conditions of the

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implementation of the objectives. This must be done taking into account the needs of respondents in the field of anonymity. For a company, the benefits of such a system are

- (1) A global solution promoting employee well-being
- (2) Easy to implement and pragmatic
- (3) Preventing risks rather than repairing damage

These insights and their translation into concrete action are the result of more than ten years of research on human risk. Over time it became clear that an “operationalization” of this knowledge could benefit human risk management in enterprises.

In September 2018, we obtained an important grant from the Swiss Innovation Agency (Innosuisse) to develop and implement this idea. This was done with the help of Oxial, an international company offering Enterprise Risk Management (ERM) software, also called a Governance, Risk, Compliance (GRC) system. The collection system was designed and marketed as a software module that could be integrated into a comprehensive ERM solution. For the research aspect, we brought together an interdisciplinary team ranging from psychology to statistics, as well as data collection in marketing and risk management.

This paper is organized as follows. In [Section 2](#), based on a review of the scientific literature, we contextualize the concept of human risk in the workplace in light of the digital transformation of society. In [Section 3](#), we present the major studies and models that allow us to scientifically measure these concepts of occupational stress and well-being at work. In [Section 4](#), we show how, based on a quantitative survey of 1,129 employees, we were able to design a questionnaire model based on just four dimensions. In [Section 5](#), we trace the long development process, including a qualitative survey of about 20 employees in each testing company for a purely fine-tuning purpose of the app. This process of trial and error allowed us to operationalize our questionnaire tool into a software module that is part of professional ERM software. In [Section 6](#), we report on a comprehensive managerial experience we had with a partner company just recently that illustrates how to conduct preventive risk management for human organizational risk. Finally, the last section concludes by indicating the limitations of this work and the avenues for future research.

## 2. Literature review

In this literature review we focus first on the scientific findings of human risks, which will change significantly with the digital transformation of society. Then, we consider the scientific literature specialized in the measurement of occupational stress. Finally, we address the aspects of digital trust that the employee has when disclosing information about his own perception of occupational stress.

### 2.1 *What is human risk in the context of digital transformation*

In previous eras, companies have struggled with an ill-identified risk called psychosocial risk. When this risk occurred, it resulted in significant costs, particularly in, absenteeism, reduced decreases in productivity and even fraud ([Dubosson, Fragnière, Reynard, & Palma, 2017](#)). As the phenomenon was not measured, it went unnoticed. If human-related problems appeared, we often blamed stress, for example. In order to address it, the stress of the employees was measured using a specific scale. Other explanations included employee dissatisfaction measured by conducting an internal satisfaction survey. These initiatives, at best, took place once a year, which was long enough for a problem to emerge, for its effects to be felt and for companies to be forced to cope with disastrous consequences in financial, human and organizational terms.

The aspects of the problem that have been measured are numerous and specialized, such as mental health, burn-out, occupational stress, etc. They investigate the whole phenomenon in depth thanks to long and sometimes tedious measurement tools. It is therefore impossible to use all of these metrics on a regular basis in order to detect a problem at an early stage when it is still easily manageable. This raises the question: how can we provide managers with the means to prevent human-related risk rather than expecting them to mitigate damage once it's occurred and try to remedy it as best, they can?

In practice, psychosocial risks are identified under labels such as burnout, poor performance, deterioration in quality, negative stress, illness leave and staff turnover (INRS, 2006; Brun, 2005; Chiarini, 2012). If psychosocial risks are first and foremost a risk affecting humans, they must also be considered a corporate risk affecting the smooth running of its business in addition to being a personal health problem of the individual with the potential to become a public health issue. According to ERM, risks include all phenomena that could prevent a company from achieving its objectives. The COSO ERM (Committee of Sponsoring Organizations Enterprise Risk Management) and ISO (International Standards Organization) 31000 (the main two ERM standards in the world) standards have therefore listed different kinds of risk categories. However, there is no category dedicated to human risk factors. We find them distributed among other categories.

In the context of corporate governance, the concept of risk is understood to be the relationship between the probability of being exposed to a given hazard and the consequences of its manifestation (in financial terms, of course, but also in physical or psychological terms). In risk management, we unfortunately tend to focus more on the consequences of risk and less on its origins.

All this is happening in an environment that is pushing digitization and the use of technologies to automate complex tasks that were once reserved for humans. This movement is sometimes not well received by employees and their managers who report additional stress caused by information technology (IT) system bugs, the introduction of new simplistic and boring administrative tasks and an increased workload (Dubosson *et al.*, 2019). This translates into resistance to changes in the workplace, manifested in decreases in performance, errors, absenteeism and a subtle form of presenteeism.

Although new technologies are often seen as a positive component that assist employees' work, in some circumstances, they can lead to augmented stress (Tovey & Adams, 1999; Jennings, 2008), an anxiety-inducing climate (Akst, 2013), lower job satisfaction, and increased psychosomatic complaints (Korunka, Weiss, Huemer, & Karetta, 1995). Society is becoming increasingly aware of the risks associated with digitalization. As an example, we can mention the first standard edited by Institute of Electrical and Electronics Engineers (IEEE), *IEEE 7010*, aimed at addressing the social and ethical impacts of artificial intelligence. This standard calls on governments to formulate regulations and norms to protect human welfare (Schiff, Ayesh, Musikanski, & Havens, 2020).

Identifying and managing psychosocial risks is therefore becoming even more crucial in our digitized society. However, companies will not be able to efficiently combat a toxic environment if they do not have the right tools at their disposal. Addressing human risk is not just a philanthropic cause aimed at employee well-being but provides many financial incentives to ensure corporate sustainability. As demonstrated in a study conducted in Switzerland with 5,000 people, a human risk management approach can lead to higher company performance, preserve or enhance employee health, reduce absenteeism and contribute to economic profits (Jenny *et al.*, 2011).

## 2.2 The scientific literature about measuring occupational stress

The scientific literature has proposed a wide variety of questionnaires and myriad metrics to assess human risk. These risks have been identified and measured using different

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approaches regarding attitudes and feelings about work, focusing on a specific concept evaluated in all its breadth and depth. This could cover work stress, well-being, employee engagement or job satisfaction, to name a few. Based on the most widely cited and commonly used questionnaires in practice, we identified and selected 195 items used as metrics (e.g. Maslach & Jackson, 1981; Cohen, Kamarck, & Mermelstein, 1983; Diener, Emmons, Larsen, & Griffin, 1985; Siegrist *et al.*, 1986; Theorell & Karasek, 1996; Leiter & Maslach, 1999; Morgeson & Humphrey, 2006; Schaufeli, Bakker, & Salanova, 2006).

Three models will be explored in more detail in this section, as they have ultimately contributed significantly to the development of our measurement tool. The first is Karasek's job-demand-control model (Theorell & Karasek, 1996), which describes the work environment as a conflict between decision-making autonomy and psychological demands. If decision-making authority is low and psychological demands are high, the risk of employees developing physical or mental problems increases. In this model, psychological demands include workload, time constraints and mental load. Autonomy in decision making refers to the employee's ability to exercise control over the tasks to be performed and to pursue opportunities to improve his, her or their skills. Later, social support was added to this model. Indeed, interactions between colleagues and within the hierarchy can require someone to play the role of tension moderator at work. This last component can either become a beneficial role as HR supports the employee in his or her difficulties or it can make the situation even worse by leaving the employee alone to deal with his or her problems.

The second model, known as effort-reward imbalance, was first developed by Siegrist *et al.* (1986). It is based on the hypothesis that a high level of effort poorly acknowledged and rewarded is likely to generate pathological reactions, both physiological and emotional. The effort demanded may be internal (such as an exaggerated sense of duty, the need to excel or the excitement of achieving ambitious goals) and/or external (such as greater responsibilities or being constantly interrupted while working). Whether in the form of low pay, lack of respect, job insecurity or other factors, if there is insufficient reward for what the employee feels is demanding so much effort, the risk becomes very high.

The last model, the Maslach Burnout Inventory (MBI) measures burnout or its counterpart, commitment. Burnout is defined here as a response to chronic stressors in the form of a psychological syndrome of exhaustion, cynicism and ineffectiveness. Exhaustion is an individual and personal feeling of being completely overwhelmed and drained both physically and emotionally. On an interpersonal level, cynicism is characterized by excessive detachment or indifference. It develops as a response to overload as a way employees protect themselves by using an emotional buffer. The risk associated with cynicism is a loss of ideals and a dehumanization of others. The feeling of ineffectiveness is linked to an impression of personal incompetence, the inability to accomplish tasks and a lack of productivity. While the model focuses on the consequences of stressors, it does not measure the contribution of these stressors to generating a burnout situation. In order to address this problem, Leiter and Maslach (2003) expanded their theory by adding a model that assesses whether there is a balance between an individual and six domains of the work environment: workload, reward, community, control, fairness and value.

Some authors recommend focusing on fluctuations in employee attitudes, perceptions and behaviors, as well as the reasons and consequences of these fluctuations (Wang *et al.*, 2013; Zheng, Zhu, Zhao, & Zhang, 2015). Through a systematic literature review, (Fernandes & Pereira, 2016) highlighted work schedules, task content, participation, workload, role definition, social responsibility and safety as psychosocial risk factors. While other authors put more emphasis on the group and group dynamics (Martin, Karanika-Murray, Biron, & Sanderson, 2016) and recommend carrying out measurements at the group level. To our knowledge, there is no integrative research for developing a synthetic human risk score at the employee group level.

In summary, working in a stressful environment increases the risk of suffering from physical illness and/or psychological distress (Clarke & Cooper, 2004). In businesses,

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occupational stress is linked to lower productivity, higher absenteeism and higher employee turnover (Frangopoulos, Eloff, & Venter, 2013; Hassard *et al.*, 2014). Second-order results vary from excessive drinking and smoking, drug abuse, eating and sleep disorders to workplace violence (Frangopoulos *et al.*, 2013).

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### 3. Developing a rapid occupational stress measurement in organization based on a quantitative survey

In this Section, we concentrate solely on the statistical analysis that has been used to reduce the number of dimensions under study and therefore the length of the questionnaire (for more details see Dubosson, Fragnière, Meier, Varone, & Berdeaux, 2019). The point here is to show how to move from questionnaires that come from the scientific literature with many answer items to a small questionnaire that takes little time to administer in a company. The relationship between human risk in the context of digital transformation and the measurement of stress is fundamental in the sense that we are also witnessing a dematerialization of work relationships. The classic rituals of going to work, such as drinking coffee with colleagues during the break, no longer exist in a context of digitalization of work. New human risks appear that are more difficult to detect at an early stage, such as, for example, an isolation of the employee due to teleworking. We therefore need a questionnaire that can be answered very quickly by employees and that can be administered on a regular basis.

#### 3.1 Dimensions, questionnaire and participants' identification of relevant dimensions

On the basis of the three reference questionnaires (see literature review) complemented by other highly cited works (e.g. Morgeson & Humphrey, 2006; Cohen *et al.*, 1983; Diener *et al.*, 1985; Schaufeli *et al.*, 2006) we identified and retained 195 relevant items. These items were then synthesized using a Delphi procedure (a process used to arrive at a group opinion or decision by surveying a panel of experts) with eight experts. The result consists of the following sixteen dimensions grouping all 195 items: (1) Workplace Organization (2) Decision-making or initiative, (3) Variety of tasks, (4) Material resources, (5) Workload, (6) Matching tasks and skills, (7) Meaningful work, (8) Recognition, (9) Fair treatment, (10) Job security, (11) Works Life/Balance, (12) Organizational Culture, (13) Support from the hierarchy, (14) External relations, (15) Attention to the employee's well-being from the hierarchy and (16) Cooperation with team members.

We have developed a new questionnaire inquiring about these sixteen dimensions and measuring levels of employee well-being and job satisfaction.

#### 3.2 Construction of the questionnaire

The questionnaire was made up of thirty-two questions that evaluated job conditions and organizational and relational factors in the workplace. Additionally, we measured the employees' general attitudes toward their work environment and their overall job satisfaction. The core of the questionnaire assessed the sixteen items listed above (i.e. "Currently, in your job, how satisfied are you with the workload?"). Each question was measured on a 5-point Likert scale statement ranging from "Strongly disagree" to "Strongly agree."

#### 3.3 Participants

The sample consisted of 1,129 service employees in the Fribourg region of Switzerland. We retained and processed the responses of 813 people (see 4.2) of whom 417 were women (51.3%) and 396 were men (48.7%). Regarding hierarchy, the sample is comprised of 595 general

employees (74.4%), 148 managers (18.5%) and 57 senior managers (7.1%) (for more details see [Meier, Dubosson, Fragnière, & Fournier, 2021](#)).

#### 4. Results

##### 4.1 Preliminary analysis

In order to control the quality of our database, it was tested and analyzed in order to eliminate questionable or incomplete observations. Specifically, we excluded incomplete questionnaires (less than 70% completed), questionnaires completed too quickly (fewer than 90 seconds) or too slowly (more than ten hours). Finally, the statistical calculation of the Malhanobis distance was used to calculate and exclude the extreme values from the database ([Tabachnick & Fidell, 2001](#)).

##### 4.2 Data analysis, principal component analysis (PCA) and interpretation of the axes

PCA is a technique that summarizes the information contained in a database into a number of synthetic variables, also known as principal component analysis (PCA). Using Kaiser's rule, we retained four principal components that explained 56.6% of the total inertia.

In order to obtain a simpler factorial representation, we proceeded with a Varimax rotation and retained only the variables that returned an adequate saturation (factorial weight greater than 0.600) and only on one factor (see [Table 1](#)).

The first factor is associated with elements related to the relationship between the organization at all levels and the employee and is composed of recognition, fair treatment, support from the hierarchy and the interest of the hierarchy in the well-being of the employees. The second factor addresses the relationship between aspects of the self and the work and is composed of the variety of tasks, the match between the tasks allocated and the skills of the person and the degree of the work's meaningfulness. The third factor relates to work-specific constraints and includes workload and work/life balance. Finally, the fourth factor deals with relationships among co-workers and includes the variables of team atmosphere and cooperation between team members.

	Components			
	1	2	3	4
Organization of work				
Decision-making or initiative				
Variety of tasks		0.803		
Material resources				
Workload			0.683	
Matching tasks and skills		0.670		
Meaning of work		0.716		
Recognition	0.640			
Fairness of treatment	0.714			
Job security				
Separation of private/professional life			0.790	
Team atmosphere				0.877
Support from the hierarchy	0.815			
External relations				
Hierarchy attentive to well-being	0.798			
Cooperation between team members				0.868

**Table 1.**  
Component matrix  
after rotation

4.3 Creation of reduced scales

On the basis of the PCA, we selected all items that were well represented by the four factors. Then we combined these items into four different scales by checking the internal consistency with Cronbach’s alpha. This index expresses a degree of homogeneity (internal consistency) that increases as its value approaches 1 (see Table 2).

In order to evaluate the internal consistency, we use the George and Mallery’s (2003) proposal: if  $\alpha$  is equal to or higher than 0.9, the consistency is excellent. It is good if  $\alpha$  is higher than 0.8, acceptable if  $\alpha$  is higher than 0.7, debatable if  $\alpha$  is higher than 0.6, poor if  $\alpha$  is higher than 0.5 and unacceptable if  $\alpha$  is lower than 0.5. We observe that only the result related to work constraints is poor ( $\alpha = 0.53$ ). The result related to the coherence between the employee and their work is acceptable ( $\alpha = 0.70$ ), and the results reporting on interpersonal relations and the relationship between the employee and the organization are good ( $\alpha = 0.81$  and  $\alpha = 0.82$ , respectively).

4.4 Linear regression

Linear regression aims to model a dependent (explained) variable through several independent (explanatory) variables. In this research, the variables to be explained are the level of general satisfaction (see Table 3), while the explanatory variables are the generated satisfaction results. One of the advantages of using a linear regression is that it increases our understanding of the phenomenon studied by avoiding collinearity between the explanatory variables. In other words, a multiple linear regression allows the effects of the independent variables on the dependent variable to be considered at the same time and in a single analysis, thus allowing the respective weights of the predictors to be measured.

Our model indicates that 46% of the variance in job satisfaction is explained by these four factors. All factors contribute to the explanation of job satisfaction. The most important factors (see Table 3) are the coherence between the employee and the required work ( $B = 0.409$ ;  $p < 0.001$ ) and the relationship between the employee and the organization on all levels ( $B = 0.313$ ;  $p < 0.001$ ). Job strain ( $B = 0.134$ ;  $p < 0.001$ ) and interpersonal relationships ( $B = 0.098$ ;  $p = 0.002$ ) were less important in defining satisfaction.

Based on the results of the PCA, we constructed scales that summarize the job conditions and the organizational and relational factors reported by this survey. The internal consistency of these scales is high, except for the work stress scale ( $\alpha = 0.53$ ). Further studies could improve this scale by modifying or adding relevant items to increase its internal

Scale	Item	Alpha ( $\alpha$ )
Coherence between employee and the work	The meaning you find in your activities	0.7
	Variety of tasks	
	Adequacy between the tasks allocated and your skills	
Interpersonal relationships	Atmosphere in the team	0.81
	Cooperation with team members	
Relationship between employee and organization	Support from the hierarchy	0.82
	Attention of the hierarchy to the well-being of the employees	
	Fairness of treatment	
Job strain	Recognition of your work	0.53
	Workload	
	Separation between work and private life	

**Table 2.**  
Composition of scales  
and internal  
consistency



consistency. Each generated scale is important in explaining job satisfaction, and all of these scales account for 46% ( $R^2 = 0.46$ ) of the variation in job satisfaction. It seems that a good fit between the characteristics of the individual and the components of the job and its organization (e.g. support from the hierarchy, fair treatment, etc.) is important characteristics leading to better employee satisfaction.

**5. Developing a human risk measurement through a short questionnaire**

In this section, we use a qualitative field survey together with User eXperience (UX) techniques to design the application in such a way that it is easy to use by employees and addresses most of the user’s concerns about its use (see for more details [Dubosson, Fragnière, Fournier, Meier, & Varone, 2022](#)). As seen in the previous section, many questionnaires based on a myriad of measurements were designed and tested in order to measure and assess human-related risks. We identified the most meaningful dimensions and combined them into a score. These dimensions and their associated items were used and integrated into a digital human risk management system to analyze data collected directly from employees and to calculate a single score measuring the level of occupational stress (see [Figure 1](#)).

*5.1 Starting with qualitative data: requirements for data collection*

One of the challenges of our approach is collecting good quality data. This requires ensuring that employees are committed to the proposed system. In order to define the conditions for successful implementation and identify the incentives for employee participation, we conducted semi-structured interviews with over 100 people on the following topics:

- (1) Personal experience with human risks
- (2) Perceptions of the actions taken by their company to mitigate human risks
- (3) Expectations regarding a human risk management approach (e.g. support to be used, time, frequency, incentives, etc.)
- (4) Barriers to their involvement in a human risk management system.

The results show that although all participants were in favor of participating in this type of approach, there are two very important barriers: (1) the requirement for anonymity and (2) the fear of consequences. We therefore had to provide the user with a concrete guarantee of confidentiality and anonymity while allowing for the collection of sufficiently precise and applicable information to support decision making. In no case was a monetary incentive considered to be a motivator. The motivation to participate lay mainly in the desire to have

<i>R</i>	<i>R</i> <sup>2</sup>	<i>F</i>	df1	df2	<i>p</i>
0.675	0.456	169	4	808	<0.001

Predictor variables	<i>B</i>	SD	<i>t</i>	<i>p</i>
Constant	0.209	0.169	1.235	0.217
Coherence between employee and the work	0.409	0.035	11.813	<0.001
Relationship between employee and organization	0.313	0.029	10.814	<0.001
Job strain	0.134	0.028	4.764	<0.001
Interpersonal relationships	0.098	0.032	3.116	0.002

**Table 3.** Linear regression between job satisfaction and scales assessing job conditions and organizational and relational factors



**Figure 1.**  
The four resulting  
dimensions for  
measuring a unique  
human risk score

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their opinions taken into consideration and to push management to implement new policies and practices based on this information.

Furthermore, repeated requests for information could lead to individual and organizational fatigue. To ensure a high response rate, incentives should be designed to counteract disincentives (e.g. reluctance to provide personal information, lack of trust, lack of perceived interest, etc.). Honest participation by all is critical because the results show that a human risk situation can be detected by co-workers even before the person suffering from it is fully aware of it.

We chose to employ this data collection approach in the ERM framework in order to leverage the risk management approaches already in place and thus create true synergy. This aspect is very innovative, as no ERM software to date includes a dedicated human risk management module.

### *5.2 From conception to implementation*

It may be instructive to report the concrete difficulties encountered in our tests with three Swiss companies as follows.

In each company, we started with about fifteen semi-directive interviews. These qualitative data allowed us to contextualize our approach in order to adapt the modus operandi. For example, in a company with seventy-four nationalities represented, language and illiteracy would pose a real problem. Thus, we oversimplified our questions, developed a new interface that used emojis and suggested that respondents be accompanied by a neutral person who would read out the questions.

Then came the question of the best support. Should we offer access to the device through the employee's smartphone, a company PC or paper questionnaires? How often could the information be collected without losing the goodwill of employees? Should the data collection

be done weekly, monthly or every six months? Finally, the application had to be adapted to the IT structure of each company including: the browser used, the availability of a camera, the operating system, user codes or quick response (QR) codes, data storage, data security, etc.

However, the biggest challenge was and remains the guarantees of the anonymity and confidentiality of the employees' responses. We quickly realized that assuring anonymity and providing a history of a respondent's responses would be very difficult when implementing the system. According to employee response, ensuring that the data would be aggregated into a single score was not a sufficient guarantee. Solutions were found for each situation, but they required adaptations that were not optimal in terms of data precision and comparability.

Additionally, we had to deal with details that arise in real-life testing and seemed trivial from our point of view. For example, we had to abandon the use of QR in one company due to obsolete hardware. Our user codes contained "0," "O," "I" and "l," which led to a lot of confusion and widespread panic among employees who complained that the system was outdated. The only way to avoid this is pretesting and lots of communication with the company.

### *5.3 Actual human risk module implementation*

It took several months of testing before we arrived at a protocol that successfully reassured the employees of the organizations we worked with. When using the platform for the first time, the following instruction was given to each employee:

- (1) You randomly draw a QR code that allows you to access the platform
- (2) Then, four options are available:
  - You use the camera of your computer.
  - You use the printed alphanumeric identifier
  - You use a smartphone
  - You download your QR Code

The questionnaire is displayed and only takes a few minutes to complete. It consists of eight randomly selected, nonrepetitive questions from a sample of hundreds of questions measuring the four dimensions retained in our quantitative analysis. To this, we include three questions regarding intentions to leave the company and willingness to recommend our employer (Net Promoter Score type). The questions use a Likert scale. Below are two examples of the questionnaires that were used:

#### Questionnaire 1

- (1) My supervisor is concerned about the well-being of his or her subordinates.
- (2) I think that my job is interesting.
- (3) There is good cooperation between the members of my team.
- (4) I am urged to do an excessive amount of work.
- (5) I am proud of my job.
- (6) My supervisor's explanations of procedures are clear.
- (7) The deadlines imposed on me are difficult to meet.
- (8) I get along well with my colleagues.
- (9) I would recommend "Enterprise XXX" as an employer to my friends/family.

- (10) I would like to find a new job.
- (11) I am actively looking for another job.

Questionnaire 2

- (1) Overall, my co-workers are pleasant.
- (2) In my job, there are too many repetitive tasks.
- (3) My supervisor treats me fairly.
- (4) If I have difficulties, I can ask my colleagues for help.
- (5) My job requires too much concentration for too long.
- (6) I find meaning in my work.
- (7) My supervisor is always there to give me advice.
- (8) I can easily balance my professional and private life.
- (9) I would recommend "Enterprise XXX" as an employer to my friends/family.
- (10) I would like to get a new job.
- (11) I am actively looking for another job.

All these steps were necessary and instructive as we went through the process of starting with proven knowledge, using it to develop a new concept of aggregate score and implementing it in real organizational contexts. The difficulties were numerous and showed us the necessity of pretesting and of testing everything before implementation. In terms of future research, these difficulties allowed us to identify an important research question related to the need for maintaining and guaranteeing anonymity as well as the necessity of tracking responses over time. Reconciling the need for anonymity with the ability to track the identity or history of the user is an actual research issue that is not only present in this case but also for in electronic voting and medical follow-ups.

## 6. Using the human risk module GRC: a real case study

In this section, once the prototype of the human risk management app is fully operational, we illustrate how management can integrate it to improve well-being in the company. Despite the waves of COVID-19 necessitating imposed remote work, several companies of different sizes in different sectors were interested in our approach and were ready to implement and test our system. They were companies involved in the food industry, security equipment and social services. Herein we will report on a complete experiment conducted in 2021 over a period of nine months with five test runs. The company has agreed to have its experience told in this paper. Coup d'Pouce is a foundation offering social and professional reintegration services. The director of this foundation was immediately enthusiastic about our methodology and the approach. Indeed, he was concerned that, despite appearances, there might be a few situations that needed to be addressed. Unfortunately, he did not have the means to verify this because he did not have any tools at his disposal and therefore lacked the necessary information. Our approach should make it possible to remedy this situation.

We first met with the director to understand the context of the company and the sector in which it operates. Concretely, Coup d'Pouce is represented throughout the region with five branches, each running a store that sells second-hand items and clothing. It supports unemployed and low-skilled people with the aim of helping them in their professional and

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social integration as they develop and reinforce their skills at work. In order to do so, it relies on socioprofessional teachers who see to the needs of various groups of people. Over the last few years, the foundation has developed into a small-to-medium-sized enterprise (SME) with commercial objectives despite its legal status being that of a foundation.

The environment in which it operates has become more tense and complex, in particular due to its digital transformation, even if the bulk of its activity still remains physical. It must therefore restructure and become more efficient without neglecting its social mission. This is a difficult problem to solve, which has led to resistance and conflicts in the management of activities and the prioritization of objectives. To better understand these challenges, we had to become acquainted with the work environment through semi-structured interviews with randomly selected employees. The interviews were conducted face-to-face (with the necessary precautions due to current public health considerations). The interview grid used was very similar to the one previously used in our qualitative study. We wanted to see if Coup d'Pouce's employees' responses seemed radically different from those in our qualitative survey in order to adapt our approach to this context.

Through these interviews, we were able to address issues that are important to the well-being of these employees. We are very grateful for the trust they placed in us by addressing issues such as the meaningfulness of their work, interpersonal conflicts, lack of recognition, competition between sites and poorly used and rewarded skills. We were also able to hear about their expectations and concerns regarding approaches to human risk measurement.

On this basis, we contextualized and refined our approach. It was very important to ensure full anonymization of the data. To this end, we tried to be present as much as possible, to give a face and a voice to the "outsiders" interested in their well-being. We created a two-minute video that could be broadcasted to everyone explaining in detail the course of the research. Both the researchers and Oxial's contact persons participated in the creation of this video. Different information was given such as we did not specify the work locations where the data was collected, even though this would prevent us from comparing them; secondly, that the management will only receive a condensed summary of the information given by the employees, i.e. impossible to identify the respondent. We also had to reassure employees that our questionnaire would fit easily into their schedules as the measurement only takes a few minutes.

This was not a problem as our tool was designed with these principles in mind. We agreed to carry out five collection campaigns at eight-week intervals. As agreed, the employees drew a unique and nontraceable QR code to gain access to the questionnaire. They could keep their code for future campaigns or draw a new one.

At the end of each collection campaign, the data was used to calculate the unique score as well as to report the results of each axis and each question. As a reminder, the four axes were workload, employee-company relations, interpersonal relations and coherence between self and work. These results were then discussed with the foundation's director to allow us to better interpret the data and verify that the tool was capturing the potential risks to be managed. As the data were collected, the new results were put into context of the previous ones in order to study variations and the evolution of the results.

We assumed that the variations were at least as important as the averages obtained. We still had to define the reference value in order to study these variations. We did so by using the variations between each campaign and the subsequent one, which we named "sliding standard." We also used the first campaign as a period of reference and called this method "the gold standard." These elements are illustrated in [Figure 2](#).

At the end of each round of observation, the board sent a brief announcement to all employees telling them about the results obtained and the eventual measures that would be taken to respond to a reported potential risk. By informing the management about the current state of the company and putting the results into perspective using the above-mentioned

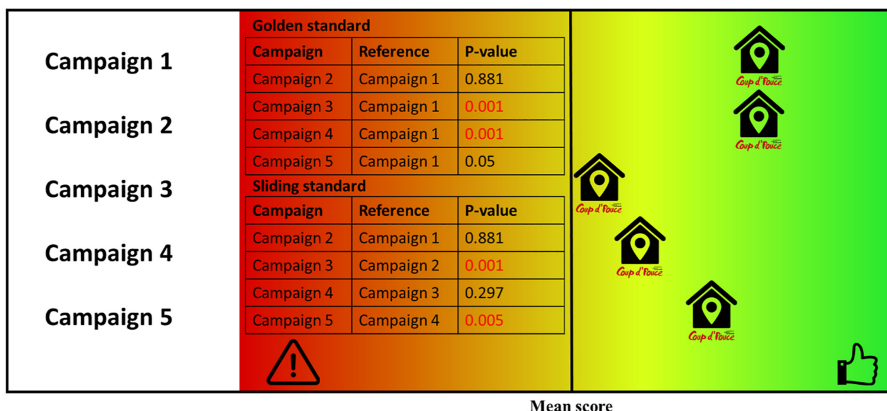
methods (gold and sliding standards), we gave them the opportunity to act quickly on the dimensions that needed action. For example, the employee’s perception of the workload improved from a lower value than the average score to a higher value. This was made possible by a better allocation of resources by the management. The same methodology was applied when worsening values in the other dimensions were observed. At this stage of the research, how to intervene was a management choice, as we will see in another example below.

At the end of the five campaigns, we summarized all the information for upper management. This presentation was also communicated to all employees during a day off. This day with our collaboration, normally used as the company’s annual day, was strongly desired by the director. In fact, our process put in place within the company revealed, among other things, a need to consolidate interpersonal relations. The morning served as a team building process thanks to our presentation and the intervention of a psychologist, a process then consolidated with group activities during the afternoon. Then, to better understand the impact of our tool, we asked the employees to answer a questionnaire about their perception of the tool, the system and their own involvement. All employees who participated in the team building day answered the questionnaire administered in paper form. They answered 11 questions, six of which were rated on a 5-point Likert scale concerning the general impression of the approach, such as: “I appreciated that my company participated in this process”; “I think that this process contributes to improving the general well-being of the company”; “I don’t want to answer questionnaires anymore”; “I would like the company to continue measuring our well-being”. Three open-ended questions completed the picture by giving employees the opportunity to express themselves, and the last two questions focused on the number of campaigns they had participated in and their work location.

It reported that 88% of employees were satisfied or very satisfied that their company had participated in this research. Interestingly, 56.7% (vs 13.3%) felt that this type of approach contributes to improving well-being within the company (30% abstained). 70% percent agreed or strongly agreed that they were willing to answer this type of question again, and 90% of respondents said they wanted the company to continue measuring their well-being.

Even if there are some unresolved questions about anonymity and data protection, especially in an increasingly digitized society, we can conclude that this approach is a success since it satisfied both managers and participants. During the various campaigns, all the

## Relationship Employee – Organization



**Figure 2.**  
Example of the  
information returned to  
management about one  
dimension

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scores of the observed dimensions remained above the average score (i.e. 3). Importantly, if a score was lower than either the gold standard or the sliding standard, measures were taken to reverse the trend before the next campaign. It could then be observed that the score improved.

## 7. Conclusion

In the context of the trend of the digital transformation of companies, it is easy to forget that human beings must remain at the center of all concerns. Digital transformation is occurring and will undoubtedly bring enormous benefits to the way we work, especially from the point of view of inclusion. However, organizations whose goal is to achieve objectives in an efficient way has tendencies to generate stress, anxiety, fatigue and other psychosocial risks or business human risks in the workplace. These risks must be taken into account more than ever before because innovation, the key factor in today's business success, is not possible if the personnel is demotivated, is no longer involved and no longer takes the initiative to contribute to the achievement of objectives.

COVID-19 has also taught us many things. Organizations have adapted to telework on a massive scale and in a completely unplanned way. Many recent studies ([Madero Gómez et al., 2020](#); [Tuzovic & Kabadayi, 2021](#)) have shown its disastrous impact on the well-being of workers, especially from a psychological point of view, including the loss of social ties, lack of support, increased burnout and chronic boredom. Corporate ill-being, which is a major organizational human risk today, absolutely must be taken into better account within the framework of ERM, particularly in an era of digital transformation, as telework makes it less and less visible to the manager and thus more and more undetectable.

The old adage “an ounce of prevention is worth a pound of cure” is quite relevant as companies seem to be doing well up until the day they collapse because even if the business model is good, the employees who no longer believe in it or benefit from it will not want to contribute. To this end, we have created what is to our knowledge the first tool designed to measure a global human risk score for the company. This tool is integrated in an ERM and allows, through a quick and digitized survey, companies to obtain a low-stakes wellness check that indicates if the organization is facing a deterioration of organizational well-being. Many scientific studies have developed long and precise questionnaires, but their operationalization is tedious and therefore cannot serve companies in their risk management practices.

Developing our tool for measuring human risk in companies took us many years. We went through all these scientific studies and conducted qualitative and quantitative surveys in companies in order to come up with a questionnaire that was scientifically relevant and easy to understand and access among all types of employees. Next, we entered the important phase of operationalizing the questionnaire with IT and UX design developments. After lot of back and forth and errors, we were finally able to create a solution that was integrated into an existing ERM system. At last, this tool could be tested in a large-scale company whose main objective was the social reintegration of people who have almost lost everything. The case is interesting because human risks are at the heart of the company's mission. Thus, even if this case has been successful and we continue the adventure together, many elements must be improved.

### *7.1 Limitations and future research*

One point of future research that we will focus on, which is completely related to the digital transformation of society and the need to protect everyone's personal data, is the fact that we have encountered enormous difficulty in developing a system that guarantees total anonymity. This point is crucial because employees are afraid of revealing their feelings

about powerful employers. We have also observed a high attrition rate between the first data collection and the last. One of the solutions suggested by our interviewees is to provide relevant and truthful feedback to make the intentions of the data collection clear. Employees are willing to participate but it has to be worth it to them.

A crucial point that we were not able to address in this study is to be able to track the information provided by the same person in each iteration of the data collection campaigns. This information would have been invaluable in refining the diagnosis of a possible deterioration of the company's climate of well-being. In order to guarantee anonymity and to convince employees that they are safe, we could not choose this option. Recently, we have started a study on blockchain in order to integrate the possibility of following a given employee without compromising the anonymity of the collected data.

Finally, we realized that this research, which was essentially exploratory, would lead us to other research on this theme, whether it is the purely digital aspects of the future of work, but also sociological and psychological.

## References

- Always Designing for People. (2019). *The workforce view in Europe 2019*. ADP. Available from: <https://odpowiedzialnybiznes.pl/wp-content/uploads/2019/06/Workforce-View-Europe-2019.pdf>.
- Akst, D. (2013). Automation anxiety. *The Wilson Quarterly* (1976-), 37(3).
- Brun, C. (2005). Risques psychosociaux: stress, mal-être, souffrance, . . . guide pour une démarche de prévention pluridisciplinaire. Working Paper. Bordeaux: Aract Aquitaine.
- Chiarini, B. (2012). *Projet de sensibilisation des médecins à la santé au travail*. Doctoral thesis. Université de Lausanne. Available from: [https://serval.unil.ch/resource/serval:BIB\\_2EC7437F0B2A.P001/REF.pdf](https://serval.unil.ch/resource/serval:BIB_2EC7437F0B2A.P001/REF.pdf).
- Clarke, S., & Cooper, C. (2004). *Managing the risk of workplace stress: Health and safety hazards*. Routledge.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396.
- Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, 49(1), 71–75.
- Dubosson, M., Fragnière, E., Reynard, C., & Palma, D. (2017). Human risk and its relationship to value destruction through internal fraud: A survey conducted in the Geneva banking sector. In *Paper presented at ENROAC Conference*, 29-30 June, Naples. Available from: [https://www.researchgate.net/publication/323561593\\_Human\\_risk\\_and\\_its\\_relationship\\_to\\_value\\_destruction\\_through\\_internal\\_fraud\\_a\\_survey\\_conducted\\_in\\_the\\_Geneva\\_banking\\_sector](https://www.researchgate.net/publication/323561593_Human_risk_and_its_relationship_to_value_destruction_through_internal_fraud_a_survey_conducted_in_the_Geneva_banking_sector) (accessed 20 May 2022).
- Dubosson, M., Fragnière, E., Rochat, D., Sitten, M. and Berdeaux, E. (2019a). Vers une dissonance cognitive due à une mauvaise compréhension du potentiel de l'IA : Étude des perceptions des employés en Suisse Romande. *Conférence Psychanalyse et Management*, Octobre, La Rochelle.
- Dubosson, M., Fragnière, E., Meier, S., Varone, S., & Berdeaux, E. (2019b). Determining the main variables to measure human risk in organizations: A quantitative survey conducted in Switzerland. In *10th International Research Symposium in Service Management (IRSSM-10)*, Dubai. Available from: [http://www.irssm.org/docs/IRSSM10%20Proceedings\\_101119.pdf](http://www.irssm.org/docs/IRSSM10%20Proceedings_101119.pdf) (accessed 18 June 2022).
- Dubosson, M., Fragnière, E., Fournier, A., Meier, S., & Varone, S. (2022). Measuring real time occupational stress in organizations via a digitalized risk management app. In *Education, research and business technologies* (pp. 421–429). Singapore: Springer.
- Fernandes, C., & Pereira, A. (2016). Exposure to psychosocial risk factors in the context of work: A systematic review. *Revista de Saúde Pública*, 50(24), 1-14.



- Frangopoulos, E. D., Eloff, M. M., & Venter, L. M. (2013). Psychosocial risks: Can their effects on the security of information systems really be ignored? *Information Management and Computer Security*, 21(1), 53–65.
- George, D., & Mallery, P. (2003). *SPSS for windows step by step*, (4th ed.). Boston, MA: Allyn and Bacon.
- Hassard, J., Teoh, K., Cox, T., Cosmar, M., Gründler, R., Flemming, D., . . . van den Broek, K. (2014). Calculating the cost of work-related stress and psychosocial risks. Working paper. Luxembourg: Publication Office of the European Union. Available from: [https://publications.europa.eu/resource/ellar/c8328fa1-519b-4f29-aa7b-fd80cffc18cb.0001.01/DOC\\_1](https://publications.europa.eu/resource/ellar/c8328fa1-519b-4f29-aa7b-fd80cffc18cb.0001.01/DOC_1).
- INRS (2006). Stress et risques psychosociaux: concepts et prévention. Documents pour le médecin du travail, No. 106, 2eme trimestre. Paris. Available from: <https://www.inrs.fr/dms/inrs/CataloguePapier/DMT/TI-TC-108/tc108.pdf>.
- Jennings, B. M. (2008). Work stress and burnout among nurses: Role of the work environment and working conditions. In Hughes, R. G. (Ed.), *Patient safety and quality: an evidence-based handbook for nurses*. Rockville, MD: Agency for Healthcare Research and Quality.
- Jenny, G., Inauen, A., Brauchli, R., Füllemann, D., Müller, F., & Bauer, G. (2011). Projet SWING, Rapport d'évaluation finale. Available from: [https://promotionsante.ch/assets/public/documents/fr/3-bgm/studien-wirkung/swing/2011-07\\_Projet\\_SWiNG\\_rapport\\_final\\_-\\_resume.pdf](https://promotionsante.ch/assets/public/documents/fr/3-bgm/studien-wirkung/swing/2011-07_Projet_SWiNG_rapport_final_-_resume.pdf).
- Korunka, C., Weiss, A., Huemer, K. H., & Karetta, B. (1995). The effect of new technologies on job satisfaction and psychosomatic complaints. *Applied Psychology*, 44(2), 123–142.
- Leiter, M. P., & Maslach, C. (1999). Six areas of worklife: A model of the organizational context of burnout. *Journal of Health and Human Services Administration*, 21(4), 472–489.
- Leiter, M. P., & Maslach, C. (2003). Areas of worklife: A structured approach to organizational predictors of job burnout. *Research in Occupational Stress and Well-Being*, 3(1), 91–134.
- Madero Gómez, S., Ortiz Mendoza, O. E., Ramírez, J., & Olivas-Luján, M. R. (2020). Stress and myths related to the COVID-19 pandemic's effects on remote work. *Management Research*, 18(4), 401–420. doi: 10.1108/MRJIAM-06-2020-1065.
- Martin, A., Karanika-Murray, M., Biron, C., & Sanderson, K. (2016). The psychosocial work environment, employee mental health and organizational interventions: Improving research and practice by taking a multilevel approach. *Stress and Health*, 32(3), 201–215.
- Maslach, C., & Jackson, S. E. (1981). The measurement of experienced burnout. *Journal of Organizational Behavior*, 2(2), 99–113.
- Matrix, I. (2013). Economic analysis of workplace mental health promotion and mental disorder prevention programmes and of their potential contribution to EU health, social and economic policy objectives, Available from: <http://www.mentalhealthpromotion.net/?i=portal.en.enmhp-news.2900>.
- Meier, S., Dubosson, M., Fragnière, E., & Fournier, A. (2021). Defusing psychosocial risks: Development of a detection system. In *Paper published in the RESER 2021 Conference Proceedings*, Heilbronn, 14-15 October, pp. 157–163. Available from: <https://publica.fraunhofer.de/bitstreams/cb1d785a-de4b-4460-bd40-561fd5aed013/download>.
- Morgeson, F. P., & Humphrey, S. E. (2006). The work design questionnaire (WDQ): Developing and validating a comprehensive measure for assessing job design and the nature of work. *Journal of Applied Psychology*, 91(6), 13–21.
- Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and Psychological Measurement*, 66(4), 701–716.
- Schiff, D., Ayesh, A., Musikanski, L., & Havens, J. C. (2020). IEEE 7010: A new standard for assessing the well-being implications of artificial intelligence. In *IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, (pp. 2746–2753).

- 
- Siegrist, J., Siegrist, K., & Weber, I. (1986). Sociological concepts in the etiology of chronic disease: The case of ischemic heart disease. *Social Science and Medicine*, *22*(2), 247–253.
- Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Ally and Bacon.
- Theorell, T., & Karasek, R. A. (1996). Current issues relating to psychosocial job strain and cardiovascular disease research. *Journal of Occupational Health Psychology*, *1*(1), 9–26.
- Tovey, E. J., & Adams, A. E. (1999). The changing nature of nurses' job satisfaction: An exploration of sources of satisfaction in the 1990s. *Journal of Advanced Nursing*, *30*(1), 150–158.
- Tuzovic, S., & Kabadayi, S. (2021). The influence of social distancing on employee well-being: A conceptual framework and research agenda. *Journal of Service Management*, *32*(2), 145–160. doi: [10.1108/JOSM-05-2020-0140](https://doi.org/10.1108/JOSM-05-2020-0140).
- Wang, M., Liu, S., Liao, H., Gong, Y., Kammeyer-Mueller, J., & Shi, J. (2013). Can't get it out of my mind: Employee rumination after customer mistreatment and negative mood in the next morning. *Journal of Applied Psychology*, *98*(6), 989–1004.
- Zheng, X., Zhu, W., Zhao, H., & Zhang, C. (2015). Employee well-being in organizations: Theoretical model, scale development, and cross-cultural validation. *Journal of Organizational Behavior*, *36*(5), 621–644.

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