EUWIN

The Future of Workplace Innovation International Conference

2024 | Oct. 1st to 3rd

University of the Basque Country (UPV/EHU)
Carlos Santamaria, Plaza Elhuyar | 20018
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The Future of Workplace Innovation
EUWIN Conference
Oct 1-3 -2024
University of the Basque Country (UPV/EHU)
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Keynote presentations

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2	Arturo Lahera	Universidad Complutense de Madrid, Spain	**Digital technologies, artificial intelligence and workers' participation: job quality in the future of work**
3	Richard Ennals	University of Agder, Norway	**Technological Change and Human Centredness**
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5	Frank Pot	**Radboud University** Nijmegen, Netherlands.	**Artificial intelligence and job quality**

1. Introduction to the conference

Egoitz Pomares (University of the Basque Country, UPV/EHU; Spain)

As we navigate transformative changes in our workplaces, spurred by rapid technological advances and shifting societal values, the role of workplace innovation has never been more crucial. The upcoming European Workplace Innovation Network (EUWIN) conference hosted by the University of the Basque Country in San Sebastián (Spain) is not merely an event; it is a timely conclave to reflect on how we can harmonize productivity and well-being at work with human-centric work practices.

Workplace innovation, as chronicled by EUWIN and highlighted through various European policies and programmes, transcends conventional organizational changes. It integrates the participation at work, work organization, and supportive technologies, aiming for good jobs. This multifaceted approach has been pivotal in Europe in the last decades.

The narrative of workplace innovation in Europe has evolved significantly since EUWIN's inception in 2013. With its foundation firmly rooted in European socio-technical traditions and democratic dialogue, workplace innovation has emerged as a response to Europe's economic and social challenges. It promotes a systemic view that sees technological advancements not as replacements for human work but as enablers.

The upcoming conference aims to showcase different approaches across Europe. These discussions are crucial as they provide actionable insights that can help bridge the gap and increase diffusion.

2. Digital technologies, artificial intelligence and workers' participation: job quality in the future of work

Arturo Lahera (Universidad Complutense de Madrid, Spain)

Digital technologies, artificial intelligence and workers' participation: job quality in the future of work:

The hegemonic social and media images of digital technology and artificial intelligence are still centered on the fear of mass technological unemployment... which is not happening empirically. This traditional debate on the future of work and labor focused on their supposed disappearance should be oriented towards a discussion on the quality of current and future digitized jobs. To this end, on the one hand, showing the indispensable contribution and participation of workers to sustain digitization and artificial intelligence (their dependence on human computation), and, on the other hand, presenting dimensions to identify and evaluate the quality of the working conditions of digital jobs and those organized through artificial intelligence algorithms.

3. Technological Change and Human Centredness

Richard Ennals (Editor in chief of the European Journal of Workplace Innovation)

Abstract

I have been asked to address some central issues from research over the last 40 years. It is possible to find over-simplistic accounts, expressed simply in terms of "Industry 3.0", "Industry 4.0" and "Industry 5.0". In a network organisation such as EUWIN, which operates across Europe and beyond, I suggest that there is no one single narrative. On the other hand, key elements of sociotechnical systems thinking and human-centredness provide recurrent themes. We are concerned with the "Futures" of Workplace Innovation, and with learning from differences.

In the 1980s, in individual countries and at EU level, there were many attempts to design and manage major programmes addressing technological change. Some, such as the UK Alvey Programme in Advanced IT, were largely technological in focus. The aim was to develop a new generation of enabling technologies, with a range of applications which were intended to meet the needs of ordinary people. The Alvey Programme lacked strong links with sociotechnical systems thinking; it offered "technology push" rather than "demand pull".

Programmes in the UK and the EU were partly responses to the Japanese Fifth Generation Computing Systems initiative of 1981, which was intended to meet the needs of ordinary people. This had strong technical foundations in European research in logic programming, functional programming and highly parallel computer architectures. Logic programming could also be seen as central to natural language understanding and translation systems. From 1980 I worked at Imperial College London, on logic as a computer language for children, with the role of research manager from summer 1984. In 1985 I was responsible for the UK Logic Programming Initiative, working in the Alvey Directorate.

In December 1985 I resigned my government posts in opposition to UK participation in the US Strategic Defense Initiative, whose task was to protect the US and her allies from Intercontinental Ballistic Missile attacks. I began collaborative work with Scandinavian partners.

Journals

A series of academic journals have supported work in the field and have published reports of managed research programmes.

AI & Society: Knowledge, Culture and Communication (AIS), published from 1987, has included papers from the EUWIN community, considering technology change in the context of society and human centredness.

Concepts and Transformation, later known as the *International Journal of Action Research (IJAR)*, founded in 1995, has had a focus on social rather than technological change. It has re-conceptualised research, with a focus on engagement rather than scientific detachment. In recent years, different models of Action Research have been explored, with extensive wider implications for academic research.

The *European Journal of Workplace Innovation (EJWI)* has been published since 2015, working in association with EUWIN. There has been increasing international interest and involvement. The journal provides an important arena for debate and "learning from differences". It provides a language in which several debates can be conducted.

Human-Centredness

Human-centredness provides valuable links between, for example, Human-Centred Manufacturing, and Human-Centred Cybersecurity. Sociotechnical systems thinking provides core vocabulary and concepts. There have been several lines of development, with early accounts in Germany from the late 1980s as a corrective to overly technological accounts of change, with themes such as "Human-Centred CIM". There have been several major national programmes, such as in Sweden, Norway and Finland, and discussions of "programme learning".

About the Author

With a background as a history teacher, Richard Ennals was a researcher and research manager at Imperial College London and with the UK government, with particular responsibility for the Alvey Programme Logic Programming Initiative. He resigned his government posts when the research was wanted as part of UK involvement in the US Strategic Defense Initiative. He was co-founder of *AIS*; he has been co-editor of *IJAR* since 1998; and editor in chief of *EJWI* since 2015. He was a co-founder of the UK Work Organisation Network in 1997 and is an Honorary Advisor to EUWIN. Due to health problems, he will not be physically present at the San Sebastian conference.

Richard Ennals has been adjunct professor at the University of Agder, which publishes EJWI: free, open access and online. He has advised on projects on regional development. He has been adjunct professor at NTNU, teaching on the EDWOR PhD programme. He has then worked with the Department of Technology Management, advising on projects on Cybersecurity, Human-Centred Manufacturing and Blockchain.

4. The Future of Work? The end of HRM!

Geert van Hootegem (KU Leuven, Belgium)

In this presentation, I want to argue that major labor market shifts will necessarily lead to an immense push toward workplace innovation. I want to argue that this disruptive organizational turn will herald the end of current human resources management theory and practices. The function is the smallest organizational building block of the traditional, functional organization. This is also the premise of theory and practice of HRM. TWIN does away with "the function" as a constant in organizational practice. From now on, the multidisciplinary team takes center stage. A new HRM theory and practice must be built around it.

The current labor market in many Western countries is characterized by large labor shortages. To say that is still an understatement. That shortage is, among other things, a direct result of World War II. Few children were born during that war, but a real baby boom followed afterwards as two generations of women had children at the same time. This cyclical demographic development has led to an expanding working-age population since the 1960s. These were golden times for recruiters. Those looking for the white raven with green freckles did find them in the oversupply in the labor market. The flip side of the coin was that our human resources were lavished because there was no need to use them sustainably. Now that the first generation of baby boomers is leaving the labor market - we talk about aging in the labor market - we will of necessity have to change the shoulder of the gun.

This will be necessary because two structural developments occurred simultaneously with this cyclical development. From the beginning of the seventies, we note a significant decline in natality. This de-greening means that the departure of the so-called baby boomers is not compensated by a proportionate number of newcomers. As if that were not enough, de-growth is accompanied by another structural demographic development. Due to a significant and continuous increase in life expectancy, we are trending toward a society with very many very old fellow citizens. The latter phenomenon is called the aging of aging.

So, for six decades there were (too) many people in the labor market. That translated into numerous organizational choices and drivers, into workplace design, macro, meso and micro. Let's go over some of them:

- the traditional organization, whether called Fordist, Taylorist or bureaucratic is an organization that bets on economy of scale. Economies of scale by grouping similar operations together. Economies of scale by extreme specialization. The flip side of that specialization is that it creates scarcity. One specialist too much cannot replace another too little. The relaxed labor market allowed this scarcity-creating specialization. The current labor market cannot have it. Of course, we should not all become generalists or Da Vinci-like polymaths, but we will have to be sparing with the space for specialization. the scarcity in the labor market will thus force us to seek labor organizational alternatives (TWIN) that bid farewell to the traditional, functionalist, specialization-oriented organization.
- Parkinson's Law (1955) *"work expands so as to fill the time available for its completion" or* "The amount of time required to complete a task is the time available" can be applied both to the smallest task level (such as household dishwashing) and to the entire labor market volume of a national, regional or sectoral economy. Applied to the past sixty years, the law teaches us that we have probably applied the sumptuous available volume with numerous redundant tasks. Lots of red tape and masses of lost time due to meetings required to keep bureaucratically designed systems afloat. The maladjustment of classical organizing to the VUCA environment could be compensated for decades by the available labor supply. The tightening labor market will require governments and management to re-focus primary processes through TWIN.
- Research continuously shows that the quality of work of a great many jobs is pitifully low. That same research also shows that it is only getting worse. While mutual responsibility for each other's health (e.g., regarding smoking in public places) has become the absolute norm, that does not apply to the organization of work. So there was apparently no substantial drive to organize work well. Instrumentally, there was no drive either because with so many potential workers in the labor market, we didn't have to worry about work-related attrition. It was, as it were, a strategy to combat unemployment. The current labor market forces us to

deal with quality of work instrumentally. TWIN is the only answer to combat labor market tightness.

- The large number of people of working age has allowed more and more aspects of life and society to become commodified. Although it was fashionable for a time to predict the disintegration of the (large) organization, we now observe that there are more and more organizations, that organizations are larger and more powerful than ever before. Commodified work is performed by more and more wage earners. That was possible but under the pressure of labor market scarcity we are going to have to downscale. Numerous jobs in education, healthcare, the sociocultural sector and/or government are no longer going to be able to be performed by salaried employees because there just aren't enough of them in number. New combinations of volunteers, volunteer carers, local residents and employees will have to be sought and organized. Organizations consisting of polyform membership relationships will have to take shape. The TWIN ideas are ideally suited for this.
- The traditional, functional organization cannot deal with diversity. Orders (whether for products or services) are accidentally linked to transformers/employees. Within the mono-functional departments, order variance cannot be dealt with. The result is that every employee in a functional department must be able to process all orders. So, they must all know and want the same thing. In this sense, traditional organizations are totalitarian organizations. They are structurally unable to deal with the diversity in the employee population. That wasn't necessary either. After all, there were enough candidates to select from. That has been turned upside down today. Diversity is the starting point. Employers recognize that in today's shortage, they select what they can get. Organizing based on the diversity of employees is new and mandatory today. Traditional organizational concepts do not get you anywhere. TWIN's organizational design instruments are ideally suited to human-centered organizing.

The labor market therefore forces us to develop workable work in synergy with the diversity in the labor market. But how do you start? How do you get such a TWIN design done? Firstly, by no longer designing, thinking and acting in terms of “functions”. The organizational turn is obvious. We need to think and design a step higher. The organization must be designed down to group level. The inventory of all tasks that need to be done in an organization is called the organizational task pool. This task pool must be divided into subsets that correspond to the amount of work that can be performed by eleven people. Why eleven? There may also be ten or fifteen but know that it is no coincidence that football is played with eleven. Multidisciplinarity is the alternative. This can be done by creating the subsets based on customer or order groups. The entire process is then completed within these subsets. This change is possible in any organization, in any sector.

The division into mini-units is done without paying attention to specific people. Here only the sustainable fit between strategy and structure counts. That is why the proposed way of working does not only focus on workability, but on the contrary is based on the performance of the organization. From then on, flesh and blood people come into view. For each mini unit there is an inventory of tasks it will perform. It is then examined for each (potential) employee which competencies (C) he or she has, which tasks the employee in question is authorized (A) for (the so-called professional competencies) and which tasks he or she prefers(P). This is the so-called CAP model. This approach allows a job design tailored to the diversity of employees in the group and organization, and ultimately society, but also in function of the CAP dynamics in the life course and career of each individual employee.

“Putting a profile in a function”: that has been the reality for sixty years. The function was the given. The employee had to fit into it or be pushed aside. There were plenty of people anyway. Sustainable employability reverses the direction. No longer is the job the constant and the employee the variable. Henceforth, the employee is the constant and the job is the variable. Indeed, the function or roles must be tailored to the (sometimes changing) CAP profile of each available worker. Only then can workable work be created for everyone. Only then can room be made in the workplace for everyone. If successful, our welfare state can be safeguarded.

However, it has major consequences in the boardroom and especially for human resource managers. The theory and practice of Human Resources Management departed from the job as a small building block of the organization. Organization charts, selection tests, job classifications, reward systems, ... you name it, the job is always the measure of things. Rarely was it made explicit that a generous labor market was the prerequisite for realizing this way of thinking regarding organizational design and associated human resource management. The current and future labor market will force organizations to do away with that. Organizations and work will have to be designed one aggregate level higher. Flexible, dynamic multidisciplinary teams with partially overlapping roles (role allocation and sharing) that breathe according to labor market availability will become the new normal. The way Human Resources Management is practiced today will no longer be normal. Total Workplace Innovation will be all the more so.

5. Artificial intelligence and job quality

Frank Pot, EUWIN, the Netherlands

As a result of demographic developments and the existing migration policy, there is a shortage of workers. At the same time, Cedefop (2022) finds that the share of EU workers who are not fully using skills at work in 2021 is 55%. The jobs of over skilled workers typically entailed a low level of task complexity and lacked adequate learning opportunities.

Monotonous and repetitive work is an affront to human dignity. It also carries risks of stress and RSI. Over the years more than 20% of the working population in Europe carries out tasks of less than one minute (European Working Conditions Survey 2005-2015, in Pot, 2022).

We know from the European Company Survey 2019, based on management interviews, that establishments with low job quality and low employee involvement (21% in EU27) have low results on performance and employee wellbeing, while establishments with high job quality and high employee involvement (20% EU27) have the highest performance as well as employee wellbeing (Eurofound & Cedefop, 2021). This means there is room for improvement.

As has been the case for a hundred years, observers expect that new technologies will make monotonous and repetitive work disappear. However, research indicates that AI does not automatically lead to good jobs nor to the disappearance of bad jobs (Ittermann & Virgillito, 2019). The 'massive market failure', as Rodrik and Sabel (2019) call it, to create a 'good jobs economy', should be compensated by a better coordinated policy and more action by governments, social partners and research institutes.

AI can assist workers to perform their work better, but AI can also reduce autonomy or lead to algorithmic management without human intervention or to unwanted surveillance (Piasna, 2024; Pot, 2024). The outcome depends on organisational design and management regimes on the one hand and employee participation in decision-making on the other. This is a mixture of co-creation as well as the struggle between management and workers over organisational control (Pot, 2024).

In the context of AI, for employees this struggle boils down to the question of how to fool the algorithm. Perhaps the application of AI will mark the beginning of a new phase of this struggle.

Alleviating monotonous and repetitive work through job rotation, ergonomic aids and breaks has become quite common, but these measures do not address the heart of the matter, the organisation of work.
Workplace innovation and similar approaches offer solutions for better jobs and performance, but unfortunately rarely for monotonous and repetitive work. The combination of high productivity and low well-being is generally considered normal or unavoidable. Fierce global competition dominates any moral consideration. Nevertheless, I call on the workplace innovation community worldwide to develop solutions for monotonous and repetitive work. Develop and apply human-centric design and leave no one behind!

If the implementers of Industry 5.0 want to 'place the wellbeing of the worker at the center of the production process' they should simultaneously work on an important condition at the level of society, also mentioned in the industry 5.0 policy: moving from a profit-oriented shareholder economy to a mission-oriented economy and stakeholder value (Breque et al., 2021).

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3	Anders Örtenblad	University of Agder, Norway	**How can we get to know what employers want: an examination of some basic assumptions in employability research**
4	Aitziber Elola Ceberio, Maddalen Alkorta Elzo	Orkestra Basque Institute of Competitiveness (Deusto Foundation) and Deusto Business School (University of Deusto, Spain	**Integrating Advanced Digital Technologies with Human-Centric Approaches: Exploring the Path to Triple Sustainability in SMEs through Industry 5.0**
5	Milan R. Wolffgramm, Stephan Corporaal, Aard J. Groen	Saxion University of Applied Sciences, University of Groningen, Centre of Expertise for Technology Education, The Netherlands	**The Impact of Collaborative Robot Arms in Dutch Small- and Medium-Sized Manufacturing Enterprises: A Comparative Case Study**
6	Marcelo Sousa, Guilherme Neves, Tatiana Teixeira, Maria Covas, Nilza Ramião, Soraia Alves, Flávia Barbosa	INEGI, Porto, Campus da FEUP, Portugal	**Human-centered design approaches to guide companies into Industry 5.0**
7	Peter Oeij Frank Pot	TNO; Radboud University. Netherlands	**A good example of workplace innovation is to design a dialogue between engineers and HR-professionals Relevance of European Skills Alliances for Workplace Innovation**
8	Antonius Schröder	TU, Dortmund University. Germany	**Relevance of European Skills Alliances for Workplace Innovation**
9	Stefan Jana	Anglia Ruskin University, UK	**Who is the "human" in "human- centric" Industry 5.0 A network analysis of organizational flexibility taxonomies**

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17	Hans Chr. Garmann Johnsen	University of Agder	**In Search of the 'Communicative Turn 2.0': Reflections on the Intellectual Legacy of Olav Eikeland**
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Call for Abstracts

1. Social innovation in active labour market policies for vulnerable groups

Angelina Atanasova (ARC Fund, Bulgaria)

Zoya Damyanova (ARC Fund, Bulgaria)

Social Europe has become one of the most important EU's roles, recognized both by EU Member States' politicians and citizens. The EU-level social targets set within the framework of the European Pillar of Social Rights to be achieved by 2030 aim for 1.) at least 78% of people aged 20 to 64 to be in employment; 2.) 60% of all adults to participate in training every year; and 3.) the number of people at risk of poverty or social exclusion to decrease by at least 15 million, including at least 5 million children, compared to 2019. In this regard, the active labour market policies (ALMPs) at national level play a crucial role in achieving these targets via activation of the unemployed as well as by up- and re-skilling of already employed persons to acquire better quality jobs. Having realized that 'governments cannot address sustainably unemployment through demand expansion alone' (Bellmann and Jackman 1996), ALMPs turn out as an important aspect of achieving overall better employment rates[1].

Variety of factors are researched as potentially important for the effective implementation of ALMPs. For example, some scholars have suggested that provision of 'training and private sector employment programmes' and 'job search assistance' tend to yield different results with regard to short, mid- and long-term goals. Another important factor represents 'the design, targeting and implementation of a policy' (ILO 2016)[2]. Despite the ample literature on the subject of ALMPs, scholars report an existing gap on the effects of ALMPs on the low-skilled population and vulnerable groups (Escudero 2018)[3]. The type of target group (e.g., vulnerable groups, low- or high-skilled) has been found to be affected differently by ALMPs. For example, according to Escudero 'the ALMPs are more effective for the low skilled than for the overall population' (2018)[4].

The project SYNCLUSIVE that we present is an experimental one for which ALMPs are implemented across four pilot projects for vulnerable groups under the form of interventions (i.e., trainings) with different thematic focus in Bulgaria, Finland, the Netherlands and Portugal. The project incorporates an innovative ENGINE approach that is specifically designed and implemented for this purpose. It entails targeting various vulnerable groups and regional stakeholders with tailor-made interventions to stimulate labour market inclusion for vulnerable groups. These are implemented with the support of regional coalitions of stakeholders, where the local governments and employers, are supported by training and other third-sector organisations.

The effects of the interventions and the overall impact of the ENGINE approach will be traced throughout the process and evaluated via qualitative and quantitative research methods. Interviews and surveys will be conducted with the vulnerable target groups before the start of the interventions to test their motivation, prior experiences and self-perceived self-efficacy; right after the interventions, and four months after the finalisation of the interventions to measure the short-, mid-

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[4] *Ibid*.

and long-term effects for the targeted vulnerable groups, as well as the effectiveness of the ENGINE model in each country. Additional interviews and surveys will be conducted with the key stakeholders involved in the project as part of the coalition: namely, employers, social partners, national public institutions representatives, and other related non-governmental representatives. The results of these interventions will be contextualized in the overall national policies implementation of ALMPs at domestic level, the effectiveness of national institutions with ALMPs and the specificities of the sectors, in which the interventions have taken place.

Thus, this research abstract presents the planning for the first research paper as part of a paper series, which will focus on presenting the project set-up and its uniqueness in terms of the ENGINE approach. The paper will aim to position the project's goals in the context of the existing EU and national-level ALMPs in the four researched EU Member States. The paper will first introduce the existing challenges of inclusion of vulnerable groups in the labour market, and the definitions of the latter in the EU and national contexts; second, it will describe the current EU goals and the national, and local specific goals for inclusion of vulnerable groups. Next, it will provide an overview of the current EU-level and national ALMPs for vulnerable groups with view of the existing gaps and already identified success factors. Last but not least, it will map the stakeholders involved in the process and their perceived roles.

Overall, this paper will aim to compare the existing ALMPs at national level across the four researched EU Member States, their gaps and potentials for effective implementation at domestic level from the perspective of key national stakeholders. Thus, we will present how the project set-up in each country is aimed at complementing already existing labour market inclusion policies targeted at vulnerable groups and the expected results from the project implementation. From theoretical perspective, the paper will formulate and state some hypotheses on the factors that would prove crucial for the successful implementation of the project set-up in the different national contexts, and how these differ from the traditional ALMPs implemented at national level.

2. Human-Centric Technician and Service Engineer Turnover Management

Pascal Kampert (TNO, Netherlands)

Facing industrial labour shortages, employee retention is becoming an increasingly relevant channel to maintain functional workforces (Heneman et al., 2018). Yet, in 2022, industrial turnover in the European Union increased vastly and, since 2023, stabilised at an increase of 40% compared to pre-COVID levels (Eurostat, 2024). This phenomenon is not specific to European labour markets but part of a global phenomenon commonly referred to as the Great Resignation (compare: Great Attrition) (McKinsey, 2022). Research on employee turnover has a long history and yielded a broad body of theories on drivers of turnover intention (Mobley et al., 1979; Ngo-Henha, 2017). Compared to pre-COVID attrition, new factors constitute the top drivers of employees to leave: Inadequate pay remains the leading cause, but lack of advancement opportunities and lack of meaningful work increased in importance (McKinsey, 2022). Less research has been conducted about how employers can successfully address these shifts in employee priorities. In this paper, we present the multi-pronged research methodology, supported by Machine Learning approaches, that will be used to identify the main causes for the growing employee turn-over in a company case.

In collaboration with a global industrial machinery manufacturer a research project to investigate increased turnover and coping strategies among technicians and service engineers (SE) globally is rolled out. This research project contains three major work packages. First, the company- and sector-specific identification of drivers for SEs staying and leaving. Second, the project aims to make turnover predictable on an individual or profit-centre (PC) level. Third, the project aims to understand what is a "healthy" turnover for SEs and the company is (Heneman et al., 2018), and identify and evaluate human-centric organizational interventions to approach healthy levels of turnover.

Three steps are planned to support the organization to reduced employee turnover. A global survey among technicians and interviews with managers is a first pillar for the identification of drivers of SE turnover. The survey contains quantified data on job satisfaction, alignment of job expectations to job reality, the relationship to managers and the company on a larger scale. A separate emphasis will be on what has motivated the SEs to stay over the last three years. The survey will be issued to SEs in their third year in 17 PCs, of which 8 have turnover rates higher than 10%. From then on, we aim to conduct the survey yearly to each cohort of technicians to ensure comparability between cohorts and over time. A second pillar of the research consists of interviews with managers to compare management practices in comparison and working conditions to country markets. The data resulting from these interviews will be unstructured textual data, analysed with natural language processing (NLP) methods, which yet have to be determined precisely.

A potential third pillar is an analysis of leavers through exit interviews, trying to identify differences between leavers and stayers. At this point it is unclear how the exact data would look, as exit interviews are conducted, but we are unaware of their precise structure and their potential biases. Furthermore, it is impossible to contact leavers and inquire their motivations and destinations. An alternative to such a survey would be to inquire among stayers why their colleagues who departed left, and what benefits they saw in alternative employers.

The second work package, facilitating predictability of turnover, focuses on creating a prediction model. Such a prediction model provides two benefits: First, if precise, it provides an effective mean for the company to adapt hiring strategies aimed at sustaining SE workforces (Lazzari et al., 2022; Akasheh et al. 2024). Next to the preparation and alignment of coordinated action, workforce costs are expected to decrease by facilitating preemptive action. The second benefit is that the study can empirically test the effect sizes of turnover drivers from the first work package. A quantified understanding of effect sizes provides orientational knowledge on the effectiveness of different solution directions, offering vital input for the third work package, in which interventions are

designed. Additional insight will be provided by what cannot be explained through predictive models: The prevalence and size of unknown unknowns. This effect size of unknown unknowns can be used to retrospectively evaluate the comprehensiveness of the first work package. Should the outcome prove to reveal a high proportion of unexplained deviation, this could motivate a revision of the identified drivers of turnover. Multiple prediction models will be set up and compared for their empirical performance, before a model is chosen and deployed. Next to linear regression models, we will consider decision tree-based models (including random forests, and xgboosted models), Support Vector Machines (SVMs), Artificial Neural Network (ANN)-regressor models, as well as the respective ensemble-models. These models constitute the majority of means for prediction of employee turnover (Akasheh et al., 2024)

Insights from this process guide the development and exploration of targeted, data-driven and human-centric organisational interventions. This research phase facilitates insights of two kinds. First, it allows us to evaluate the chosen organisational interventions in their direct efficacy. Second, our close-to-practice setting provides insights into underlying management factors. These factors allow for the analysis of decision-making processes that prioritise employee well-being and retention, the alignment between policy intent and its effective implementation to improve the employee experience, organisational strategies that balance business goals with employee well-being to support retention, and empathetic internal communication that fosters trust and reduces attrition.

At this point three types of interventions are foreseen: First, the pre-employment communication between candidate SE and recruiter shall be adapted to better reflect the position and accordingly improve the match between candidates who sign, and the jobs. Second, early-employment experiences are aimed to be changed by interventions in middle management. Third, general changes to working conditions are foreseen. However, this research is in its early, explorative stages, with further analysis required to refine strategies and validate outcomes. As such general interventions also require alignment with local management and the global operations department, it is unclear to what extent interventions of this kind can be part of the scope of this research project.

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3. How can we get to know what employers want: an examination of some basic assumptions in employability research

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Employers' expectations on graduates is a theme dealt with in a research area that often uses the notion of "employability." "Graduate employability" may be defined as "the possession of the understandings, skills and personal attributes necessary to perform adequately in a graduate-level job" (Knight & Yorke, 2002, p. 261). A common conclusion from such studies is that employers prioritize "soft" (or "generic") skills, over "occupational" (or "hard" or "technical") skills.

The literature in this area is relatively extensive. However, such research is far from unproblematic. In this paper/presentation I discuss some problems that are connected to research on, especially, what employers want and demand from graduates, but do also touch upon the difficulty to helping graduates becoming employable as well as studying how well prepared the graduates are. It is important to emphasize that the intention definitely *not* is to blame any single scholar or study, but rather to identify areas for improvements.

The paper/presentation is based on literature reviews. Foremost, studies that have efforts to report on the employability of graduates is reviewed, but studies on how well the graduates are prepared are also reviewed. In addition, the paper/presentation is based on literature that has examined such employability studies critically.

The paper/presentation contributes by offering an overview of problems connected to employability studies. Its main contribution, though, may be the thoughts and suggestions for how the research area considered could be made more relevant.

The paper/presentation deals mainly with three basic groups of assumptions that many employability studies could be said to have. The first of these assumption groups is that employers, when studied, are assumed to be able to express what they want and need from graduates in a relevant way. Most employability studies use questionnaires with a set of given alternatives. The terms used are rarely defined (Jackson & Chapman, 2012; Prikshat et al., 2019; Tomlinson, 2017) and there is seldom space to add anything beyond the questionnaire for the respondents (Chowdhury & Miah, 2016). Another problem – which goes beyond the questionnaire method – is that employers' demands on graduates may be politically incorrect and would therefore never be expressed, even if they are known to the employer and no matter which method that is used (see, e.g., Hossain et al., 2020; Monllau Jaques, 2022).

The second group of assumptions has to do with the universality of results from employability studies. The universality can be divided into time, space and subject. The time-wise universality problem is rarely dealt with in employability studies (but see, e.g., Be & Khatoon, 2022), but we could expect any results from such studies to be relatively limited in time. When it comes to space, most studies are conducted within a certain national culture, although there are a few exceptions (e.g., Bhatti et al., 2022). Even if this is often mentioned as a limitation in the studies, it does, of course, decrease the universality of the results (which has been discussed by, e.g., Bhatti et al., 2022; Elrayah, 2021; Winterton & Turner, 2019). Also the subject aspect limits the universality. It could, for example, be expected that employers do not have the same expectations on graduates who have studied any professional education program as those having studied a disciplinary education program.

The third group of assumptions considers which implications the results have, should they be reliable and valid. There is an assumption behind many employability studies that higher educational institutions (HEIs) should do whatever they can to help making their students "employable", which could be questioned. For instance, one could discuss if HEIs should educate people to replace those that are currently working and who, for one or another reason, eventually will quit, or if HEIs instead should educate people to contribute to making the world a better place. There is also some kind of assumption in much employability research that it is the responsibility of the individual (and HEIs) to become employable, while the demands on employers to adapt to existing graduates are small (e.g., Hesketh, 2003; Sin & Amaral, 2017).

The presentation/paper also offers a few suggestions for how the problems listed could be dealt with. Among these suggestions are 1) to view employability studies for what they are – that is, snapshots with limited universality but with relevance for single students, scholars and study programs; 2) to use other methods to study employability; and 3) to develop better concepts and tools that researchers could use, to increase the comparability between studies.

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4. Integrating Advanced Digital Technologies with Human-Centric Approaches: Exploring the Path to Triple Sustainability in SMEs through Industry 5.0

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Problem Statement

The rapid advancement of digital technologies presents both opportunities and challenges for the triple sustainability of SMEs (economic, social, and environmental). Despite the potential benefits, many small and medium-sized enterprises (SMEs) struggle to achieve digital transformation due to various internal and external barriers. Thus, understanding the specific factors that influence the digital transformation of SMEs is crucial for fostering workplace innovation, participation, inclusivity, and achieving triple sustainability. In this regard, industry 5.0 emphasizes the integration of advanced digital technologies with human-centric approaches to enhance manufacturing processes, drive sustainability, and improve workforce well-being. This paper explores how the fusion of advanced digital technologies with human-centric approaches can drive economic, social, and environmental sustainability in SMEs, providing a framework for their successful digital transformation.

Thesis

The fusion of advanced digital technologies with human-centric approaches, central to Industry 5.0, can drive triple sustainability—economic, social, and environmental—in small and medium-sized enterprises (SMEs). This integration fosters workplace innovation, creating more inclusive and participatory manufacturing environments that enhance productivity and job satisfaction while reducing environmental impact. By exploring the socio-technical systems underpinning Industry 5.0, this paper emphasizes the transformative potential of combining technological advancements with a focus on human well-being and sustainability.

Theories Discussed

The TOE framework (Technology, Organization, and Environment) provides a comprehensive lens for analysing the determinants of digital transformation in SMEs. This framework considers technological factors (e.g., digital tools and systems), organizational factors (e.g., leadership and culture), and environmental factors (e.g., market and regulatory pressures), offering a holistic approach to understanding how these elements interact to drive triple sustainability in SMEs (Ghobakhloo et al., 2022).

Digital leadership, characterized by high digital skills, positively influences employee innovation by fostering a supportive environment for digital transformation. This leadership style is crucial for driving the economic, social, and environmental aspects of sustainability in SMEs, aligning with the triple sustainability goals of Industry 5.0 (Erhan, Uzunbacak, & Aydın, 2022).

The integration of digital technologies enhances employee engagement, which is essential for achieving social sustainability. An innovative *organizational culture* combined with transformational leadership supports employees' acceptance and effective use of digital tools, contributing to the overall social well-being and satisfaction of the workforce (Hooi & Chan, 2023).

A culture of *digital awareness*, employee participation, and open-mindedness fosters innovation and supports the successful integration of new technologies. This culture is pivotal for achieving economic sustainability by enhancing productivity and competitiveness, thereby ensuring long-term viability (Kiefer, van Dinther, & Spitzmüller, 2021).

Industry 5.0 aims to create manufacturing systems that prioritize environmental sustainability and resilience. By balancing technological advancements with human and environmental considerations, these systems help SMEs reduce their ecological footprint and enhance their adaptability to market changes, ensuring environmental sustainability (Ivanov, 2022).

Method

This research adopts a mixed-method approach, combining a review of existing literature with case studies of SMEs undergoing digital transformation. The literature review focuses on identifying key determinants and impacts of digitalization in SMEs, structured around the TOE framework (Technology, Organization, and Environment).

- Analysis of digital leadership and its influence on innovative work behaviour and triple sustainability.
- Examination of the impact of digitalization on employee engagement and social sustainability.
- Evaluation of organizational culture and its role in fostering digital innovation and economic sustainability.
- Assessment of the integration of sustainable practices in digital transformation, emphasizing environmental sustainability.

Empirical data is collected through in-depth case studies of three SMEs, analysing their digital transformation processes, determinants, and impacts. The analysis of the determinants is based on the identification of technological, organizational, and environmental factors influencing digitalization, guided by the TOE framework. Then, the analysis of the economic, social, and environmental impacts of digital transformation is performed, demonstrating how these processes contribute to triple sustainability.

- *Company 1*: A company that initiated its digital transformation to improve reliability and dynamic planning. The process involved changing the ERP system and implementing digital tools for better data management and planning. The company emphasizes communication with employees to ensure their participation in the digitalization process, contributing to social sustainability.
- *Company 2*: An established company that has integrated digital tools like ERPs and data capture systems to enhance production planning and efficiency. The company's digital transformation also includes collaboration with external consultants and participation in innovation projects to develop sustainable products, supporting both economic and environmental sustainability.
- *Company 3*: A company focusing on improving its supply chain and production processes through digital technologies. The digital transformation aims to enhance product quality, reduce waste, and improve overall operational efficiency, thus contributing to economic, social, and environmental sustainability.

By employing this mixed-method approach, the research provides a comprehensive understanding of the factors driving digital transformation in SMEs and their impacts on triple sustainability, offering valuable insights for both practitioners and policymakers.

Conclusion

The fusion of advanced digital technologies with human-centric approaches in Industry 5.0 drives workplace innovation by creating more inclusive, participatory, and sustainable manufacturing environments. The successful integration of digital technologies in SMEs requires strong digital leadership, an innovative organizational culture, and a supportive external environment. By addressing the specific determinants of digital transformation through the lens of the TOE framework, SMEs can achieve significant economic, social, and environmental benefits. This approach ensures their long-term sustainability and competitiveness, aligning with the goals of triple sustainability in Industry 5.0. As SMEs navigate the digital transformation journey, focusing on these elements will be crucial for harnessing the full potential of Industry 5.0.

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5. The Impact of Collaborative Robot Arms in Dutch Small- and Medium-Sized Manufacturing Enterprises: A Comparative Case Study

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Thematic Area Workplace Innovation and Industry 5.0

Problem Statement Workplace innovation is crucial for manufacturers in Western Europe to increase the resilience of their production system and cope with external developments such as rising labour shortages (European Labour Authority, 2022), high and diversifying customer demands (Pech et al., 2022), an ageing workforce (European Commission, 2023), and the Industry 5.0 policy agenda (European Commission, 2021). The collaborative robot arm is a workplace technology currently gaining a strong foothold in contemporary manufacturing. The cobot can be equipped with a broad range of tools and used for many tasks, such as welding, packing, assembling, drilling, inspecting, and machine (un)loading (Bauer et al., 2016; Kadir et al., 2018; El Makrini et al., 2018; Salunkhe et al., 2019; Wolffgramm et al., 2021). Moreover, in contrast to classic industrial robotics, the cobot is considered easier to use, faster to (re)deploy, safe for direct and mutual interaction with individual operators (i.e., human-cobot interdependence), and more affordable (Hentout et al., 2019; Sherwani et al., 2020; Javaid et al., 2022). These features are particularly relevant for small and medium-sized manufacturing enterprises (SMEs) since they often lack the financial or human resources to implement long-lasting and complex technology (Prajogo et al., 2014) – due to these unique organisational features, this research focuses exclusively on SMEs. Available evidence provides a clear impression of the cobot's impact on human factors and performance (see, for instance, Weidemann et al. [2023] for a recent overview). Nonetheless, we noted that the current knowledge base fails to describe how deploying a cobot affects production unit resilience and what organisational significance this impact bears. We argue that four potential impact areas are overlooked: 1) the human-cobot interdependencies' functional requirements, 2) the operator's work perceptions, 3) the production unit's performance, and 4) the SME's strategic flexibility.

Thesis

With this research, we aimed to describe across various comparable production situations if and how cobot deployment affects functional requirements, work perceptions, performance, and strategic flexibility. We followed a classic organisational design theory that is centrally positioned in workplace innovation literature (Oeij et al., 2023) and concerned with aligning technical and social subsystems for sustainable and robust production (i.e., modern sociotechnical systems design theory [MSTS]). Conducting this research was not only scientifically relevant because it uniquely combined core literature from the fields of MSTS, operations management, human-robot interaction, applied psychology, and entrepreneurship. It also illustrated four understudied cobot- related impacts, described human-cobot interdependencies from both a functional and capacity alignment viewpoint, and contributed to calls for more MSTS-related research in contemporary work contexts (Parker et al., 2022; Govers et al., 2023; Guest et al., 2022; Oeij et al., 2023).

Theories Discussed

This research is grounded in workplace innovation and MSTS literature (de Sitter et al., 1997; Kuipers et al., 2020). It builds on the premise that structurally aligning technical and social subsystems through synergetic human-technology interactions and high worker involvement increases production system resilience and results in more competitive performance and a sustainable quality of labour. We discussed various theories to study if and how this premise applies to production units comprising a cobot and individual operators in an SME manufacturing context.

Firstly, we discussed human-machine interaction literature from a function allocation and capacity alignment viewpoint (de Winter et al., 2014; Johnson, 2014). The latter looks explicitly into the complementary between task interdependencies. Secondly, we used applied psychology literature to zoom in on the operator's work perceptions. A distinction has been made between work design perceptions and operator-out-of-the-loop perceptions. While both perceptions relate to the sustainability of production labour, there is a clear theoretical distinction. Work design perceptions primarily focus on the characteristics embedded in the work design of operators interacting with the cobot – we only studied the motivational characteristics prescribed by Morgeson et al. (2006) since this research concerned the interaction between individual operators and their cobot in a production context. Operator-out-of-the-loop perceptions focus on how technology deployment affects the operator's cognitive alertness or the extent to which the operator is placed out of the control loop (Gouraud et al., 2018). We focused on the operator's situation awareness (Endsley, 1995) and automation-induced complacency (Parasuraman et al., 1993). Thirdly, classic production and performance concepts were borrowed from operations management literature (i.e., functional requirements, productivity, and production reliability). Fourthly, the strategic flexibility concept from strategic management and entrepreneurship literature was used to abstract operational findings to a higher level (Brozovic, 2018). We examined whether the design of human-cobot production units related to how SMEs respond to developments in their external environment. The theories above were used to formulate various expectations that would help describe whether deploying a cobot indeed 1) led to the establishment of human-cobot interdependencies that can handle more and more complex functional requirements, 2) resulted in acceptable work perceptions, 3) came with higher performance, and 4) provided a substantial contribution to the SME's strategic flexibility.

Method

We adopted a comparative case study approach to richly and extensively study the cobot's impact in the areas of interest. As for multiple case studies, comparative case studies produce strong and reliable evidence since they meticulously illustrate how the phenomena under study behave in similar situations (Baxter et al., 2008). We study SMEs in the same country to enhance the comparability between cases and harmonise the demographic, economic, political, and legal context in which these cases are embedded (Stake, 2013). The Dutch manufacturing sector suits this research. Our previous work has shown that Dutch SMEs use cobots in their production system (Wolffgramm et al., 2021). Using a sampling method with strict requirements, we found that 15

SMEs matched these criteria and were willing to participate in this research. The participating SMEs produce a wide variety of (mostly metal) products, employ roughly 7 to 140 employees, and have a functional cobot in their production system for half a year up to six years. Since this research takes place at the operational and strategic levels, we included two types of workers per SME. The first type captured operational workers directly interacting with the cobot, such as machine operators, work organisers, and inspectors (i.e., operators). The second type comprised managerial workers involved in the SME's operations management and strategy formation, such as operational directors, manager-owners, and production leaders (i.e., managers). In total, 16 managers and 20 operators participated in this study. Based on our theoretical framework, we developed two interview protocols. We had to develop two protocols because some of the concepts under study were tied to the experiences of a specific respondent type. A conversation tool has been developed to help the

operators indicate eventual changes in their motivational characteristics. This tool is included in the protocol. All interviews were transcribed verbatim and imported into ATLAS.ti (version 22). Given the predetermined concepts, a deductive coding approach was used (Fereday et al., 2006).

Empirical Data

Our empirical data described how the cobot technology's limited robustness required considerable time, effort, and money to become operationally functional. These high (re)programming efforts caused the cobots under study to function as autonomous, preprogrammed, and rigid mini-robots, handling up to a few high-quantity products in ways that are not more reliable and efficient by default. The functional requirements of the human-cobot interdependencies were often not higher than those of previous production methods (i.e., manual production). Instead, the operator was decoupled from the initial production unit to conduct other, often more complex, production tasks on top of maintaining the cobot. Moreover, most cobots ran on one or a few (similar) cobot programs, stressing that the cobots under study were merely used for a few large-quantity and repeat products. Operators interacting with the cobots experienced stronger motivational work aspects. However, the cobot's autonomous and stable operation also provoked classic out-of-the- loop problems (i.e., slacking monitoring behaviour and a deep-rooted overreliance on the cobot). Poor monitoring behaviour increased the chance of cobot-related flaws not being noticed by the operator in time or at all, resulting in more defects in some cases. Productivity outcomes faced structural downtime caused by the operator notifying too late that the cobot had fallen to a standstill. Consequently, cobot-equipped production units did not perform better by default. Nonetheless, SMEs deemed their units strategically relevant. Deploying a cobot presumably improved financial flexibility, increased production capacity, streamlined future automation projects, and resolved labour scarcity issues. The empirical data has been illustrated with clear-cut tables and relevant quotations from managers and operators.

To conclude, this research creates a pathway for more workplace innovation and MSTS research at the crossroads of human-robot interaction, organisational design, production management, applied psychology, and entrepreneurship. Practical implications and suggestions for future research to quantify and expand the cobot's impact have been provided. Particular efforts should be invested in making the cobot technology more robust. That way, the cobot technology can be used in more dynamic production contexts, accommodate more synergetic human-cobot interdependencies, and allow operators with a practical educational background to participate more prominently in designing and redesigning their human-cobot production unit.

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6. Human-centered design approaches to guide companies into Industry 5.0

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Introduction

As industries evolve towards increased automation and digitalization, the seamless adoption of New Technologies (NT) by shop floor workers becomes vital for enhancing productivity and efficiency across various sectors. However, this transition often encounters resistance due to concerns such as job security and perceived complexity.

Addressing human factors through comprehensive workplace analyses is essential to achieve human-centered technology integration. Thus, this study formulates a baseline to support the implementation of two NT in an industrial context, through a dual approach: the characterization of the process and the identification of the workers' technology acceptance factors.

To that end, it was employed the novel UTAUT-for-Industry methodology, an extension of the Unified Theory of Acceptance and Use of Technology (UTAUT). This model helps predict workers' intentions to use (IU) NT in industrial settings, while aiming to create an inclusive and supportive environment for technology adoption. Meanwhile, the process' characterization will enable the company to refine the specifications for the NT and assess the suitability of the proposed solutions.

The conjunct formulation of a process and technology acceptance baselines aligns with Industry 5.0 principles, emphasizing human-machine integration, where advanced technologies complement human capabilities. This dual approach assists manufacturing companies in making strategic decisions regarding technology implementation while enhancing worker well-being and promoting an innovative workplace.

Case Study

This model was validated in the screws kit-assembly section of a company, which is aiming to meet Industry 5.0 standards. In this regard, the company is introducing two NT, an automated warehouse and a robot for picking and sorting of screws. These changes will significantly affect daily activities, making it essential to apply a technology acceptance methodology to prepare both the workforce and the organization, before the implementation. This includes:

Methodology

Two approaches were implemented in this study: UTAUT-for-Industry, a new methodology proposed by the authors, to formulate the technology acceptance baseline, and a characterization of the current state of the process, to formulate the process baseline.

UTAUT-for-Industry

This model is designed to deepen the understanding of technology adoption in industrial settings, addressing limitations of current models such as lack of consideration for the user's satisfaction with the current system (SCS). The model's primary objective is the quantification of the factors that impact the workers' IU both NT, forming a technology acceptance baseline to guide future implementations.

The UTAUT-for-Industry framework uses a questionnaire to assess users' IU the NT and their perceptions across eight macro dimensions: perceived usefulness, ease of use, safety, SCS, implementation process, social influence, organizational support and long-term consequences. The methodology consists of four main steps:

1. Objective definition: Both NT were chosen for the assessment;
2. Factor's selection: the eight macro dimensions were considered relevant for the company's context;
3. Surveys definition: a SCS and technology acceptance survey was employed, using Likert-type scales (1-5) to rate the participant's agreement/disagreement with each question;
4. Analysis and data interpretation: survey responses were processed using appropriate methods to formulate the results.

Characterization of the process

To ensure that the NT meet worker's needs, the process was analyzed, accounting for the time flow, warehouse capacity and worker's feedback. By thoroughly understanding the existing workflow, ergonomic conditions and challenges faced by the workers, the company can identify requirements for the NT while minimizing the risks of technology rejection.

Furthermore, assessing the ergonomic status of the workers enables the identification of potential health and safety risks. By analyzing aspects such as posture, repetitive movements and biomechanical load, companies can implement appropriate corrective/preventive measures, reducing injury risks while boosting productivity and employee satisfaction.

Considering this approach, the methodological implementation consists of these stages:

1. Collection of sociodemographic characteristics, clinical history and characterization of musculoskeletal injuries through questionnaires;
2. Analysis of task ergonomic suitability, accounting for the task demands, duration, workloads and physical effort. The work cycles were monitored, with photographic and video recordings;
3. On-site observations and measurements, to assess the process' current capacity;
4. Evaluation of ergonomic risk factors, including awkward postures, repetitive motions and forceful exertions;
5. Data process, through numerical analysis and descriptive statistics, based on normative references.

Results and Discussion

Participant's characterization

The participants involved in the study were workers, responsible for kit assembly and warehouse loading, directly involved with the NT implemented. Most of the participants (66,7 %) were female and have been using the current system for over 20 years.

Technology acceptance baseline

The survey's results revealed that SCS is remarkably low. To better understand this situation, SCS was divided into four aspects – physical ergonomics, mental ergonomics, workload and professional/personal development – with physical ergonomics receiving the lowest rating, highlighting an extensive dissatisfaction with the existing process. Such low levels of SCS may have significant implications for the adoption of new technologies within the company, as it indicates a potential readiness for change among workers.

Furthermore, as illustrated in Figure 1, the results show that both NT received above average ratings. However, notable differences emerged in some dimensions. Perceived usefulness, for example, presented the highest deviation between the two technologies. Additionally, social influence received identical scores for both technologies, as expected since the workplace social environment is the same.

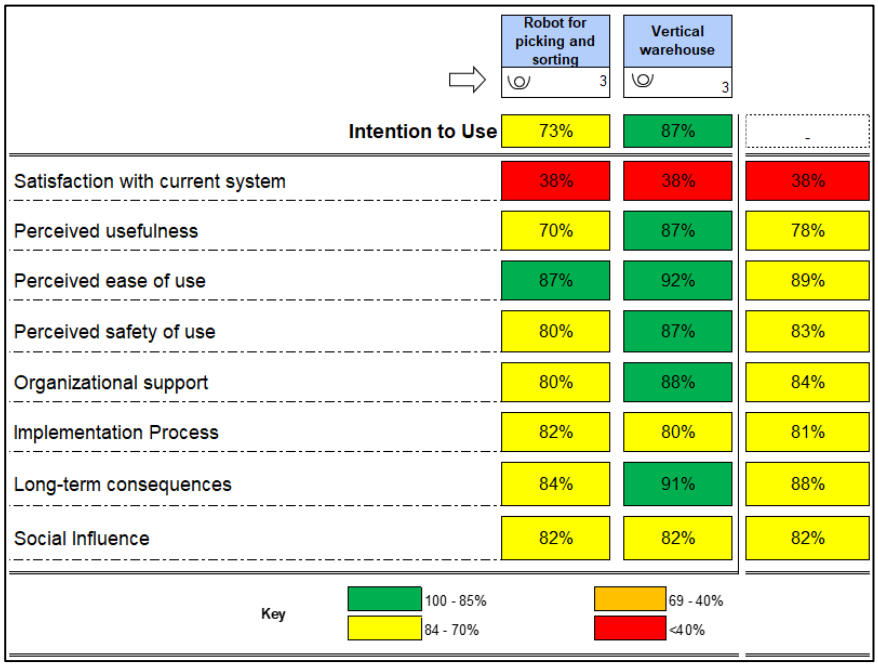

Figure 1 – Technology acceptance baseline

Process baseline

To assess the ergonomic status of the tasks, a critical worker in the assembly process was analyzed. She has indicated high levels of pain – 9 on a scale from 0 to 10 – for her neck, thoracic region, and hips/thighs, while indicating maximum pain levels for her right shoulder, elbow, wrist/hand, lumbar region, knees and ankles/feet.

That indication, and the worker's history of surgeries on both wrists, underscore the severe impact of her work conditions on her health. That remark was reinforced during the workstation observation, in which the worker has maintained awkward postures, as indicated below. With that, it was confirmed that the implementation of both NT will be beneficial to the workers physical health and are suited for their needs.

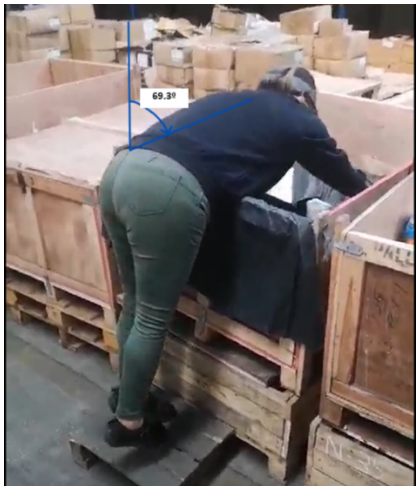

Figure 2 – Trunk inclination.

Figure 3 - Movements during manual handling of loads.

Additionally, the task execution times, and the warehouse's space were recorded, to formulate operational baseline as a combined assessment of the working condition and process capacity, as shown in Tables 1 and 2.

Table 1 - Process operational baseline

Indicator	Achieved Value	Unit
Warehouse capacity	95	m^2
Loading time	296	seconds per shelf
Average stock	81.9907	units
Average kit assembly time	75	seconds per kit
Average units per kit	67	units per kit
Average assembly pace (manual)	40,6	units per minute
Current production	93.986	units per month
Desired production	187.972	units per month

Table 2 - Process ergonomic baseline

Worker	Task / position	Energy expenditure (Kcal.min-1)	VO_2(mL.Kg.min-1)	% Eq.VO_{2max}
1	Kit assembly	7,56	24,46	84,35
	Kits transport and order dispatch	7,93	25,66	88,48
2	Warehouse loading	6,29	16,60	38,61
3	Warehouse clerk	3,88	12,22	38,19

The following specifications/ recommendations were defined for the NT and the process:

- The robot must be able to process at least 18 units per minute, in a daily 8-hour work shift, not counting setup time, to achieve the desired production;
- The automated warehouse must have a minimum space of 95 m^2, or be able to store an average of 81.9907 units;
- The weight of the bags, with raw materials, should be reduced, to diminish the load on the workers;
- The heavy bags should be handled by two workers;
- The pallets from the storage area should be placed on an electric pallet, with the ability to lift itself to the height of the automated warehouse's tray;
- An ergonomic mat and chair should be placed in the workstation.

As next steps, the setup time of the robot must be defined, to adjust its required pace and/or work shift. Furthermore, it is recommended a new application of the UTAUT-for-Industry, after the implementation of the NT, to compare the expected results and refine the technology acceptance baseline, for future implementations.

Conclusions

With the development of the process and technology acceptance baselines, this study has provided the company with a valuable tool to guide the implementation of both NT. By employing a dual approach methodology, it was possible to confirm that both technologies are suited for the workers' needs and identify requirements that the NT will need to fulfill to match the company's needs. Furthermore, the technology acceptance baseline serves as a foundation for future technology integrations, emphasizing the importance of a human-centric approach in Industry 5.0. This dual focus not only supports effective technology adoption but also enhances worker well-being and productivity.

Acknowledgment

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7. A good example of workplace innovation is to design a dialogue between engineers and HR-professionals

Peter Oeij (TNO; Netherlands)

Frank Pot (Radboud University Nijmegen, Netherlands)

Modern Sociotechnics (MST) has design criteria for both effective organisations and jobs with good quality of work. Among HR professionals, often with backgrounds in psychology and HRM, MST falls on little to no notice. Recent developments in the psychological study of "work design" have led to the SMART work design model, led by Sharon Parker. SMART combines insights about psychological needs and motivation at the person and group level with organisational conditions. Those organisational conditions are not developed in SMART, but they are in MST. Isn't it a good idea to connect the two and thus bring the HR professional into conversation with the "engineer," or organisational designer?

In this contribution, we begin by stating the importance of quality of work for both organisation and personnel. We place this in the light of the 'future of work' in the context of digitalisation and 'Industry 5.0' (with 'human-centricity' as an important pillar). We then outline how the connection of MST and SMART Work Design can meet the requirement for high quality work. We conclude with actions for stakeholders and recommendations for research. Our conclusion is that this connection breathes new life into the labour debate. Companies should become more human-centric. Organisational and job design are crucial to do this. But psychology alone, nor a pure engineering approach are the right way to go. Alignment is needed. The prerequisite is that the HR professional and the engineer understand each other better.

8. Relevance of European Skills Alliances for Workplace Innovation

Antonius Schröder (TU Dortmund University, Germany)

This presentation will discuss the relevance of existing sectoral and cross-sectoral Blueprints and Alliances (ESSA, SPIRE-SAIS) and the European Pact for Skills (Large Scale Partnership Energy Intensive Industries LSP EII) for adaptation of workforce skills and proactive promotion of innovation in the workplace. Skills intelligence measures, continuous adjustment of skills, co-creation of new technological and organisational solutions, and the integration of new (digital) solutions at the workplace are of utmost importance for the digital, green and (not to forget) social transformation. In addition, the human-centric and sustainability redefinition of job profiles in the sense of Industry 5.0 requires a current and future highly qualified, specialised and multi-skilled workforce is needed. Transversal, digital, green and industrial symbiosis skills are needed to ensure workplace innovation, including the expertise of the workers and to further develop (technological) innovation. Special attention is given to new (digital) learning arrangements that could be integrated into learning on the job: such as the online training platforms steelHub and SKILLS4Planet.

Examples of European projects (COCOP, ROBOHARSH, One4All, BRIDGES 5.0) combining technological and social innovation processes already show the high relevance of co-creation and the integration of the workers' experience for successful workplace innovation.

Against this backdrop the relevance of the European Skills Alliances and their Blueprint results for Workplace Innovation and the workers will be discussed. As Workplace Innovation depends on timely and proactive upskilling opportunities for employees, skills alliances allow for a coordinated and highlighted discussion across European industries of upskilling and re-skilling strategies, with the common goal of co-creation, implementation and support of (technological and organisational) innovation. The main question that guides the presentation is: How can the activities of European Skills Alliances be linked to the Workplace Innovation concept and community? How can both concepts endorse each other?

9. Who is the "human" in "human- centric" Industry 5.0?

Stefan Jana (Anglia Ruskin University, UK)

Industry 5.0 (I5.0) is the European Commission's (EC) flagship project to promote and foster a more resilient, sustainable, and human-centric society through acknowledging the importance of European manufacturing in tackling the multiple challenges of our time, first and foremost climate change and the social ramifications it entails (European Commission, Directorate General for Research and Innovation, 2021). With the concept still being in its infancy, there is very limited data and research available regarding its implementation, and publications so far have mostly approached the topic from conceptual angles (Alves et al., 2023; Ghobakhloo et al., 2023; Ivanov, 2023) rather than providing analyses grounded in empirical data.

Interestingly, some of these publications are designed as systematic literature reviews that, while aiming to investigate I5.0, draw on lots of literature on I5.0's predecessor, Industry 4.0 (I4.0). This is legitimised by the present lack of publications on I5.0 and it being the logical continuation of I4.0, drawing on similar technologies and adapting many of its design principles but "[taking] them to the next level" (Ghobakhloo et al., 2023, p. 440). The aims of these articles are, amongst others, to construct an "architectural design" of I5.0 to ensure it meets its set targets, looking what are I5.0's enabling technological components, design principles, and intended values (Ghobakhloo et al., 2023), investigating how I5.0 relates to I4.0 (coming to the conclusion that they are really quite similar and can be combined; Golovianko et al., 2023), and the implications of I5.0 for supply chain and operations management (Ivanov, 2023). Some articles even tackle questions that sound more critical, such as whether I5.0 is indeed a human-centric approach (Alves et al., 2023). Unfortunately, the mentioned lack of research grounded in empirical data renders these accounts fairly abstract, descriptive, and alarmingly lacking of critical depth, with most conclusions sounding very affirmative of I5.0 (for notable exceptions, albeit still on the "fourth industrial revolution", see Kravchenko & Kyzymenko, 2019; Schiølin, 2020). As such, these publications reproduce sociotechnical imaginaries (Jasanoff, 2015) of futures characterised by technological inevitability "through the discursive production of future essentialism" (Schiølin, 2020, p. 544).

This article aims to interrogate I5.0 from a more critical standpoint. Specifically, while being one of I5.0's foundational pillars, what exactly is meant by "human-centricity" has not been scrutinised. Hence, this article asks the question: *Who is the 'human' in 'human- centric' Industry 5.0?* The relevance of this question is further underscored when extending the view outside the narrow I5.0 literature and towards fields that may well be drawn on to inform I5.0's implementation. For example, in research on human-robot interaction, the role of anthropomorphism has been a foundational theoretical underpinning guiding studies into robot's trustworthiness and their acceptance by humans (Duffy, 2003; Obrenovic et al., 2024), yet without specifying what "Anthropos" it is that we aim to imitate to get "humans" to accept new technologies. Similarly, in research on the governance of new technologies such as AI, where human-centricity is stated as a core goal, the concept of the human is still often taken for granted without deeper consideration (see e.g. Chhillar & Aguilera, 2022). Finally, shedding a bit more light on the understanding of the human in the I5.0 context seems overdue given that: "The 'shared understandings' that constitute sociotechnical imaginaries ... are profoundly normative: these are desired or desirable forms of social life and social order that advocates want themselves and others to adopt" (Jasanoff, 2016, pp. 83–84).

The above-mentioned sociotechnical imaginaries stem from science and technology studies (STS), which is also the tradition that this article would like to contribute to. Therein, sociotechnical imaginaries are defined as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff, 2015, p.

4). The article investigates imaginaries of the human and (new) technologies by drawing on in-depth ethnographic data that were collected in a German SME that has participated in a Horizon Europe funded project on upskilling their workforce for I5.0. The data are analysed using thematic content analysis, examining both participants' discourses around how they perceive different human-beings and (new) technologies while also presenting an account of how their everyday practice is an expression a specific imaginary of the human. For example, while data analysis is still ongoing, it emerges that the image of what human would use a new piece of technology may influence purchasing decisions: in the present case, work is divided along traditional gender roles, designating back-office work to women. In combination with a lower valuation of "women's work", this also means that digitalisation of back-office work (e.g. using ERP software) is not deemed valuable and thus, not worthy of investment in comparison to traditional manufacturing machinery that is used by men to produce physical outputs.

In this case, the I5.0 imaginary as championed by the EC and academic advocates who centre it around "disruptive" digital technologies, collides with imaginaries of members of civil society that construct the future in less disruptive terms but rather as a linear continuation of the status quo. This example not only illustrates a potential hindrance to the implementation of I5.0 since participants notably resist exactly the kinds of digital information technologies that I5.0 would rest on (Ghobakhloo et al., 2023). The example also suggests that, if left without intervention, investments made under an I5.0 label will likely reproduce the status quo, including societal inequalities, rather than strengthening societal resilience as it might not actually bring about human-centric workplaces for every*body*. As such, this article aims to contribute to a critical discussion of the current theoretical underpinnings in the debates around I5.0 and workplace innovation. We hope to raise awareness for how practical approaches to innovation may stifle the achievement of a truly resilient, democratic, and sustainable society.

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10. A network analysis of organizational flexibility taxonomies

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1. Introduction

The present study on organisational flexibility for employees is part of a broader research project on the analysis of taxonomies reported in the academic literature on individual clusters of organisational policies (Flexibility; Benefits and Services; Diversity Management; Ad Hoc Counselling and Training; Third Mission and Sustainability; Support and Wellbeing). To the best of our knowledge, there is no general taxonomy of organisational policies. However, several taxonomies developed by different disciplines have been observed. For this reason, the taxonomies relating to the individual cores have been recorded and unified. Organisational policies set the guidelines and principles for organisational and human resource management (Spector, 2012) and play an important role in managerial performance and well-being (Kowalski, 2017; Guest, 2017).

2. Objectives

The primary objective of this study is to develop a concise taxonomy of organisational flexibility. The research also aims to find and highlight specific instances and best practices that demonstrate the different aspects of the taxonomy. These examples can then be used in the evaluation of organisational policies.

3. Methods

With the main purpose to synthetize the taxonomies without losing their complexities and multiple facets, a review concerning each policy category was executed. In this way the elements necessary for the theoretical development of the tool will be identified, which will be implemented in the following phases. The literature search on scientific databases such as Scopus, PsychInfo, and PsychArticles, provided taxonomies, which were elaborated to create a summary cross table of all dimensions. Subsequently, the presence of the different declinations of the dimensions in all identified dimensions was coded dichotomously (1 = present; 0 = absent). This allowed us to proceed with the net analysis and pinpoint the summary dimensions by eliminating redundancies.

The main purpose of the first analysis is to look at eventual correlations among concepts.

The secondary analysis aims to examine the potential overlap between various concepts.

Each of these steps will be conducted as follows:

- computing the most suitable correlation matrix according to the data-set typology
- computing a network analysis
- Observe indexes such as node centrality (betweenness and strength) and clustering.

This collection of papers explores various aspects of Flexible Work Arrangements (FWA) and telework. Several studies propose taxonomies to classify different forms of FWA, considering dimensions such as spatial mobility, temporal flexibility, and degree of supervision (Wang & Le, 2023; Yeraguntla & Bhat, 2005; Fritz et al., 1995). The literature highlights the importance of job characteristics, individual traits, and organisational factors in successful remote work implementation (Olson, 1983). Researchers emphasize examining boundary control, policy bundling, and implementation effectiveness when studying FWA (Kossek et al., 2022). The papers also discuss

the impact of telework on work-life balance, organisational performance, and societal structures (Qvortrup, 1998; Hardill & Green, 2003). Overall, these studies provide valuable insights into the complexities of remote work arrangements and their implications for individuals, organisations, and society at large. The cluster analysis reveals three main cores that can be summarised as flexibility in time, flexibility in place, and a more general core related to flexibility management. The betweenness centrality indices of the nodes designate an element within each core, with a value ranging from 14.00 and above.

5. Limitations

The main limitation of this study is the difficulty of finding many articles. Furthermore, the taxonomies identified are very varied and often inconsistent between authors. Future research should analyse a larger number of documents.

6. Innovation

This study introduces a new strategy for analysing taxonomies. It builds a new taxonomy from other taxonomies. Network analysis offers several strengths that make it particularly suitable for this research. Firstly, it provides a comprehensive and integrative view of the individual cores of organisational policies, integrating multiple dimensions and their interrelationships, ensuring a thorough understanding of the concept. Secondly, the method is based on empirical data, reinforcing the validity and relevance of the resulting taxonomy in different contexts and sectors. Thirdly, network analysis facilitates the identification of key nodes and connections, providing insights for practitioners to improve organisational policies.

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11. The Role of Ductility in Sustainable Workplace Design

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Problem Statement

The advent of hybrid work is a tangible consequence of the accelerated pace of technological advancement. Nevertheless, hybrid work represents merely one aspect of a more expansive concept, namely a "hybrid society." This term denotes a context in which the distinctions between the digital and the physical, the individual and the collective, the personal and the professional, and the local and the global are becoming increasingly indistinct.

In the context of a hybrid society, the role of work in people's lives and the function of workspaces are undergoing a deep transformation. Traditional office environments no longer align with the dynamic, fluid nature of contemporary hybrid workplaces. This paper posits that in order to achieve effective and sustainable workplace design in this hybrid era, it is essential to embrace a new spatial quality: ductility.

Methodology/Approach

This study employed a mixed-method approach, obtaining data through both desk-based and field research methodologies, encompassing both quantitative and qualitative data. The field research comprised direct observation of 82 mixed work environments, including innovative offices, hybrid third places, and work cafés. The majority of these were located in Europe, with 60 cases observed in eight countries and 18 cities.

The data were integrated through interviews and surveys with designers, users, and managers of these spaces. The analysis focused on identifying how these spaces cater to the diverse needs of hybrid workers, examining their design, functionality, and impact on employee well- being and productivity. The qualitative nature of the research permitted a nuanced understanding of the complexities and revealed a quality inherent to all those spaces that optimally fulfilled the diverse requirements of hybrid work. This quality was designated *ductility* – an allusion to the capacity of certain metals to withstand high stresses, undergoing significant plastic deformation but never losing their essential properties.

Findings

This study found that hybrid work can be considered a fragment of the hybrid society, intended as a profound cultural societal change. Many values have transformed since the pandemic, such as the role of work in people's lives or the importance of personal well-being, impacting how the workplace should support workers. The biggest challenge organisations face in implementing sustainable workplaces lies in creating environments that attract people, support them during their work, embrace non-working activities, and remain engaging regardless of continuous changes in people's presence and preferences. Ductility can help meet these challenges and contribute to creating resilient and sustainable workplaces.

Originality/Value

To the best of the authors' knowledge, this paper is among the first to examine the characteristics of

hybrid workplaces, highlighting specific workable drivers that can provide sustainable and stress-resistant workspaces. This study also describes specific office areas and functions that contribute to redefining the role of the office in people's work experience and well-being.

Thesis

Hybrid Office in Hybrid Society

The modern workplace has undergone a significant transformation, evolving from a purely physical office environment to a complex hybrid ecosystem that integrates various settings, including homes, third places, and digital environments. This transition to a hybrid workplace environment presents new design challenges[5] and reflects the broader transformation of contemporary society into a "hybrid society". This hybrid society denotes the coexistence of humans and machines, accompanied by changes in the cultural, spatial and temporal dimensions of our communities[2]. It can be argued that the hybrid society represents an ongoing reformulation of these dimensions, driven by several factors, including technological advances, evolving cultural norms and the redefinition of work and community values. In the context of this paper, the term "hybrid" is also employed to describe a society that is currently undergoing a period of transition, moving away from a past that is no longer perceived as viable and towards an uncertain future.

Technological advancement, evolving cultural norms and the redefinition of work and community values are the driving forces behind this transformation. The hybrid society synthesises traditional and modern values in order to navigate the inherent volatility, uncertainty, complexity and ambiguity. Radical visions frequently encounter opposition due to the absence of shared cultural references, impeding the establishment of common ground for discussion. Nevertheless, hybrid cultures facilitate the inclusion of diverse demographic groups, fostering a sense of belonging and cohesion.

At the individual level, remote and flexible working practices require greater self-organisation and management of private and work life, given the varied work environments and times. The traditional concept of "work-life balance", with a clear separation between life and work, is evolving towards "work-life blending". This shift challenges the conventional notion of well- being as a discrete break from work, instead viewing it as an enduring necessity, encompassing numerous positive moments throughout daily life.

The Need for a Different Workplace

The aforementioned changes make current workplace design criteria inadequate for the future, yet they do not render the office obsolete.

The collective experiences of recent years have demonstrated that digital technologies cannot wholly supplant the necessity for physical space. The latest research in neuroscience and cognitive psychology highlights the substantial neurophysiological and neurological advantages of face-to-face

[5] Sailer K. et al., (2023), The challenges of hybrid work: an architectural sociology perspective, *Buildings and Cities* Buildings and Cities, 4, pp. 650–668. DOI: https://doi.org/10.5334/bc.350

[2] Meyer S. et al., (2022). Responsibility in Hybrid Societies: concepts and terms. *AI and Ethics*. 3. pp 25-48. DOI: https://doi.org/10.1007/s43681-022-00184-2

collaboration[3]. It is evident that working from home and third locations have inherent limitations in terms of fostering a sense of team and belonging.

Despite a desire to maintain an office presence, the workspace requirements of individuals have shifted in the post-pandemic era. For individuals who have undergone a significant transformation in their work habits and work environment over an extended period, it can be exceedingly challenging to resume their previous work patterns and surroundings. This necessitates that time and space accommodate the novel approach to work that has been adopted, affording individuals autonomy and accountability in managing their personal commitments, personal well-being, and professional obligations. It is challenging to satisfy the diverse needs and desires of individuals in a single workspace.

Consequently, the hybrid office can be conceptualised as an ecosystem of spaces, wherein the space traditionally occupied by the office must possess distinctive characteristics. It is a space for meetings, for discussion, for learning and for periods of deep focus when required. It is a space for hospitality, rather than one solely concerned with operational efficiency. This does not, however, imply that such a space is less productive; on the contrary, it has the opportunity to be more so[46].

Ductility in Workplace Design

The foregoing observations lead to the conclusion that a novel approach to workplace design is essential. This approach must take into account the evolving role of work in people's lives, integrate aspects of non-work life, and emphasise well-being (physical, professional, and social) as an integral part of work. The concept of sustainability is integral to the way the office incorporates changes, focusing on efficiency, hospitality, and the integration of personal and collective well-being.

This approach is founded upon the necessity for spaces that are capable of withstanding the ever-changing demands of the hybrid workplace and is related to the concept of *ductility*.

Ductility extends beyond conventional notions of adaptability and flexibility. It is particularly noteworthy for its capacity to facilitate a multifaceted environment that supports collaboration, communication, focus, and relaxation simultaneously.

[3] Lin, Y. et al., (2023), Remote collaboration fuses fewer breakthrough ideas. *Nature*, 623 pp. 987–991. https://doi.org/10.1038/s41586-023-06767-1

[4] Rupcic, N. (2024), Working and learning in a hybrid workplace: challenges and opportunities, *The Learning Organization*, Vol. 31 No. 2, pp. 276-283. https://doi.org/10.1108/TLO-02-2024-303

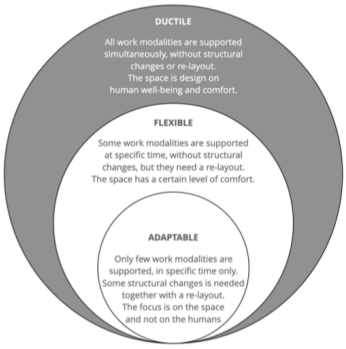

Fig.1 _ Difference among Adaptable, Flexible and Ductile workplace

This can be achieved without the necessity for structural alterations or rearrangement, offering a high level of comfort.

The findings of the case studies indicate three key characteristics that emerge in ductile spaces:

- *Resilience*: Ductile spaces are resilient, exhibiting the capacity to absorb changes through dynamic adaptation to new contexts. This resilience is achieved through typological variety and functional redundancy, enabling spaces to accommodate a diverse range of activities and working styles without significant reconfiguration.

- *Integrity*: Despite frequent alterations, ductile spaces retain their fundamental identity and purpose, fostering a sense of belonging and community among users. This is paramount for sustaining organisational culture in hybrid work environments.

- *Interpretability*: Ductile spaces facilitate a high degree of interpretability, enabling users to customise and influence their environment according to their needs and preferences. This user-centric approach enhances satisfaction and productivity.

These characteristics define many urban third places that have evolved to serve dual functions, hybridising their original purpose with work. The essence of these spaces, familiar to many workers during the pandemic, is now being adopted by innovative office environments designed to provide a collaborative and communicative setting for employees, facilitating interaction and idea exchange.

Conclusion

Ductility represents a novel, human-centric approach in workplace design, prioritising the capacity of spaces to adapt to the evolving needs of workers. This approach permits organisations to reimagine the office as a component of a long-term strategy for creating sustainable, resilient, and adaptable workspaces.

The integration of resilience, integrity, and interpretability principles within ductile offices establishes a distinctive relationship with workers, consistently meeting their expectations in the workplace.

Office hybrid commons manifest this quality, creating dynamic and multifunctional spaces that foster

community, connection, and well-being. As organisations continue to navigate the complexities of hybrid work, embracing the principles of ductility and hybrid office commons will be essential for creating workplaces that support innovation, collaboration, and employee well-being. This extended abstract highlights the importance of ductility in sustainable workplace design and its potential to shape the future of work in a hybrid reality.

12. Sustainable Transformation and Workplace Innovation

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Introduction/Background

In today's evolving landscape, organizations across sectors are increasingly recognizing their social responsibility beyond profit-driven objectives (Wood, 1991; McWilliams & Siegel, 2001; Matten & Moon, 2005; Lockett et al., 2006). Despite widespread acknowledgment, many organizations struggle to define and implement sustainable practices effectively (Jørgensen & Pedersen, 2011). The CapSEM-model (Capability System for Environmental Management, (Fet and Knudson, 2021)) offers a practical framework for aligning organizational practices with Sustainable Development Goals (SDGs). Grounded in system and life cycle thinking, the model guides firms in measuring and improving sustainability across four distinct system levels.

However, few organizational practices are inherently sustainable. The Natural Resource- Based View (NRBV) of the firm, introduced by Hart (1995), emphasizes that environmental capabilities can provide a competitive advantage. This study explores the application of the CapSEM-model in Unger Fabrikker AS (UF), a globalized chemical firm, which integrates the NRBV perspective into its sustainability strategy.

Central to UF's strategy is its commitment to the innovation process of "involving the whole organization in innovation[1]", to "develop a strategy firmly orientated towards the creation of innovative and self-sustaining process of development" (Belussi and Garibaldo, 1995; European Work and Technology Consortium, 1997) in particularly through employee-driven involvement in an autonomous business model, which is crucial for driving sustainable practices.

Research Objectives

The study's objectives are addressed through three research questions (RQs):

1. **How can sustainable development be operationalized for a globalized chemical firm using the CapSEM-model?** This question is explored through the analysis of UF's integration of SDGs into its sustainability practices, adapted to the CapSEM-model. The focus is on practical implementation, ensuring alignment with global sustainability goals.

2. **How can the firm's strategy, incorporating the NRBV perspective, be employed within the CapSEM-model?** This question involves a conceptual analysis connecting the NRBV perspective with the CapSEM-model's tools and methods. The analysis examines how UF's strategies for pollution prevention, product stewardship, and clean technology can be applied across the CapSEM-model's levels to achieve SDGs.

3. **How can the firm's innovation strategy be implemented by involving employees in workplace innovation through a self-sustainable business model?** This question explores the development of an autonomous, employee-driven business model for innovation (EDI) for high-involvement of employees in innovation. The value shop model is discussed as a value configuration for fostering innovation within a decentralized structure.

Methodology

The CapSEM model is applied to categorize UF's sustainability efforts across different organizational levels. The NRBV perspective is introduced, highlighting its interconnected strategic capabilities for pollution prevention, product stewardship, clean technology, and the base of the pyramid (BoP). These strategies are examined for their potential to achieve competitive advantages and how they can be integrated into UF's innovation strategy implemented through an autonomous business model for workplace innovation.

Research Design and Data Collection

A qualitative approach was employed, with data collected through a case study strategy. The analysis was conducted using semi-structured interviews and multiple sources of evidence, including archival data and external documentation.

Results

The analysis demonstrates how UF's interconnected strategies for pollution prevention, product stewardship, and clean technology can be applied across the CapSEM-model's levels to achieve SDGs. Key findings include UF's reduction in water consumption and the successful implementation of life cycle assessments for product certification. The strategic operationalization of sustainable development is mapped to SDGs within UF's global operations for two sustainable product groups.

The study highlights the role of self-managed teams and autonomous business models in implementing UF's innovation strategy, centered on employee-driven and high-involvement innovation processes supported by management. UF's approach, characterized by small power distance and minimal organizational layers, facilitates communication across the organization and supports self-sustaining innovation. This organic structure within UF's Innovation Management Team (IMT) promotes a self- sustaining project that leverages UF's unique competence in solving unstructured problems through direct customer engagement (Andreassen, 2016).

Discussion

Businesses today face challenges in balancing product supply with sustainable living, pollution prevention, and sustainability reporting. While much of the sustainability literature is conceptual, the CapSEM model provides practical tools for applying sustainability through a life cycle and system engineering approach. The model guides organizations from environmental process improvements to recognizing their role in a larger societal system, aligning with SDGs.

To integrate sustainability into business strategy, a concept bridging the CapSEM model and the NRBV has been developed. This approach helps firms like UF achieve competitive advantages, reduce costs, enhance reputation, and promote long-term growth. By addressing pollution, product stewardship, clean technology, and BoP strategies, UF aligns its resources and capabilities with SDGs. It prescribes the recognition of the interconnections not only between the two systems, but also goals and their targets of SDGs that see the dimensions in a nested system for SD and the SDGs (Griggs et al., 2014).

The implementation of this innovation strategy is facilitated through an autonomous business model by self-managed teams within a decentralized structure. UF's approach, characterized by small power distance and minimal organizational layers, facilitates communication across the organization and supports self-sustaining innovation. This organic structure within UF's Innovation Management

Team (IMT) promotes a self-sustaining project that leverages UF's unique competence in solving unstructured problems through direct customer engagement (Andreassen, 2016).

Conclusion

The study's purpose is threefold: to operationalize sustainable development for a global chemical firm using the CapSEM-model, to employ the firm's strategy with the NRBV perspective adapted to the CapSEM-model, and to implement the innovation strategy through an autonomous, self-sustaining business model. The concept provides UF with a competitive advantage through lower costs, enhanced reputation, and future market positioning. The proposed approach serves as a roadmap for achieving sustainable competitive advantages through employee driven innovation, applicable not only to UF but potentially to similar firms. The study underscores the need for ongoing research and innovation to address the evolving societal challenges of sustainable development, enabled by workplace innovation for performance and well-being in a globalized world.

Key-words: Sustainable Development; The Natural Resource-Based View; CapSeM-model; Self-sustainable business model; Employe Driven Innovation; Workplace Innovation

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13. Darkside of Workplace Innovation: The Emergence of the Digital Panopticon through Workplace Surveillance Technologies

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Nicolas Pélissier (Université Côte d'Azur, France)

In an increasingly digital workplace, employers have turned to monitoring technologies to maintain productivity, protect corporate interests, and mitigate legal risks. These systems, which monitor email, internet use, and even personal behavior, are intended to safeguard against defamation, data theft, and other liabilities (Chory et al., 2016). However, the rise of "bossware"—a growing constellation of surveillance tools—has led to concerns about the erosion of employee privacy, trust, and well-being (Barili, 2024; Munn, 2024). Drawing on Foucault's concept of panopticism, these technologies create a "digital panopticon," where workers exist in a state of conscious and permanent visibility, aware that they may be observed at any moment through surveillance technologies (Schleusener, 2018).

While intended to enhance efficiency and protect business interests, the excessive use of these tools can have detrimental effects, compromising employee privacy and leading to decreased motivation and engagement (Ball, 2021; Siegel et al., 2022). Excessive monitoring can also be detrimental to employees because privacy can be compromised if employees do not authorize the disclosure of their information, and it is broadcast to unknown third parties.

The shift to hybrid and remote work, accelerated by the global pandemic, has intensified these concerns, particularly as surveillance practices become more pervasive and invasive. Employee monitoring applications (EMAs) like Interguard and Teramind equip companies with extensive surveillance capabilities, enabling them to log keystrokes, monitor locations and browser activity, and even access webcam feeds, as well as biometric surveillance (Lockwood & Nath, 2020). The intense surveillance and online monitoring, coupled with the even online reprimands in Amazon warehouses, have drawn widespread attention due to the resulting high work pressure and increased rate of workplace accidents (Delfanti, 2021; Elnahla, 2019; Mikell, 2021; Negron & Nguyen, 2023). Organizations like EY have made headlines for analyzing data from office entry turnstiles to measure attendance, provoking debates about the ethical implications of such surveillance practices (Coffey, 2024)

This proposal will explore how various industries are incorporating these intrusive measures, from tracking keystrokes and social media usage to AI-driven sentiment analysis and digital body language assessments, both in physical and remote work settings. The study explores the role of transparency in technology adoption and how businesses can navigate the delicate balance between productivity and employee well- being. It emphasizes the importance of trust in the employer-employee relationship and suggests that fostering a culture of autonomy, choice, control, trust, and respect can positively influence employee engagement (Martin & Freeman, 2003). Furthermore, it will draw attention to the urgent need for stronger regulation to protect workers from the potential abuses of intrusive surveillance technologies. Ultimately, this study calls for a comprehensive exploration of the ethical, legal, and psychological implications of workplace surveillance technologies in both physical and digital work environments.

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14. The use of smart glasses in the workplace

Niek Zuidhof (Saxion University of Applied Research, Netherlands)

Smart glasses could be revolutionary in the workplace in many sectors such as industry and healthcare. Although pilots have been done with smart glasses, there are still a few users of smart glasses from whom we can learn about long-term use. However, in healthcare, examples of the use of smart glasses can found and in a specific use case, nurses have used smart glasses in wound care for control and treatment for several years. A nurse visits the patient at home, contacts the remote expert in the hospital via smart glasses (Vuzix M400), and treats the patient in consultation with the remote expert. However, since we know little about the long-term use and appropriation of smart glasses, this paper aims to provide insight into experiences and influences on long-term use from users of smart glasses. A qualitative study was conducted and interviews were done with nurses from various home care organizations working at the patients' homes (n=7), remote wound care nurses (n=7), and managers of a Dutch Hospital (n=3). Data were analyzed through directed content analysis. The results can be divided into four main themes: 1) personal experience, 2) collaborative experiences, 3) unanticipated consequences of long-term use of smart glasses, and 4) future needs. Respondents reported personal habits, emotional aspects, and experiences when working with smart glasses. In collaboration through smart glasses, respondents mentioned the increased quality of care and the change in interdependencies. Furthermore, working together via smart glasses had an impact on care at home as well. The consequences of the long-term use of smart glasses led to more feedback between nurses and patients, and to shifts in tasks between stakeholders. Future needs for smart glasses lie in further coordination with various stakeholders: patients, colleagues, IT, management, HR, and developers of smart glasses. We conclude that smart glasses facilitate hands-free, high-quality home care, where an expert advises with a first-person perspective, the nurse learns new skills and a vulnerable patient can remain in the comfort of their environment. Despite it is currently cost-increasing, it also saves time and space in the hospital.

15. Task Content Variety and Task Sequence Variety. Bridging Task Level and Job Level Analyses of Wellbeing at Work

Michiel Bal (KU Leuven, Belgium)

Empirical studies on wellbeing at work take either discrete tasks or entire jobs as their prime level of analysis. This paper suggests bringing these separate analytical realities, based on differences in research objects, scope and wellbeing outcomes, back together. To do so, the paper bridges this analytical split by introducing two concepts, i.e. task content variety and task sequence variety. We show how linking these two with the concept of task interdependence allows for the task-level micro-foundations of autonomy or job control at the job level. The paper connects these two concepts and contributes by deploying them as a junction between task level analyses and job level analyses of wellbeing at work.

16. Integrating Situational Awareness and Social LCA in hydrogen transitions: Implications for operators and societal outcomes in glass manufacturing

Christina Mitcheltree, Kristine Bly, Thiago Lima Silva, Giuseppe Fragapane, Fabian Rocha Aponte, Halvor Holtskog (NTNU, University of Agder)

Problem statement

The glass manufacturing industry is urgently transitioning to hydrogen to meet the 2050 global decarbonization targets, a move prompted by the 12–15-year lifespan of glass furnaces. This transition supports the European Commission's climate neutrality goals and requires rapid innovation and cross-sector cooperation to introduce new business models within the "Energy Transition" and "Hydrogen Economy" frameworks (European Commission, 2021; 2022a; 2022b; 2024; Pratap Chandran and Purayil, 2022). Entailing substantial updates to infrastructure and safety protocols due to hydrogen's flammability, workers are required to learn new skills, merging technical changes with a strong human-centered approach (Harichandan et al., 2023; Hasankhani et al., 2023; Hassan et al., 2023). On the other hand, the upscaled switch to hydrogen by energy-intensive industries will have direct and indirect societal impacts through the value chains such as on employment, value-added and emissions and more broadly on the Sustainable Development Goals (SDGs). Sociotechnical systems theory calls for a balanced development of social and technical workplace elements (Cherns, 1976; Marquardt, 2019; Parker et al., 2021a) ensuring transitions are both socially sustainable and technologically sound. By enhancing social perspectives with technological insights, this research advocates for a balanced method to technological adaptation, setting the stage for a more in-depth exploration (Cherns, 1976; Parker et al., 2021b).

Thesis

Research project overview

This initiative is part of the EU research project H2GLASS, which focuses on exploring the role of hydrogen in glass manufacturing as a strategic response to global decarbonization targets. The project is coordinated by SINTEF Energy Research with strong involvement of two other institutes, SINTEF Manufacturing and SINTEF Industry. SINTEF Manufacturing leads a work package focusing on the industrial demonstrators whereas SINTEF Industry leads a work package where one of the key objectives is to assess the societal impacts of implementing hydrogen technologies in the industry, focusing on employment, local economies, and social well-being. To achieve a nuanced understanding of these impacts, our research employs a mixed methodology (Creswell, 2009) that blends direct experiences of operators with a broader analysis of societal impacts.

The "Factories of the Future" initiative highlights the increasing complexity of processes as a major challenge in today’s manufacturing environments (Ghimire et al., 2017). As such, our investigation places significant emphasis on Situational Awareness (SA) during the transition to hydrogen, examining how individual and systemic factors affect operators' ability to adapt to new environments (Endsley, 1995; Endsley, 2017). SA is a crucial element in understanding how operators perceive, understand, and respond to changes introduced by the adoption of hydrogen

technologies in their work environment (Andreassen & Eileraas, 2022; Endsley, 1988, 1995; Evesti et al., 2017; Stanton et al., 2001). This approach helps us explore the immediate human responses to operational changes, offering insights into how these shifts influence workplace safety, dynamics, and overall well-being.

In addition to understanding contextual and individual responses, we utilize Social Life Cycle Assessment (S-LCA) informed by Environmental Life Cycle Assessment (E-LCA) and Techno-Economic Assessment (TEA) (Mahmud et al., 2021) to systematically analyse the broader social and socio-economic impacts throughout the lifecycle of hydrogen technologies. This approach bridges the gap between individual experiences and broader societal impacts, providing a comprehensive view of how technological changes affect both the workplace and the wider community. By merging qualitative research with S-LCA to study green hydrogen technologies, we offer an innovative approach that distinctively integrates deep technological insights with human and social dimensions.

While H2GLASS´ primary focus is on advancing hydrogen technologies in the glass manufacturing industry, it also involves the aluminium sector to demonstrate the transferability of these technologies to other energy-intensive industries. This cross-industry approach not only enhances our understanding of SA and related societal impacts amid hydrogen transitions, but also ensures that our findings are robust and broadly applicable, enriching the generalizability of our research (Creswell, 2009).

Methodology

Effective SA entails mastering new technologies, continuous learning, and effective human-automation collaboration, crucial in sectors like aviation and healthcare but less explored in manufacturing, particularly with emerging technologies like hydrogen (Marquardt, 2019; Weick and Sutcliffe, 2007; Whiteman and Cooper, 2011). While energy sector research often highlights how technology boosts SA in hydrogen management, it typically overlooks the complex human and organisational dynamics involved (Chu et al., 2019; Franzl et al., 2022; Chouaf et al., 2023; Hong et al., 2023; Singh & Govindarasu, 2020; Song et al., 2022; Van Der Veen et al., 2024). Our study addresses this oversight by exploring SA within the manufacturing industry (glass/metal) transitioning to hydrogen. Employing an exploratory sequential mixed methods design grounded in SA principles (Endsley, 1995; Fetters, 2013; Creswell, 2015; Creswell and Clarke, 2017), we combine qualitative interviews (case study) (Eisenhardt, 1989; Yin, 2018) with Social Life Cycle Assessment to investigate how human cognitive processes (recognising SA cues) intersect with environmental (context) and social sustainability.

By applying S-LCA after recognising awareness cues through SA we present a comprehensive framework for gaining a nuanced understanding. Through merging quantitative evaluations of socio-economic impacts with qualitative considerations of human factors, this integration enriches both disciplines.

Such a holistic approach facilitates a thorough analysis of SA, supporting sustainable industrial practices. Moreover, it sets the stage for an empirical inquiry driven by both SA and S-LCA, aimed at improving operational efficiency and societal outcomes as industries transition to hydrogen.

Our research examines the following questions:

- *How does the transition to hydrogen affect operators' situational awareness in glass manufacturing, and in what ways can improved awareness facilitate a more efficient transition?*

- *What are the broader implications of changes in situational awareness for social LCA assessments, and how do these changes contribute to achieving societal goals?*

- *How do societal impacts, as identified through S-LCA influence the situational awareness of operators in the transition to hydrogen technologies?*

Social Life Cycle Assessment (S-LCA)

Social Life Cycle Assessment provides a methodological framework to assess the social and socio-economic aspects of products and their potential positive and negative impacts along their life cycle (UNEP, 2020). The 2020 update of the UNEP's "Guidelines for Social Life Cycle Assessment of Products and Organisations" delineates four primary phases: Goal and Scope, which establishes study objectives and methodological pathways; Social Life Cycle Inventory, involving input-output classification and social inventory assessment; Social Life Cycle Impact Assessment (S-LCIA), which measures impacts through Reference Scale Assessment (RS S-LCA) and Impact Pathway Assessment (IP S-LCIA); and Results interpretation, where conclusions are drawn and recommendations made, with triangulation of data being crucial due to the dynamic nature of social phenomena (Bonilla-Alicea and Fu, 2021; Prasara-A & Gheewala, 2017). Our S-LCA utilises interview insights for a comprehensive sustainability analysis, ensuring credibility and relevance through participant verification.

Integration of S-LCA in the context of hydrogen transition involves:

- Assessment of social hotspots (Ostos et al., 2024): Identifying phases in hydrogen production where decisions by operators significantly impact social factors. The specific factors and the broader societal implications will be thoroughly defined and analysed through our S-LCA analysis.
- Stakeholder engagement: Evaluating how operational decisions impact not just the workforce but also the wider community and other stakeholders.
- Impact analysis: Understanding how improving SA can lead to better societal outcomes, such as enhanced worker safety, reduced risk of accidents, and overall community welfare.

S-LCA differs from Environmental LCA (E-LCA) by directly assessing a wide range of social impacts, thereby enhancing our understanding of how products and services affect human well-being (Moltesen et al., 2018). In contrast, E-LCA focuses primarily on environmental effects and their indirect impacts on people (Mahmud et al., 2021). Currently, Techno-Economic Analysis (TEA) and E-LCA are widely used at the early stages of technology development to evaluate techno-economic feasibility and future environmental performance. As a relatively new and continuously evolving tool, S-LCA may face challenges related to measuring and standardising diverse and context-specific social phenomena, despite the existing frameworks and guidelines from organisations like UNEP (Barros et al., 2017; Kühnen and Hahn, 2017). Nevertheless, by integrating both qualitative and quantitative methods, S-LCA provides a comprehensive approach that captures a broader spectrum of social impacts.

To enrich our focus on S-LCA and SA we incorporate inputs from TEA and E-LCA (H2GLASS). Moreover, including insights from operators' SA is intended to inform the social impact categories and indicators developed within the S-LCA. As such, we provide a holistic understanding of environmental and economic contexts, ensuring a thorough evaluation of the technological transitions' direct and indirect effects across multiple dimensions: economic, environmental, social, and cognitive. This integration fills significant research gaps identified in standalone assessments (Mahmud et al., 2021; Wunderlich et al., 2021), enables informed decision-making, clarifies essential trade-offs, and addresses the complexity of social impacts, thus enhancing S-LCA's effectiveness for various stakeholders (Barros et al., 2017; Kühnen & Hahn, 2017).

We recognise that integrating SA and S-LCA may present challenges (e.g., aligning qualitative and quantitative data, bridging different scales of analysis, balancing subjectivity with objectivity and addressing temporal dynamics (time frames). Thus, we aim to effectively address these through the techniques within our exploratory sequential mixed methods design.

Aligned with the H2GLASS project timeline, two key papers are planned for publication, each corresponding to a distinct phase of the project that investigates different hydrogen production methods. The first paper will discuss the use of grey hydrogen in glass manufacturing, produced from natural gas (although cost-effective, it is less environmentally sustainable). The second paper will evaluate the use of green hydrogen, produced via electrolysis with renewable energy, focusing on the operational and environmental benefits of this cleaner technology (Van Der Veen et al., 2024; Franzl et al., 2022).

Theoretical foundation

Situational Awareness

Endsley's Situational Awareness model, a cornerstone in understanding SA, is particularly vital in sectors where predictive and adaptive capabilities impact safety and operational efficacy (Endsley, 2021; Andreassen & Eileraas, 2022). Emphasising operators' mental models, SA relies on internal representations crucial for operational awareness (Rasmussen et al., 2018). Mental models, informed by context and experience, shape individuals' understanding of systems, tools, or processes

(Borders et al., 2024). Operator effectiveness in SA is further influenced by personal goals, skills, experiences, and cognitive attributes such as confidence levels and long-term working memory, pivotal in information processing and decision-making (Endsley, 1995; Endsley, 2017; Endsley and Kiris, 1995; Smith and Hancock, 1995; Stanton et al., 2001). Moreover, SA is affected by various system and task attributes including interface design, automation, stress, workload, and sustained attention (Endsley et al., 2003; Gopinath & Johansen, 2019; Hoff and Bashir, 2015; Munir et al., 2022).

Endsley's model delineates three key stages: Perception, comprehension, and projection, pivotal for refining mental models to support decision-making (Endsley, 1995; Endsley et al., 1998; Endsley and Kiris, 1995; Ahmad et al., 2021). *Perception* involves understanding environmental cues through sensing and visualization tools, while *comprehension* integrates these elements into coherent insights for decision-making, known as data fusion (Franke and Brynielsson, 2014). *Projection*, the highest level, entails forecasting future conditions and adapting strategies accordingly, crucial for effective risk assessment and strategic decision-making (Ahmad et al., 2021; Evesti et al., 2017), thus creating a feedback loop that continually enhances SA (Andreassen & Eileraas, 2022).

Loss of SA often stems from insufficient monitoring, distractions, misunderstandings in control systems, and unsafe practices, highlighting the need for improved strategies (Johnsen et al., 2019). Enhancing SA can increase safety and efficiency while complying with environmental standards (Endsley, 1995; Stanton et al., 2001; Evesti et al., 2017; Andreassen & Eileraas, 2022). However, SA discrepancies alone do not explain accidents, which are more deeply rooted in systemic issues (Johnsen and Porathe, 2021).

Addressing both individual and environmental stressors is essential (Day et al., 2010; Endsley, 2013; Sætrevik and Hystad, 2017). In transitioning to hydrogen-based manufacturing, maintaining SA is key to managing human errors within the complex socio-technical environment, thereby improving performance (Endsley, 2015; Hollnagel, 2016).

This study focuses on cues that influence Situational Awareness (SA) to deepen our understanding of SA's impact in manufacturing. Our attention extends past simply innovating to also identifying and addressing obstacles that impede the adoption of new technologies. By aligning operational practices with wider goals of sustainability and profitability through improved situational awareness, this research aids in policy formulation, enhances sustainability, and enhances decision-making processes.

17. In Search of the 'Communicative Turn 2.0': Reflections on the Intellectual Legacy of Olav Eikeland

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Olav Eikeland left behind an extensive body of intellectual work. In this text, I will focus on one of his works, specifically his last book, *In Search of the Seventh Constitution: Aristotle and the Norwegian Collaboration Model – Power, Dialogue, and Organizational Learning*. The book is in many ways both unusual and somewhat atypical for an academic book. It is unusual because it appears both as an intellectual biography and as an introductory book to Aristotle's conceptual world. It is atypical because personal experience serves as the primary source of reflection on the book's main theme. At the same time, I want to emphasize that *In Search of the Seventh Constitution* is an important contribution to work life research, particularly within the tradition that developed at AFI (Work Research Institute of Norway) from the 1980s, known as the communicative turn. The book challenges us to think anew about work, organizations, and society. By building on Eikeland's ideas, we can help create a more just, sustainable, and meaningful future for work and working life. As I will argue in the following, the book can also serve as a constructive starting point for discussing a Communicative Turn 2.0. In this essay, I will attempt to explain what this entails and why I believe such a renewal has the potential to bring new engagement and relevance to this tradition.

18. Smart Specialization – Broadening the scope to the social dimension

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The concept of Smart Specialization has for almost two decades been at the forefront in making overall EU ambitions to spur economic growth operational at lower geographical levels within the union. Coupling the concept as a mandatory take for accessing structural funds, has been pivotal in spreading its adoption. Thus, from a systemic point of view, the economic dimension of catering for a sustainable future has got its instrument for making the dynamics of economic renewal working across various geographical levels of policy formation and implementation by mobilizing the potentials for comparative, competitive and collaborative advantage to unfold.

As for our common future, we know that the economic dimension of it is but one of three that we need to pay attention to, the remaining two being the social and the ecological. In the GI-NI project, the social dimension, especially as it is linked to the economy through labor market participation, is of special interest. More specifically, the concern that processes of economic change may entail new or increased forms of inequality, is being studied. Processes of economic and social change are interlinked, and to a large extent underpinned by institutions that apply to both of them, but then often with different outcomes and/or unintended consequences. To complicate, institutions come in a continuum from the more or less informal to institutions that are highly formalized and accessible to legal and political intervention. Like in the economic field, the competence to deal with institutions affecting social (in)equality is spread along the geographical steering system, even in countries that do not have federal structures.

In this paper we set out to explore the potential for taking the Smart Specialization experience from that of business development to the field of developing institutions for dealing with social inequality within the themes studied in the GI-NI project. Especially we are interested to look for ways in which governance practices and experiences can be dealt with by theorizing them in the terms of creating collaborative advantage. To the extent that we are able to identify such possibilities, we aim to go further and suggest policy opportunities to be explored.

From an overarching perspective, the aim is to point at possibilities for a stronger realignment of economic development and social cohesion, theoretically as well as politically.

19. Jobs and skills of production workers at manufacturing SMEs: an empirical exploration of smart technology adoption

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Industry 5.0 (I5.0) is expected to promote the integration of advanced digital technologies while fostering employee well-being and job quality (Breque et al., 2021; Ghobakhloo et al., 2023). In reality, technologies enabling I5.0 present both opportunities and challenges for workplace innovation, especially for Small and Medium Sized Enterprises (SMEs) (Maddikunta et al., 2022). On the one hand, the integration of smart technologies allows SMEs to streamline production processes and enhance competitiveness (Chavez et al., 2023). On the other hand, there are significant workplace challenges associated, including increased job complexity (Hecklau et al., 2016), new skills requirements (Müller, 2021), novel job profiles (Wilson et al., 2017), and potentially diminished job quality (Spencer, 2018).

At the core of I5.0 are production workers, who require specific skills to fully leverage smart technologies (Nair et al., 2024) whilst development of required skills largely dependent on how the jobs are designed (Humphrey et al., 2007). However, context- specific literature on skills (Büth et al., 2017) and work designs of production in I5.0 SMEs is lacking (Oeij et al., 2023). Together, these challenges hinders successful adoption of I5.0 (Maisiri et al., 2019; Mavrikios et al., 2018).

Since last decade, workplace innovation (WPI) gained attention, as it explores practices for effective integration of smart technologies while also ensuring the well-being and development of their production workers (Dhondt et al., 2015; Kopp et al., 2019; Oeij et al., 2017; Oeij et al., 2021). However, further empirical data on skills and work design is necessary to address this challenge (Oeij et al., 2023; Rus et al., 2019). This study aims to advance WPI in I5.0 SMEs through the exploration of the required skills and perceived work design characteristics for AI, AR/VR, and Robotics adoption by production workers. Drawing on theories of work design (Humphrey et al., 2007) and skills (e.g., van Laar et al., 2020), this study seeks to identify the factors that facilitate the successful adoption of smart technologies in I5.0 SMEs. The I5.0 context entails human-centricity, sustainability, and resilience as the core principles (Breque et al., 2021). Work design, a crucial component of WPI, involves the process of structuring work, defining roles, and allocating responsibilities within an organization (Morgeson & Humphrey, 2006).

Additionally, a framework derived from literature for distinguishing between transversal and professional skills was employed to analyse the skills required for I5.0. Transversal

skills encompass digital, personal, green, social, and methodological competencies (Behrend et al., 2022), while professional skills refer to the technical abilities needed to perform a specific job (Kohlgrüber et al., 2021).

20. Toward a Sustainable Professional Community for Workplace Innovation Catalysts within a Regional Innovation Ecosystem

Thomas Carey[7], Adam Frye, Barry Leavitt and Anahita Baregheh (Workplace Innovation Network for Canada, Canada)

Integrating Workplace Innovation in Regional Innovation Ecosystems

We describe below some initial activities underway in a mid-sized Canadian city to integrate employee-led Workplace Innovation into the regional innovation ecosystem. There are three distinctive elements which are explored in sequence:

- The focus on nurturing and sustaining an innovative knowledge-practice community for the emerging professional role of Workplace Innovation Catalysts.
- The expanded role of tertiary education institutions in capability development and knowledge mobilization for this professional community.
- Positioning this initiative as enhancing the impact of the Regional Innovation Ecosystem. The model we are adapting for this purpose is a Regional Innovation Engines program to grow and sustain regional innovation ecosystems. [NSF 2024; Guzman et al 2024].

The Emerging Professional Role of *Workplace Innovation Catalyst*

Context: The pilot study site for integrating Workplace Innovation into a Regional Innovation Ecosystem is the city of Windsor and county of Essex – population 400,000 – in southwestern Ontario (distant from major Canadian urban centres). Windsor has traditionally been known for its industrial and manufacturing heritage as the "Automotive Capital of Canada".

WEtech Alliance, the regional innovation centre for Windsor-Essex, created an "*Innovation Catalyst*" program in 2018, to develop frontline staff as workplace innovators [WEtech 2019]. The projects developed by employees addressed challenges in their workplaces. The program also included training for organizational managers, from the industrial automation sector[i] as well as a municipal utility[ii], a long-term care network[iii] and the county School Boards[iv].

Most of the staff in the six-month programs continued in their jobs with workplace innovation as a complementary activity; however, some staff were assigned new roles as focal points and enablers for innovation across the organization[8].

Challenges: The program's success was interrupted by the Covid pandemic. In planning for a restart, several challenges were noted:

i. There was no explicit training or networking to support the emerging organizational role as a catalyst for workplace innovation programs or as enabler of innovation projects initiated by other employees.
ii. Individual *Innovation Catalyst* participants expressed enthusiasm for the exchange of insights and experiences from other workplaces. Reliance on internal knowledge sources alone could limit the complexity and novelty of innovation projects [Wylie-Toal 2021].

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[8] One such staff member, the Human Resources Services manager, later won an award from her industry association for her work as a "Workplace Culture Innovator[8]".

iii. In a follow-up project, we[9] studied how research insights and practices from Europe could be adapted for Canadian workplace contexts [Carey, Frye et al 2023]. One result from the workplace case studies was that research adaptation was dependent on a sense of professional identity as a Workplace Innovation Catalysts.

iv. The primary mandate of Ontario's regional innovation centres is to promote technology driven entrepreneurship. The *Innovation Catalyst* program, despite responding directly to community needs, lay outside that mandated scope for WEtech Alliance. After the COVID disruption, no other stakeholders in the regional innovation ecosystem had the mandate, budget or required expertise to continue the program.

In the sections below, we will explain how each of these challenges is being addressed in the design of a reframed program to advance the impact of Workplace Innovation within the regional innovation ecosystem.

Sustaining a Knowledge-Practice Community for Innovation Catalysts

A two-level approach to workplace innovation capability development will address challenge (i):

- a primary level for *Enabling Workplace Innovation* catalysts at the organizational level across or within sectors, including both Catalyst capability and organizational support program capability.
- a secondary level for *Employee Workplace Innovators* in understanding and applying workplace innovation, offered largely within organizations, sectors or tertiary education (not discussed further in this Concept Paper)

The new program for *Enabling Workplace Innovation* is intended to engage a network of catalysts across organizations and sectors, beginning with previous *Innovation Catalyst* participants currently fulfilling Enabling roles. The current Minimum Viable Prototype (MVP) and its sustainable business model reflect past European experiences both across organizations within an industry sector [e.g., Putnik, Oeij, Dhondt et al 2019; Dessers & Mohr 2021] and across sectors [e.g., Exton & Totterdill 2019].

To address challenge (ii) above, a key element of the development plan for the *Enabling* program is a self-reliant ongoing network for sharing insights and challenges. The base model is a professional Community of Practice, adapted from Wenger-Traynor et al 2023]. We are also incorporating elements of the *Innovative Knowledge-Practice Networks* model for collaborative learning in emerging professions, where professional identity is evolving and both practice and research knowledge are rapidly developing [Hytönen et al 2019; Russell 2019; Van Waes & Hytönen 2022].

The Role of Tertiary Education in Capability Development and Knowledge Mobilization for Workplace Innovation

As stakeholders in the regional innovation ecosystem, tertiary education institutions in Windsor-Essex are initiating programs to support development of Employee workplace innovation capability. These initiatives are part of a larger collaboration of institutions across Canada to help learners develop their identity, self-efficacy and motivation for employee-led workplace innovation[10].

In its own distinctive program, one of the Windsor tertiary institutions also plans to develop learning resources and activities for a follow-on offering in *Enabling Workplace Innovation*, with a special emphasis on Inclusive Workplace Innovation[v] that links to organizational initiatives for

[9] The project team included members from WEtech Alliance, the Workplace Innovation Network for Canada and Workplace Innovation Europe.

[10] That diverse collaboration won a European award for" Innovation and Entrepreneurship Teaching Excellence" in 2022[10] and will have sixteen programs participating in 2025. Its distinctive features are described in an article in the *European Journal of Workplace Innovation* [Carey, Baregheh et al 2023].

diversity, equity and inclusion in the workplace. This intentional alignment with the development of an ongoing professional community will help to address challenge (ii) above.

In addition, part of the value proposition for the professional community of practice includes 'first access' to students from the Enabling Workplace Innovation unit under development, in work placements to support enhancements in organizational workplace innovation. One role will be aiding in research-to-practice knowledge adaptation[vi] to advance workplace innovation, which will help address challenge (iii).

Integrating Workplace Innovation as a "Regional Innovation Engine"

We had originally framed the 'who owns this' challenge (iv) above simplistically as

> "*What Stakeholder organization(s) should be responsible for fostering Workplace Innovation within Windsor-Essex workplaces*".

That focus has now shifted to

> *"What strategic interventions in the regional innovation ecosystem can integrate and leverage Workplace Innovation to increase ecosystem innovation productivity".*

A major impetus for this reframing has been our analysis of a public policy initiative in the U.S., the Regional Innovation Engines (RIE) program [NSF 2024], which is intended to support government investment in strategic interventions (i.e.,"Engines") to enhance the innovation productivity and impacts of specific regional innovation ecosystems. Despite a focus on scientific and technological innovation, the RIE program has a strong place-based approach and goals for engaging a diverse workforce and addressing both economic and social challenges.

An analysis of the RIE approach by experts in regional innovation ecosystems [Guzman, Murray et al 2024] articulates the 'theory of change' embedded in the RIE program, how the Engines will induce changes in Stakeholder behavior, and what changes in Stakeholder access to resources, capabilities, and knowledge must occur for the Engine to reach its objectives. The step-by-step design process addresses three interrelated challenges:

- Holistic assessment of the ecosystem's latent strengths and weaknesses;
- A viable and assessable strategic program for the proposed Engine to enhance Stakeholder roles, capabilities and relationships;
- Ensuring Stakeholder engagement and commitment for those proposed enhancements.

In planning the initiatives described in previous sections, we have been adapting[11] the steps outlined in [Guzman Murray et al 2024] for processes such as "Identifying necessary conditions for realizing the potential of an Engine intervention" and "Designing and Implementing an Engine". We look forward to further discussion at the Future of Workplace Innovation conference about the impacts of these adaptations.

[11] E.g., the reframing of challenge (iv) expressed at the beginning of this section was based on the repeated demonstrations in [Guzman Murray et al 2024] that "No one is in charge of innovation… no one organization,
and certainly not the Engine itself, can require individuals across the ecosystem to engage in a way that facilitates the changes in behavior the intervention seeks to induce" p. 32

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[ii] https://youtu.be/n8b4TGZoCSY?si=eLMYiDryapti_f4I

[iii] https://www.youtube.com/watch?v=lYK8ppJvQWY

[iv] https://youtu.be/uk4NuyXJjdU?si=wTjj4-3BbX23v_Br

[v] https://www.wincan.ca/blog/2024/1/8/enabling-inclusive-innovation-in-canadian-workplaces

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