Measuring Real Time Occupational Stress in Organizations via a Digitalized Risk Management App

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Abstract. Various studies (e.g., European Agency for Safety and Health at Work, 2007) have shown the highly detrimental effects of toxic environments on human health and organizational performance. For organizations, the implication about stress is that it leads to harmful behaviors that prevent managers and their teams from achieving goals. 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 (i.e., stress, organizational justice, etc.). The goal of our original research was to identify the most meaningful items and combine them into a unique score and an effective decision-making module. In this new paper, we report on the development of a new app that we developed and used for the first time to regularly take a kind of temperature of job stress in two companies. A long process of trial and error was necessary to be able to collect very confidential information from employees, both anonymously and longitudinally, to measure human risk in the workplace objectively and globally. As a next step, our goal is for the organization to be able to provide a preventive risk response in case of identification of a deterioration of occupational stress.

Keywords: Data Collection, Occupational Stress, Risk Management

1   Context

In literature, many questionnaires based on a myriad of measures were designed and tested in order to measure and assess occupational perceived stress. The objective of our research is to identify the most meaningful items and combine them into a score. For companies, what really matters is the stress that leads to detrimental behaviors preventing the managers and their teams to achieve the objectives. After almost two years of research, our human risk module allows us to collect and analyze data directly from employees to calculate a unique score measuring the level of occupational stress. This paper corresponds thus to the follow-up of a first research presented at IE2019 that outlined the premises [1].

1.1 Research problematic

Data collection is fully integrated into the GRC (i.e. Governance, Risk and Compliance) to leverage already implemented risk management approaches. This aspect is very innovative, as no GRC software to date includes a dedicated human risk management module.
Our tool requires data collection through non-invasive methods and self-assessment of an employee's condition over time. The vast majority of studies were conducted at one point in time. We found no longitudinal studies. Long-term management of people-related risks requires that employees provide meaningful and truthful data on an ongoing basis. An appropriate incentive system must be in place to ensure employee cooperation. In marketing, studies have been conducted to measure the impact of various financial and non-financial measures on level of response rates [2], [3] and [4]). Therefore, we need to conduct research in this particular context, where financial incentives may not be an option, where participation may be mandatory, where frequency may vary, and where the information to be provided is sensitive. We intend to test several measures to obtain the highest possible response rate and the most honest responses possible over a long period of time.

The goal is to detect early signs that herald potential negative stress in order to prevent it rather than cure it. In fact, our approach will take place in a primary prevention context. Our project will improve the level of information through a meaningful occupational stress indicator. Our goal is to develop a human risk platform accessible through a SaaS. Our solution relies on data collection and processing to measure human-related risks, analyze data and provide a unique score. The main challenges in research are what data is collected and how the data collection is done.

1.2 A Short Occupational Stress Questionnaire Based on Scientific Literature

Using reference questionnaires from the scientific literature and supplemented by others (e.g.[5], [6], [7], and [8]), we identified and retained 195 relevant item.

These items were then synthesized using a Delphi procedure with eight experts. The result consists of sixteen categories grouping these items: (1) work organization, (2) decision making or initiative, (3) variety of tasks, (4) material resources, (5) workload, (6) match of tasks and skills, (7) meaning of work, (8) recognition, (9) fair treatment, (10) job security, (11) separation of personal and professional life, (12) team atmosphere, (13) support from hierarchy, (14) external relations, (15) attention to employee's well-being by hierarchy, (16) cooperation with team members.

We combined these categories into a new short questionnaire to ask employees about their job satisfaction, which included these sixteen item.

1.3 Questionnaire Construction

The questionnaire used in this research consists of 32 questions and examines working conditions, organizational factors and workplace relationship factors. We measured employees' general attitudes toward their work in the form of two general questions about overall satisfaction with their work and pride in their work. The core of the questionnaire measured satisfaction with the sixteen items listed above (i.e., "How satisfied are you with your job now? How satisfied are you with the workload in your job right now? "). Each question was measured with a statement on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." We surveyed 1129 individuals and, based on statistical analyses, identified four relevant dimensions that summarize the experience at work.

The first factor associates item 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 hierarchy's interest in employee well-being.

The second factor relates aspects of self to work and is composed of the variety of tasks, the appropriateness between the assigned tasks and the person's abilities, and the meaning of the work.

The third factor relates to work-specific constraints and includes workload and the separation between personal and work life. Finally, the fourth factor relates to relationship aspects with colleagues and includes the variables team atmosphere and cooperation between team members.

1.4 Operating Modes Insights on how to Collect Data at Work

In addition to quantitative research, we have studied how to propose this questionnaire to users. We have the results of more than 100 qualitative interviews on the following topics:

- Personal experiences with human risks
- Concrete measures taken by the company to manage human risks
- Your attitude toward a human risk management approach (conditions, time, frequency, incentives, support, issues)
- Identified key barriers to improving human risk management.

Obviously, our focus was to discover the most important elements to ensure employee motivation and participation in a human risk management approach. The results show us that all participants were open to participating in this type of approach, but there are two very important barriers.
First, the importance of anonymity and second, the fear of consequences. Therefore, the main challenge in developing our tool is to provide the user with a concrete image of confidentiality and anonymity while allowing for the collection of sufficiently accurate and actionable information. Second, no monetary incentive has been mentioned.

The most important thing for users is that their opinions are taken into account and that management is able to implement actions based on the information provided by users.

2 Development Steps and Issues

Data requiring questions and interactions with employees of the company have to be provided by workers. Some questions might be sensitive when asking about personal perceptions and feelings. Moreover, having to ask for information on a regular basis may lead to individual and organizational fatigue. In order to ensure a high response rate, incentives have to be identified in order to outweight count-incentives (reluctance to provide personal information, lack of trust, no perceived interest, etc.). Appropriate incentives have to be defined in order to maintain a high level of truthful responses. These are all challenges we had to address to move from concept to practice. Ultimately, the objective of this research is to identify early signs of stress in order to prevent it. We assume that stress might be detected by co-workers even before the person suffering from stress disorders is aware of it.

2.1 Narrative Timeline from Concept to Realization

We present here the timeline realized by our team as well as all the difficulties encountered up to the possibility to collect concretely and appropriately occupational stress information in 2 Swiss companies.

After having created the logic of a short questionnaire based on questionnaires from the scientific literature (see [1]), we conducted a series of qualitative surveys with companies that were willing to experiment with us. These qualitative surveys allowed us to contextualize our approach in terms of optimal operating mode. We discovered through numerous semi-structured interviews that language and illiteracy problems were going to be a real issue. Indeed, in the industrial sector, we were obliged to use emojis, extreme simplifications of phrasing, or even an accompaniment by a neutral person to be sure that every employee could answer correctly.

Then we had to design the application. A whole series of other questions also arose, such as whether to use an app directly on the employee's smartphone, a company PC, or paper questionnaires... The question of frequency was also important in our semi-structured interviews. Should data collection be conducted every week, month or 6 months?

Finally, most of the work was in the development of the application, which had to take into account the specificities of each company, browser used, camera, mac or pc, user code or QR code, data storage and security, etc.

Perhaps, the biggest challenge is related to this stage of development and concerns the anonymity and confidentiality of the data. We quickly realized when finalizing the first

pilot that guaranteeing anonymity and having a history of the respondent (even if in the end everything is aggregated into a single company score, as it is required by the theory) posed a lot of difficulties when setting up the system. We were able to find solutions on a case by case basis, but in the long run new research must be undertaken (we are conducting initial investigations into Blockchain techniques). But the most challenging part was certainly the use of our system in size 1/1. Often small details that we didn't suspect were important almost brought the project to a halt. For example, in a social work company where the QR code could not be used due to outdated hardware, the codes used "0", "O", "I", "l", which created a near panic in the company because employees confused these characters and therefore could not enter the system and complained that the system was not up to date. We have had many of these problems in the last few months. The only recipe is to do pre-tests, to communicate a lot with the company.

In the current stage of this research, we are analyzing the data through behavioral statistics and we will finish the project by creating a dashboard so that the company can mitigate in an anticipated way the risks of a possible deterioration of its global occupational stress score.

3   Actual Human Risk Module Implementation

It took us several months of testing before we arrived at a protocol that completely reassured the employees of the organizations we worked with. The first contact instruction as given as follow to each employee:

1. You draw a QR code that allows you to access the platform
2. Then 4 options are possible:
a. You have a camera on your computer or use an Android smartphone
b. You use the printed alphanumeric identifier
c. You use an Apple smartphone
d. You download your QR Code

You only need a few minutes to complete the questionnaire.

It consists of 11 questions drawn randomly from a sample of hundreds of questions ultimately measuring the same occupational stress phenomena. We show here two subsequent questionnaires of 11 questions that were actually used in one of the 2 enterprises that are currently employing our approach:

Questionnaire 1

1. My supervisor is concerned about the well-being of his or her subordinates
2. I find my work interesting

3. There is good cooperation between the members of my team
4. I am asked to do an excessive amount of work
5. I am proud of the job I have.
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 change employers
11.   I am actively looking for a job

Questionnaire 2

1. Overall, my co-workers are pleasant
2. In my job, I have too many repetitive activities
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 reconcile my professional and private life
9. I would recommend "Enterprise XXX" as an employer to my friends/family
10. I would like to change employers
11. I am actively looking for a job

Let's take a closer look at the actual interface proposed in the case of option 1.Option 1: You have a camera on your computer or use an Android smartphone
- Go to https://hrr.oxial.net (address sent by email)
- You arrive on the following screen and you select the option "Connect with a QR Code". Then Figure 1 show the interface to be connected to the questionnaire using a QR code and Figure 2.

💡 **Option 1: You have a camera on your computer or use an Android smartphone**

- Go to https://hrr.oxial.net (address sent by email)

- You arrive on the next screen and select the option "Connect *with a QR Code"*
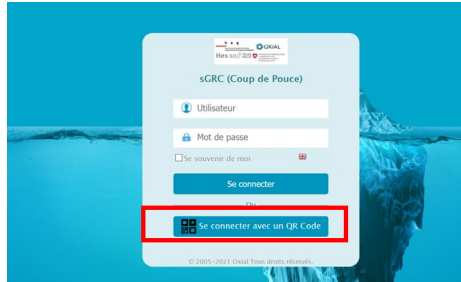
- Warning: your computer may ask for access to the camera and the web browser may not automatically find your camera.
  You should then choose *"Request camera permission"* and tell him if it is at the front or back of the camera.
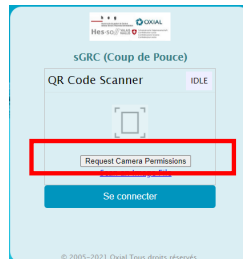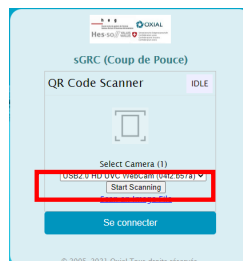

- Then   press "Start *scanning"*

Fig. 1. A scan of the first UX interfaces related to option 1

• Fill in the last 3 questions and click « *Finish* »

The questionnaire is now closed.
Thank you for your participation.

Fig. 2. The scan of the actual interface implemented after many trials

4 Conclusion and further research

In this paper, we have shown how, starting from a concept of collecting company data to calculate a global occupational stress score, we have managed to implement it in real organizational contexts.

The difficulties were numerous and showed us the necessity to pre-test and test everything before implementing. In terms of future research, these difficulties allowed us to identify an important research question related to the anonymity to be kept at the same time to have a trace in time of all the answers given by the same respondent. This last

point is a real research issue which is not only present in our case, but also for electronic voting and also for the medical follow-up of patients.

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