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THE PRACTICAL SIDE OF DIGITAL TRANSFORMATION: A TOOL BOOK FOR PRACTITIONERS

Editors
Peter R.A.Oeij
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Prof. Marin Drinov Publishing House of BAS

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BULGARIAN ACADEMY OF SCIENCES

INSTITUTE OF PHILOSOPHY AND SOCIOLOGY

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of Bulgarian Academy of Sciences

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CHAPTER 1

INTRODUCTION TO THE TOOL BOOK

Peter Oeij, Vassil Kirov, Egoitz Pomares

1. PURPOSE, BACKGROUND AND TOPICS

Purpose

The European comparative research project BEYOND4.0 studied the situations of twelve ecosystems in six countries (in Work Package 4: Digital Transformation: regional perspectives and prospects), and of 30 companies (in Work Package 8: Company strategies for leading economic and social performance), with the intention to understand the development of digital transformation and its socio-economic consequences, i.e. the economic and social effects on inclusive economic growth (Warhurst et al., 2020). The purpose of Deliverable D8.2 (Toolbook on inclusive R&D&I Policy) is to transform the findings, insights and experiences into a tool book for practitioners about digital transformation that respects inclusiveness.

A tool book implies step-by-step plans to arrive at digital transformation and inclusive growth. This publication covers practical approaches for policy-makers, practitioners and consultants working at the level of regions (i.e. ecosystems) and companies. Since regions and companies are unique entities with specific circumstances, the presented approaches are of course no cut-and-dried solutions, but guidelines for the targeted practitioners.

Economic growth, inclusiveness and ecosystems

BEYOND4.0 supports an inclusive policy, which is a multi-level policy reaching any company, industry, region or ecosystem to develop evidence-based innovative, working solutions, in which relevant stakeholders, such as employees, are included in this process of innovation and co-benefit from the effect(s) of these innovations. Inclusiveness implies that interests of stakeholders are accounted for by policies that emphasize equality, diversity and sustainability, also with regard to digital transformation. Stakeholders for inclusiveness within companies are employees. But at a societal level a more broad view can be adopted including other stakeholders such as job seekers, unemployed people,

students and target groups with a weaker labour market position. The inclusiveness we point to is human-centred, and strives after balancing economic, social and technological aspects. From our understanding digital transformation, i.e. uptake and adoption of new (digital) technologies, is considered successful when both the economic and social goals are met. This is in line with the 'high road perspective'.

For that purpose, in the BEYOND4.0 project we have been using the lens of a so-called 'ecosystem model' to look at regions and companies, and the digital transformation. From the results of the study of BEYOND4.0, carried out at the level of ecosystems and companies, we have been able to understand how these ecosystems and companies behave in relation to each of the ten elements that make up the entrepreneurial ecosystems model (EES) (Figure 1; Stam, 2015).

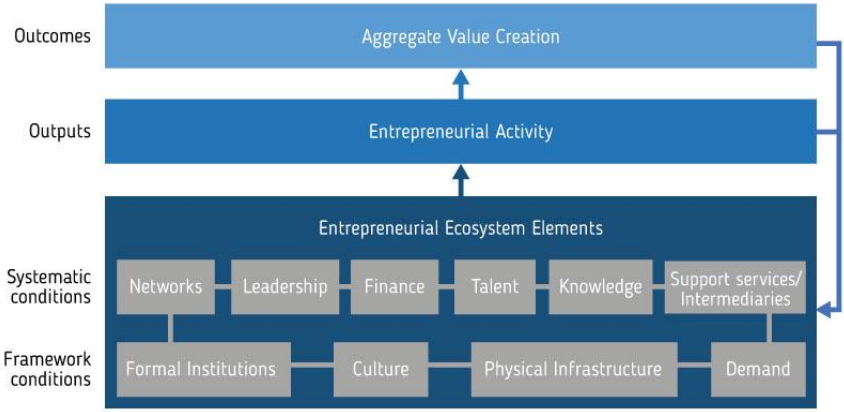


Figure 1: The entrepreneurial ecosystem and its elements, based on Stam (2015)

In connection with the EES model the presence of sound institutional arrangements (formal institutions, entrepreneurial culture, corporation and networks) seem to be a necessary condition. This counts as well for certain resource endowments, such as talent (skilled labour), entrepreneurial leadership and a developed knowledge and educational infrastructure (for R&D and innovation). Their presence is essential for economic success.

One additional element is to stimulate and facilitate inclusiveness at the level of industrial sectors and inside companies. This inclusiveness refers to the involvement and engagement of employees, job seekers, students and of people who differ in age, race, gender, nationality, etc. At the level of companies, for example, this implies voice for employees with regard to the implementation of digital technology; and at the level of an industrial sector or region it means taking into account the interest of the employed and

unemployed labour force and social inclusion. In other words the implementation of digitalisation avoids technological determinism and seeks high road solutions instead of low road solutions (Warhurst et al., 2020).

In this tool book we present approaches that can help practitioners to improve the possibilities for digital transformation of ecosystems and companies to become inclusive growth entities. By applying the guidelines and recommendations of the various chapters practitioners can get an answer to questions like these:

- How do ecosystems and companies perform on the elements of the EES model?
- How do ecosystems and companies integrate and implement new digital technology?
- How do ecosystems and companies make inclusiveness concrete and tangible?
- How do ecosystems and companies translate their strategy into policies and actions?
- How can practitioners and policy makers make use of the finding of the BEYOND4.0 project?

2. CONTENT OF THE TOOL BOOK

Seven chapters of members of the BEYOND4.0 consortium contain practical approaches, instruments, tools and tips.

Chapter 2 (by Peter Oeij & Gerben Hulsegge) offers a Theory of Change (ToC), which is a description and illustration of how and why a desired change is expected to happen given a particular context. In our case this change is to optimise digital transformation and inclusive growth. The authors sketch two routes to that goal. One is at the regional level, and describes a 'collaborative ecosystem approach'. The other one is at company level, and promotes using the concept of 'sociotechnical systems design and workplace innovation'. To make these two routes more practical, the authors present three tools: a 'process' of practical steps, a checklist, and a dialogue approach to assist practitioners in designing their own approaches at both levels.

Chapter 3 (by Carlota Perez) presents a pattern of technological revolutions, based on historical insights. Such a pattern is seen as helpful with regard to the present ICT revolution, namely to reap the full potential in bringing about a sustainable global golden age for the information society. History shows that most effective way of succeeding with the opportunities opened by this revolution is applying multi-level governance. It addresses

policymakers and business leaders at the local and regional level, as much as at the national and supranational ones in offering them a 'big picture' how to move forward.

Chapter 4 (by Vassil Kirov, Gabriela Yordanova, Steven Dhondt & Peter Oeij) extracts learning from the impact of the digital transformation on the functioning of ecosystems, on inclusive growth, and the respective implications for the future of work. It explicates which of the elements of the entrepreneurial ecosystem model contribute to economic growth and inclusiveness in the examined regions. The chapter presents policy recommendations for practitioners based on these findings.

Chapter 5 (by Asier Lakidain, Egoitz Pomares & Alfonso Unceta) illustrates how changes can be supported by consensual and government actions, with the purpose of adopting digitalisation in the most inclusive possible way. By taking workplace innovation programmes as a reference, the chapter presents that incorporating a variety of agents with common objectives is essential for successful change. The authors point out the conditioning factors that make the design and implementation of such actions possible.

Chapter 6 (by Sally Wright & Sally-Anne Barnes with Clara Behrend, Michael Kohlgrüber & Adrian Götting) illustrates a categorisation of skills that become important in light of digital transformation. There are four transversal skills (digital, personal, social and methodological skills), next to job-specific skills related to concrete work tasks and work experience. In addition the authors point out to interacting skills, which means that skills from at least two apparently separate skill categories are needed to perform a task competently. The authors offer practical steps that HR professionals and functional managers in companies can take to implement such skills in response to digital transformation.

Chapter 7 (by Olli Kangas & Esa Karonen) deals with the successful transition in a Finnish ecosystem. After the collapse of the core company the area rapidly rose from its ashes. The core of the revival was a disruptive economic restructuring by shifting to other products and services. The combination of the presence of a skilled labour force and an innovative collaboration between the local government, employment services, other public authorities, universities, university hospital, and private sector entrepreneurs was the key to success. The authors offer learnings in terms of the elements of the ecosystem model that proved to contribute strongest to the miraculous digital transition.

Chapter 8 (by Peter Oeij & Gerben Hulsegge) is the closing piece and describes a scenario approach to stimulate digitalisation and inclusive economic growth. The authors illustrate how such an approach can be developed, by using the example that was applied in the workshops carried out in the BEYOND4.0 project. Scenario approaches are seen as a tool for change, in our case, a successful digital transformation. The chapter sketches the steps to be taken and how to design the process of making the scenarios discussable.

3. EPILOGUE

While the tool book presents a practical approach to societal challenges such as digital transformation and inclusive growth, other project deliverables disclose the scientific research findings that describe and explain these processes and developments, guided by historical and social scientific perspectives. In addition to the set of Policy Briefs we have published, the main scientific deliverables are listed at the end of this introduction. All publications and Policy Briefs can be found on the website: www.beyond4-0.eu (active until 2026). In 2023 a final publication will appear, namely a scientific account of the project in an edited book, entitled 'Inclusive technological change' (working title), and containing different chapters from the various work packages.

The editors of this book would like to acknowledge the contributions made by the BEYOND4.0 project research team, as well as the companies and countless stakeholders with whom we have conducted our research.

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The main deliverables written in Work Packages 4 and 8 are:

Dhondt, S., Dekker, R.. Van Bree, T., Hulsegge, G., Oeij, P., Barnes, S.-A., Götting, A., Kangas, O., Karonen, E., Pomares, E., Unceta, A., Kirov, V., Kohlgrüber, M., Wright, S., Yordanova, G. and Schrijvers, M. (January 2022). *Regional report: entrepreneurial ecosystems in six European countries.* (Report D4.1 Analysis of incumbent and emerging ecosystems in Finland, Bulgaria, Spain, Germany, United Kingdom, and The Netherlands). Sine Loco: BEYOND4.0. (Retrieved from: https://beyond4-0.eu/publications).

Oeij, P., Dhondt, S., Hulsegge, G., Kirov, V., Pomares, E. – with Barnes, S.-A., Götting, A., Behrend, C., Kangas, O., Karonen, E., Kohlgrüber, M., Malamin, B., Unceta, A., Wright, S., & Kispeter, E. (August 2022). *Frontrunner companies and the digital transformation: strategies to deliver inclusive economic growth.* (BEYOND4.0 deliverable D8.1 'Report on changes, challenges, frontrunner companies and recommendations'). Leiden: BEYOND4.0. (Retrieved from: https://beyond4-0.eu/publications).

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Two other important references are:

Stam, E. (2015), Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique. *European Planning Studies* 23(9): 1759-1769.

Warhurst, C., Barnes, S. & Wright, S. with Dhondt, S., Erhel, C., Greenan, N., Guergoat-Larivière M., Hamon-Cholet, S., Kalugina, E., Kangas, O., Kirov, V., Kohlgrüber, M., Mathieu, C., Murray Leach, T., Oeij, P., Perez, C., Pomares, E., Ryan-Collins, J., Schröder, A. and van der Zee, F. (2020). *D2.1 Guidance paper on key concepts, issues and developments. Conceptual framework guide and working paper*. Deliverable D2.1. Beyond 4.0. (2nd version). https://beyond4-0.eu/storage/publications/D2.1%20Guidance%20paper%20on%20key%20%20concepts,%20issues%20and%20developments/BEY4.0_WP02_D2-1-Guidance_paper_FINAL_v2_revision_20200621.pdf

CHAPTER 2

DIGITALISATION AND INCLUSIVE ECONOMIC GROWTH: A THEORY OF CHANGE

Peter Oeij And Gerben Hulsegge

ABSTRACT

This chapter describes two inter-related pathways to realise digital transformation while supporting inclusive economic growth. It proposes a route at the regional level – 'collaborative ecosystem approach'; and at the company level – 'workplace innovation'. We claim that citizen engagement and employee engagement are necessary conditions to develop acceptable pathways with limited resistance to change. Theory of Change (ToC) is used as methodology to explain the 'content' of the entrepreneurial ecosystems model at the regional level, and the concept of sociotechnical systems design and workplace innovation at the company level. Both are useful to pursue the needed digital transformation that supports inclusive growth. Subsequently, the ToC presents a 'process' of practical steps, a checklist, and a dialogue approach to assist practitioners in designing their own approaches at both levels. At various points throughout this tool book, the others chapters attune with this overarching ToC.

Keywords: *theory of change, sociotechnical systems design, workplace innovation, coalition approach*

1. A THEORY OF CHANGE TO ACHIEVE DIGITAL TRANSFORMATION AND INCLUSIVE GROWTH

The purpose of BEYOND4.0

BEYOND 4.0 aims to help deliver an inclusive European future by examining the impact of the new technologies on the future of jobs, business models and welfare. This has been operationalised into a study about how regions (more specific: ecosystems) and companies succeed in digital transformation and how this affects inclusive economic growth (Dhondt et al., January 2022; Oeij et al., August 2022).

During the BEYOND4.0 project, it has been observed that ecosystems can follow different routes or strategies towards digital transformation, and that digitalisation in regions and companies vary with respect to whether a digitalisation strategy is pursued simultaneously to improve inclusiveness or not. Inclusiveness differs in terms of the engagement of employees with technological change, or what strategies companies follow to enhance the skills and employability of employees. Companies also differ in whether, and if so, how they employ people from traditionally vulnerable groups in the labour market, such as immigrants, people with disabilities, women, youth, older workers and the long-term unemployed.

In this chapter we propose a general route to enhance the opportunity of digital transformation and to improve the conditions for inclusive economic growth. BEYOND4.0 defines digitisation in connection with 'Industrie4.0', namely the digitisation of production through AI and automation/robotics. This is based on AI combined with the emergence of big data, the internet of things and ever-increasing computer power enabling robots to undertake both physical (manual) tasks and, increasingly, some cognitive (mental) tasks currently performed by humans (Warhurst et al., 2020). BEYOND4.0 thus regards digital transformation as the adoption of digital technology by an organisation to digitise non-digital products, services, or operations. The goal for its implementation is to increase value through innovation, invention, customer experience or efficiency (see also Vial, 2019). Inclusive growth is economic growth that raises standard of living for broad swaths of a population. It combines economic activity with well-being of people (Cerra, 2021). This implies conditions for entrance into the labour market in ecosystems and for employee engagement in companies. In the meantime it can be observed that Industrie4.0 is being criticised for a too strong focus on economic goals, omitting the need to put human values first. The rising substitutive concept is called Industry5.0, which aims at human-centric goals, in which similar technologies innovation should be applied in support of human needs, instead of neglecting them too much (Breque et al., 2021).

Based on our research, expertise and insights, we propose an argumentation of how to achieve digital transformation coupled with inclusive growth. Our logic is that a 'collaborative ecosystem approach' is required at the ecosystem level. In the field of the economics of entrepreneurship, an ecosystem is a set of interdependent actors and factors that are coordinated in such a way that they enable productive entrepreneurship (Stam, 2015). The BEYOND4.0 research findings stress the importance of collaboration between actors in such a regional network to support economic growth and digital transformation. Such collaboration is a condition for inclusiveness and social cohesion as well. A condition at the company level for inclusive economic growth is the engagement of employees in the process of change, renewal and innovation. Making use of the expertise and experience of employees and providing them with a certain level of decision-making power is a strategy aimed at enhancing the long-term sustainability of the firm, including the employability of the workforce. The concept of 'workplace innovation' is a condition to

support such a goal. Workplace innovation understands innovation, such as digital innovation, as a balanced interplay of technological renewal on the one hand, and human and organisational change on the other. Where, as a process, employees are engaged and involved. Workplace innovation addresses both the design of the production process and job, and organisational and leadership behaviour that enables employee engagement (Oeij & Dhondt, 2017). The logic assumes that the collaborative ecosystem approach at ecosystem (regional) level and workplace innovation at company level contribute to inclusiveness because it encourages citizen and employee engagement.

Readers should be aware that ecosystems and regions differ. A region may encompass several ecosystems. And ecosystems may be an entity beyond regional borders. The point is that regional level policy making is already well in place, but policy-making at ecosystem level in not yet well-established (Oeij et al., October 2022). We, however, keep using the terms of region and ecosystem interchangeably throughout this chapter, because an ecosystem needs support from stakeholders who often operate at the regional (or even higher) level. Who the stakeholders are, is explained further on.

Using a Theory of Change

The essence of a Theory of Change (ToC) is to offer a comprehensive description and illustration of how and why a desired change is expected to happen given a particular context. A ToC informs the mapping out or "filling in" of the "missing middle" between implemented activities or interventions, and how these lead to the desired goals. A ToC first identifies the desired long-term goals and then works back from these to identify all the conditions (outcomes) that must be in place for the goals to occur (Taplin & Clark, 2012). These are mapped out in relation to the logic explained above in a causal framework, as follows:

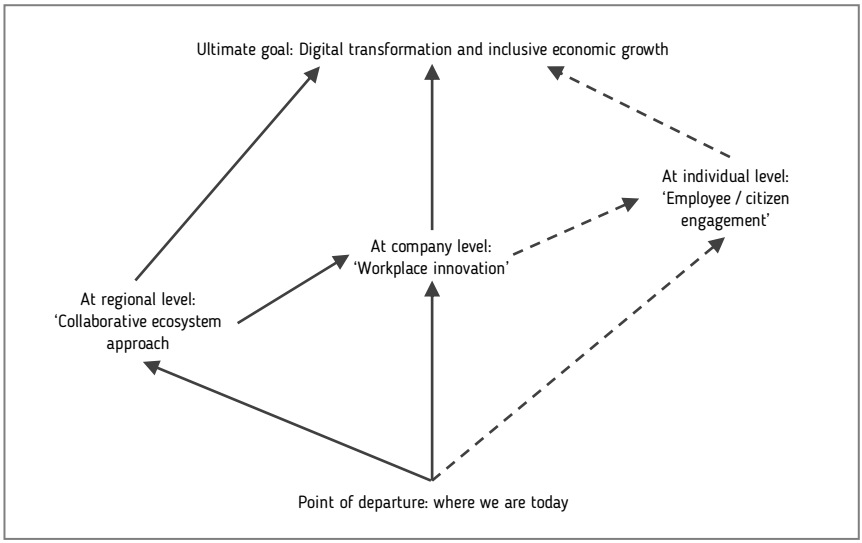


Figure 1: Causal framework: towards digital transformation by inclusive economic growth

The aim of BEYOND4.0 is to contribute insights into how to achieve digital transformation that enables inclusive economic growth (Warhurst et al., 2020). Three routes can be distinguished (see Figure 1) to achieve this ultimate goal, but this chapter will not pay attention to the 'individual level' route. First, from the analysis of ecosystems at the regional level, we learned that digital transformation requires the collaboration among many stakeholders (Dhondt et al., January 2022). Such collaboration creates fertile ground for companies to innovate and grow, and for start-ups to take off and sustain. A collaborative ecosystem approach seems advisable, at the level of the 'system', in this case the region. In the second route, it was observed that companies who apply workplace innovation practices seem more likely to be successful in digitalisation and creating involved employees, based on the 30 cases studied at the company level (Oeij et al., August 2022). This is the company level. The third route is to improve and support employee and citizen engagement via socialisation and education at the individual level. The focus of BEYOND4.0 is on the regional and company level (the individual level route, while relevant, is out of scope of the BEYOND4.0 project; that is why it is indicated with dashed arrows).

Target groups

This chapter targets different groups. Stakeholders at the level of regions and ecosystems are invited to focus on the route of the 'collaborative ecosystem approach' and stakeholders at company level on the route of 'workplace innovation'. Of course, both

routes are interconnected. But there is no required sequential order, in the sense that one route is a necessary condition for the other. However, collaborative ecosystem approaches and workplace innovation practices can strongly benefit from the presence of the other. Conversely, ecosystems that are characterised by dominant core companies with fierce competition for financial and human resources, and companies that prefer centralised management models over more decentralised ones, may pay little attention to inclusiveness and social cohesion. In such instances without collaboration, digital transformation may imply more unnecessary risks than opportunities for citizens and employees.

In the next section we offer a regional and a company route. The regional route is connected to the ecosystem model, and is a generic approach. The company route is via the workplace innovation concept. This approach is highly specific per company, and therefore requires more (theoretical) explanation.

2. TWO ROUTES: REGIONAL AND COMPANY

To achieve the ultimate goal, namely improve inclusive growth while implementing digital transformations, certain values are vital in relation to the objectives of Industry5.0 (Breque et al., 2021). New technology should be compatible with working towards a sustainable, human-centric and resilient European industry, which implies that technology should support workers instead of controlling and managing their behaviour. Contrasting 'low road' perspectives that are driven by cost-efficiency and the flexible replacement of human assets with technology, a normative argument to bring the Industry5.0 context closer to hand, is one that embraces the 'high road' perspective. A high-road company or ecosystem provides a supportive environment where employees can successfully balance work, family, and personal responsibilities. It is, for example, based on humanistic values, fair pay, and training and development opportunities (Kochan & Dyer, 2021; Oeij et al., 2019; Osterman, 2018; Totterdill et al., 2002; Warhurst et al., 2020).

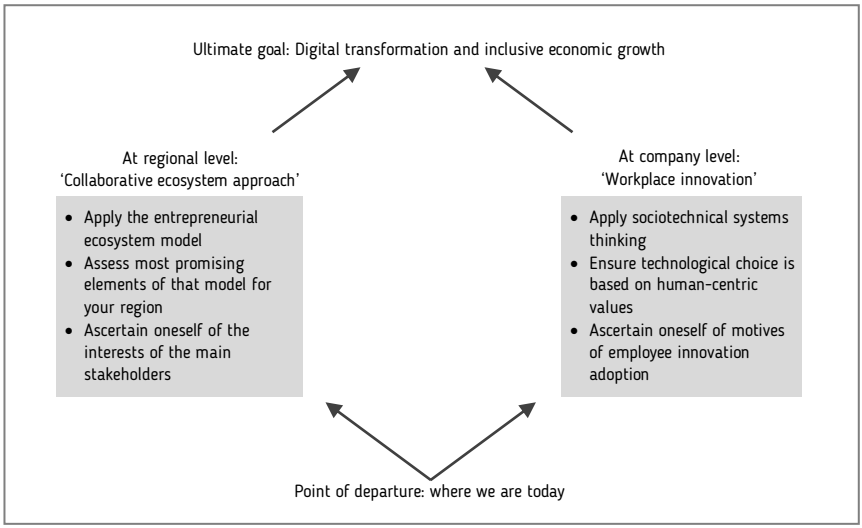


Figure 2: The regional and company route towards digital transformation by inclusive economic growth

The regional and company routes towards the digital future are depicted in Figure 2. The regional route applies the entrepreneurial ecosystem model (Stam, 2015) in a practical sense, while the company road uses a practical application of sociotechnical interventions, based on the concept of workplace innovation (Oeij et al, 2017; Oeij et al., forthcoming 2023). As said before, one route does not necessarily imply the other, but the assumption is that they can mutually reinforce one another.

Each of these routes have a content side ('what') and a process side ('how and when'). We shall outline the content of these routes first. In the section following the explanation of the content of these routes, the management of the process will be discussed.

2.1. The regional route

The entrepreneurial ecosystem model (EEM) in Figure 3 is a basic framework of the BEYOND4.0 project (through the tasks carried out in WP4 and WP8).

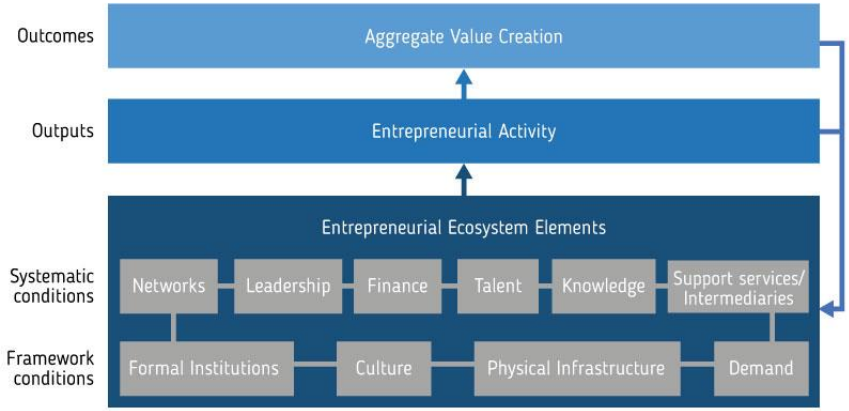


Figure 3: The entrepreneurial ecosystem and its elements, based on Stam (2015)

The EEM identifies ten elements, divided into framework conditions and systemic conditions, that together constitute outputs (entrepreneurial activities) and outcomes (inclusive economic growth). In our research of twelve ecosystems across six European countries (Dhondt et al., January 2022), we looked at two types of results: successful digital transformation and inclusiveness of economic growth. The successful ecosystems reflected a variety of combinations of the elements that were functioning satisfactorily. There are different combinations of elements that can lead to success. The implication is that for different regional ecosystems different combinations may the most promising, which require practitioners to scrutinize the working of those elements in their own regions, and assess which of those ten elements require attention. Table 4 provides a description of the elements and the desired outputs and outcomes.

Table 4: Description of the elements of the entrepreneurial ecosystem model for the ecosystem and company (based on Dhondt et al., January 2022; Stam, 2015)

Elements	
Formal institutions	Rules and regulations; enable voice for entrepreneurs; tax regime. Regional-specific elements
Entrepreneurship culture	Entrepreneurial activities, start-ups, accelerators, risk-taking culture
Physical infrastructure	Transport/mobility, digital infra, accessibility, educational institutions
Demand	Regional demand and purchasing power
Finance	Investors, banks, venture capital/angel investors, governmental support for innovation

Talent	Labour market, enough labour supply, (interregional) labour mobility, skill development
New Knowledge	Innovative sector; investments in R&D and new knowledge
Intermediaries	Institutions, supporting and business services for the sector
Networks	Partnerships, co-innovation / co-creation / open innovation in the sector
Leadership	Vision, technological entrepreneurs present, ecosystem strength compared to other competing ecosystems
Productive entrepreneurship (output)	Economic growth generated by the ecosystem; income and wealth, employment and their growth; 'high road strategy'
Inclusiveness (outcome)	Inclusive economic growth: social cohesion, support for vulnerable labour market groups, generating jobs; 'high road strategy'

Based on the regional ecosystem studies and the interviews and workshops held with the stakeholders of the twelve ecosystems (Dhondt et al, January 2022; Oeij et al, October 2022), a need for more collaboration and cooperation was recommended in all regions in order to support digital transformation and inclusive growth. For this reason, we named the route at regional level a 'collaborative ecosystem approach'. The implication is that elements such as creating 'formal institutions', 'networks' and 'leadership' may require attention in every region.

Crucial for the design of any regional approach is the need to become familiar with the principal interests of the main stakeholders in a region. These stakeholders are representatives of government, administration and politics, of businesses and industries, and of a variety of institutions in fields such as education, research, banking, business services, labour supply, unions and employee representatives and employment agencies. The outputs and outcomes are productive entrepreneurship and economic growth on the one hand, and inclusiveness on the other (see the last two rows in Table 4). The corresponding values that combine both goals are human-centric and socio-centric, which is a combination of economic welfare and human well-being. Thus, the results should be beneficial to the businesses and the regional population.

2.2. The company route

The company route towards digital transformation and inclusive economic growth is also grounded in similar human-centric and socio-centric values as in the regional route. This requires a fit between the company's economic goals, technological (digital) applications and social goals.

Box: Sociotechnical approaches

The sociotechnical systems (STS) design approach strives for joint optimisation of the technological and social 'system', which facilitates pursual of a 'high-road perspective'. Over time, the state of the art in sociotechnical systems research has developed at least three branches. On one hand, scholars of human relations focus on deployment of technological systems in firms and markets with a focus on questions of integration with human and social factors, in service of enhanced productivity, efficiency, and working conditions (Pasmore et al., 1982; Guest et al., 2022). Secondly, science and technology studies critically reflect on the social and ethical implications of the way our society, more generally, chooses to configure and deploy technological systems in bodies, homes, communities, regions, and beyond (Bijker and Law, 1994; Bojic, 2022). Yet another, third branch of sociotechnical systems science is the Lowland variant, called 'modern sociotechnics' (Kuipers et al., 2020; De Sitter et al., 1997). This variant developed design rules for organisations and functions which enable joint optimisation of organisational goals (that is, quality, efficiency, effectiveness, innovativeness) and human empowerment goals (that is, high quality job standards, e.g. job autonomy). Applying STS implies that human empowerment criteria can be integrated as functional criteria into organisational interventions, such as implementing new technology, the design of AI, and any other type of organisational innovations.

A crucial characteristic of STS approach is that employees retain significant autonomy in the execution of tasks in their jobs, and in solving problems that occur at workplace level. If, for instance, an Artificial Intelligence (AI) algorithm suggests a specific task command, then the operator can assess whether or not to follow this suggestion, or whether it makes better sense to choose a different work around.

An offshoot of STS approach is workplace innovation (WPI). In the Lowlands (i.e. the Netherlands and the Flemish part of Belgium), STS was elaborated with a strong focus on the quality of jobs. An approach was developed that interlinked designs of production processes, required information streams (IT structure) and management responsibilities (limiting hierarchical level). Its aim is to minimise interactions at all levels that create bureaucracy (minimise interdependencies), by keeping the organisation design 'simple' and by making the jobs (within teams) rich and 'complex'. Consequently, the division of labour is limited, but the required skills and competencies of employees became broad: jobs in which people can learn and develop themselves according to human-centric principles. The implication for digitalisation, as a technological choice, is that its design, application and implementation must remain consistent with keeping the jobs complex. Thus, simplification of work through automatisation and hidden algorithms is in conflict with human values.

Workplace innovation goes a step further beyond the structural design of the production process, the organisation, and jobs (and teams), by paying attention how structural design

choices may enable or disable certain organisational behaviours (i.e. the corporate culture), including the style of leadership. Organisations that are designed to be less bureaucratic have been found to be more conducive to corporate cultures that promote transparent collaboration and cooperation at all levels. Such organisations stimulate more mature employment relations and better support employees to adopt innovation, renewal, and new digital technologies (Oeij et al., 2022). Therefore, STS and workplace innovation nurture employee engagement, which implies that the interests of employees are recognised by management, and that employees are given a say in the decision-making process of companies[1].

3. DIGITALISATION IN ECOSYSTEMS AND COMPANIES AS A CHANGE PROCESS

A main point of departure from any major process of change is to involve those who are going to be affected significantly, if you want to avoid resistance to change and maximise the adoption of change. Therefore, a major step is to identify the main stakeholders and their interests. Together, stakeholders should choose the measures to be taken at the level of ecosystems or companies to realise digital transformation with inclusive growth. We first turn to the change process at the level of regional ecosystems.

3.1. The regional route: collaboratively strengthen the ecosystem

When it comes to identifying stakeholders of the ecosystem, it is essential to realise that an ecosystem is not the same as a region or an industrial sector. In fact, the borders of an ecosystem are often not easily demarcated. For reasons of practicality, it is easier to identify regions with problems in terms of limited economic growth, digital technology uptake and social cohesion issues. Subsequently, it is helpful to define the main issue(s) and then to determine who has a stake in the issue(s). Often, you will be able to identify the main policy actors, the main entrepreneurs, the main economic and social issues, the main people at risk (possible 'victims' of technology), and the regional population.

The process to develop policy recommendations to improve digital transformation with inclusive economic growth that was followed in the BEYOND4.0 project can serve as a guide (Oeij et al., October 2022). The problem statement was the elaboration of the Horizon 2020 call into a 'Research and innovation action' (RIA), i.e. a plan of actions 'primarily

[1] While employee engagement is less far-reaching than employee-involvement – the first is passive and the second is active (Boxall & Macky, 2014) – we apply the terms as similar here, to emphasize the role of voice for workers.

consisting of activities aiming to establish new knowledge and/or to explore the feasibility of a new or improved technology, product, process, service or solution.' In the case of BEYOND4.0 it concerns the simultaneous goals of realising digital transformation in conjunction with inclusive growth.

The entrepreneurial ecosystem model was applied as a lens and a framework. The following five steps that were undertaken:

1. Investigate the mechanisms of the ecosystem to improve digital transformation, while at the same time taking into account how to ensure inclusive growth;

2. Make use of representatives of relevant organisations and institutions in the region / ecosystem by interviewing them to gather their opinions, insights and suggestions; among these representative organisations and institutions are those who play a role in / have expertise in regional policy making, government and administration, education and research, business services, regional businesses and industries, business services and financial services / investments, labour market and social security issues, EU-policies, employer organisations, labour unions;

3. Report on the state of the art of the ecosystem using the entrepreneurial ecosystem model (EEM) as a framework; differentiate and weight the essence of each of the ten elements of the EEM in terms of 'well developed drivers for success' or 'factors that require strengthening' (see actions in the next box);

4. Organise workshops with stakeholders to assess policy recommendations with respect to elements that require attention; regional, national and EU level actors who should address specific tasks; define desirable outputs and outcomes at the ecosystem level (i.e. digital transformation and inclusiveness should be made tangible and operational for the region);

5. Report on the results of the former steps as the basis for developing further action plans.

Once you can identify a group of actors who have a stake in the issues that require change, it is then possible to move on to consider the following actions for step 3:

A. Define and pin down the issue, in relation to the ultimate goals with regard to digital transformation and inclusive growth;

B. Assess the knowledge gap and a possible agenda for research and investigation of the issue;

C. Design a preliminary set of goals to be achieved in order to reduce or solve the issue; and how these goals can be achieved;

D. Formulate a problem statement for the region / ecosystem (e.g. in a white paper). This could include the following: formulate the activities needed to achieve the subgoals, the involved stakeholders, who is responsible for what, when what needs to be done, what risks and potential setbacks will be and how to overcome them, how effects will be monitored and evaluated.

As a follow up to these steps the action plan(s) should be brought into practice, and their effects should be regularly evaluated to adapt the action plan(s).

3.2. The company route: an engaged way to apply workplace innovation

Identifying stakeholders at the company level seems less complicated. These are, in the first instance, management (the entrepreneur), employees, employee representatives or works council; in second instance, customers, clients or students (and their parents) of the organisation; and in third instance, key business relationships of the company, such as suppliers, sector organisations, employer organisations, and labour unions. With regard to digitalisation and inclusiveness, we focus on the first group of stakeholders for reasons of convenience. Of course, users of this method can broaden the range of stakeholders if needed.

Workplace innovation (WPI) enables companies to better appreciate and empower their employees. While it fosters the company's innovation capacities, it also helps to adapt to the changes and challenges that the new digital era brings. Dhondt et al. (2017) offer a practical approach on how to implement workplace innovation. Because developing WPI practices for companies are less straight forward than applying the ecosystem framework (for regions), we use extra lines to provide more explanation about the WPI-concept. That makes this section longer.

Starting with developing an understanding about why workplace innovation is important for your company and how it can be harnessed to transform your organisation, getting ideas about where to begin, analysing the building blocks of WPI, and realising how to achieve commitment from the people in your organisation, this guide supports the implementation of successful WPI at the company level.

The WPI Guide is built around five challenges:

1. Why workplace innovation is important for your company?
2. How workplace innovation will transform your organisation?
3. Where to begin?

4. What are the building blocks of workplace innovation?

5. How to achieve commitment from everyone in your organisation?

Why workplace innovation?

Workplace innovation practices or interventions aim to improve both organisational performance and the quality of jobs. Many interventions are imaginable, but they should emphasise an empowering job design to support employee engagement. Moreover, interventions must improve digital transformation with inclusive growth in our case.

Two main directions for such interventions are identified. Firstly, to design a production process (of products made or services delivered) that fosters job autonomy, delegated decision-making, and employee representation in strategic decision-making (e.g. implementation of digitalisation), based on sociotechnical systems design (Kuipers et al., 2020). Secondly, to perform organisational behaviour that fosters reciprocal results, via equality, diversity and inclusiveness, based on the notion of mature employment relationships and psychological contracts (Herriot, 2001). The first direction reflects structural interventions (such as innovations in the work organisation) and the second is concerned with cultural interventions (Oeij & Dhondt, 2017).

How workplace innovation can be used to transform your organisation?

Change processes often fail due to partial change approaches instead of integral approaches – a failure to recognise that organisations consist of interdependent parts that together affect new ways of working. Successful change requires an integrative view on change, a 'system's view', as in the STS approach. That is why structural and cultural interventions are interdependent. A leadership development programme, a stress management intervention, or a mindfulness course, for instance, are cultural interventions that as stand-alone initiatives will not affect the design of a production process, teams and jobs, which determines the autonomy of employees. The integrated combination of structural and cultural interventions can transform the organisation, so that better business performance and good quality jobs can be achieved simultaneously.

Where to begin?

The ToC of BEYOND4.0 adopts the approach that, in order for companies to achieve the ultimate goal of improving digital transformation with inclusive growth, the route towards this needs to involve employee engagement.

The question 'where to begin?' might be a bit odd. Hardly anyone is motivated to bring about changes in the organisation as long as things are going very well, let alone, look

for problems and issues. On the other hand, companies must remain competitive and innovative. Employee engagement is crucial in this regard, but many managers tend to overlook its importance. Hence, WPI is often mistakenly considered as 'being nice to the workers', whereas engagement can critically strengthen the innovative capability of the firm, and overcome resistance to change.

To help the reader to get an idea about what employee engagement could look like in their company, it may be helpful to provide an indication of how digitalisation that is poorly managed can threaten employee engagement and inclusive economic growth, as it could, unintentionally:

- Reduce autonomy of employees;
- Reduce the number of jobs, simplification of tasks within jobs, and/or limit learning opportunities;
- Increase work-related stress and workloads by not adequately compensating workers for their effort, or allowing them sufficient time to rest;
- Make certain types of skills obsolete
- Exclude workers from playing a role in the process of selecting and/or implementing new digital technologies;
- Reducing the quality of jobs and income security, and increasing the flexibilisation (precarity) of labour contracts.

Whilst this list is not exhaustive, it should be clear that by reversing or mitigating some or all of these threats it is more likely to foster or improve employee engagement, which, ultimately should be one of the main aims of digitalisation.

The questions to address is: what are the most pressing issues in the company that are blocking the goal of improving digital transformation with inclusive growth? And relating to this, what are the most pressing issues in the company that are stifling employee engagement? Obviously, many answers are possible. Dhondt et al. (2017) offer a short checklist to start a journey of dialogue among the main stakeholders in the company. When looking at the topics in the checklist (Table 5), an assessment can be undertaken about how each of these topics might act as a barrier to achieve the ultimate goal:

Table 5: An inventory for the identification of barriers (adapted from Dhondt et al., 2017).

Starting the Journey: what are the company's most pressing issues?		
Score each issue: 1 = No Problem; 10 = Severe Problem		Score
STRUCTURAL ELEMENT 1: STRUCTURES, MANAGEMENT AND PROCEDURES	Line managers lack team leadership skills	
	Ineffective performance management / appraisal system	
	KPIs/targets drive out opportunities for learning and improvement	
	Departmental/organisational boundaries delay decisions and inhibit innovation	
	Work gets held up by poor co-ordination between departments	
	TOTAL SCORE FOR ELEMENT AND DIVIDE BY 5:	
STRUCTURAL ELEMENT 2: JOBS AND TEAMS	Frequent delays caused by breakdowns and bottlenecks	
	High levels of employee turnover and/or absenteeism	
	Malfunctioning technology, ICT	
	Poor team cohesion, lack of collaboration	
	Persistent quality problems	
	TOTAL SCORE FOR ELEMENT AND DIVIDE BY 5:	
CULTURAL ELEMENT 3: EMPLOYEE-DRIVEN IMPROVEMENT AND INNOVATION	Lack of an innovation and learning culture	
	Opportunities to improve or innovate exist but rarely get around to pursuing these opportunities	
	Employees feel frustrated because they have no outlet/s for their ideas	
	More effective ways of engaging employees in innovation and improvement needed	
	Employees may be afraid or unwilling to challenge established practices	
	TOTAL SCORE FOR ELEMENT AND DIVIDE BY 5:	
CULTURAL ELEMENT 4: CO-CREATED LEADERSHIP AND EMPLOYEE VOICE	Gap exists between senior management and frontline staff	
	Management fails to share relevant information with employees unless it is absolutely necessary	
	Senior managers micro-manage the work of others rather than empowering them to take decisions	
	Decisions affecting the work of employees are taken without involving the workers who are impacted by these decisions	
	The corporate culture inhibits change	
	TOTAL SCORE FOR ELEMENT AND DIVIDE BY 5:	

What are the building blocks of workplace innovation?

This section looks at the building blocks from a positive viewpoint. The former step looked at problematic issues (a negative viewpoint). The reason for this sequence is that there are more solutions than problems, because one can develop different kind of interventions, at the level of the organisation as a whole, at the level of departments, teams and jobs, and at the level of people. Moreover, the WPI-concept stresses that interventions should change the root cause of problems, and that requires a careful assessment of the 'problems' first. That is why we first presented a checklist on issues, and turn now to the building blocks for possible solutions.

Structural element 1: Organisational Structures, Management and Procedures

A main issue in bureaucratic organisations is that they are hierarchical, have a high degree of division of labour, with many interdependencies between departments, work stations and people. This requires managers to have many interactions. Unless it is a simple production process with much standardisation (for which Taylorism is still highly functional), it often results in breakdowns, waiting times, and loss of quality.

The STS approach advocates for the design of solutions that involve structuring the production process in such a way that the interdependencies are reduced by grouping the work into teams with decision latitude to execute the tasks from beginning to end (so-called 'complete tasks' as in autonomous team work), and to allow these work teams to solve the problems at the level where these occur, whenever possible. This results in 'simple' organisations with 'complex' (teams)jobs (De Sitter et al., 1997; Kuipers et al., 2020; Van Amelsvoort & Van Hootegem, 2017).

The limited division of labour in sociotechnical solutions creates a reduced need to manage the production process from the top-down. In sociotechnical thinking, the argument is that technology should support employees in doing their work more effectively and efficiently at the same time as meeting the required quality standards. This is also the case for the implementation of digital technologies, Artificial Intelligence (AI) and machine learning (ML). Sociotechnical design rules follow the sequence to first address the structure of the production process from the perspective that job autonomy must not be reduced; then the next step is to look where information and communication technology (ICT) and automation is needed. Not the other way around. The result of this design sequence is less hierarchy, less bureaucracy, more decision-making autonomy at lower levels, richer jobs, and more meaningful work.

Structural element 2: Jobs and teams

From the design of organisational structures, follows the design of jobs, and how this enables employee engagement. Allowing employees discretion in scheduling their own work and in controlling its pace has a number of advantages to both the employee and the organisation (Dhondt et al., 2017). They are better able to perform their jobs because they are empowered to make decisions based on their tacit knowledge and previous experience of 'what works'. They may be able to avoid delays caused by having to unnecessarily escalate problems to their managers or by having to refer to procedural manuals. In the best cases, they are able to make time to learn and to reflect on what is working well and what could be changed. This generates steady flows of improvement and innovation. Such employees are truly engaged.

What supports employee innovation adoption? That is, situation where workers are prepared to work with a renewal? When it comes to selecting and implementing digital technologies, it is crucial that affected employees are given a voice in the process. Not only will this mean that employees are given the chance to provide valuable input into the proposed change based on their expertise. They will also be better placed to evaluate their own work, such as whether a new technology or way of working is easy to apply, whether it works ('demonstrability'), improves their work execution and if other persons in the company deem it important to use the renewal ('subjective norm'). If the answers are all positive, the chances are higher that employees will adopt, or perhaps even embrace, the innovation (Oeij et al., 2022).

Based on Karasek's model (Karasek & Theorell, 1990) depicted in Figure 6, the STS design method designs jobs that combines a high level of job demands with a high level of job control. A job design that enhances employee engagement ensures active work. High job demands can lead to high quality output, stimulating tasks, and tasks that require learning new knowledge and skills. Among the aims is also minimisation of physical strain and psychological stress. Strain and stress can be caused by high workloads and difficult problems and disturbances. A condition for good, active work, is sufficient job control to deal with such issues, and create a balance between the job demands and control.

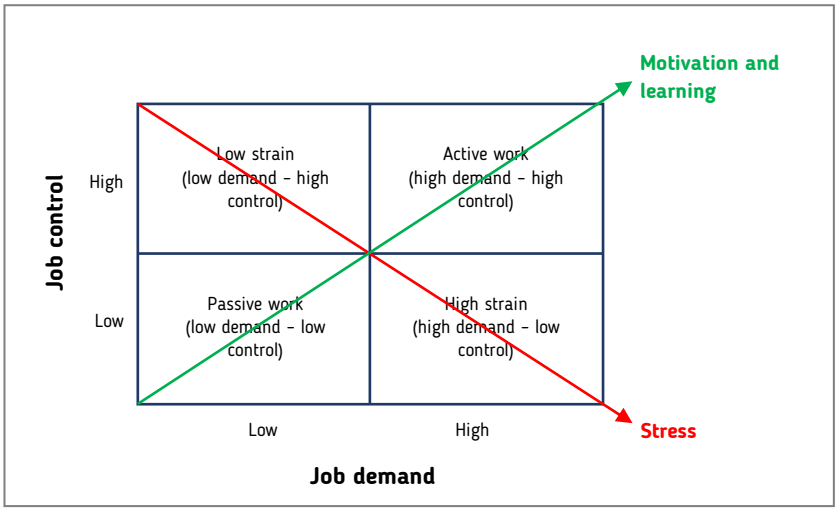


Figure 4: Karasek's Demand-Control Model of Occupational Stress

Jobs designed on the basis of the ideas of Karasek can also be applied to the level of teams. Teams can be made responsible for 'whole team tasks', that is, they can make products or services with limited dependency of other departments or teams, and with a limited division of labour among the team members. Teams can largely decide how to execute their tasks and, for instance, carry out their own personnel policies. To a significant extent such teams are self-managing.

Cultural element 3: Employee-drive improvement and innovation

A human-centric or socio-centric approach (Breque et al., 2021) is based on a management philosophy that nurtures a certain extent of decentralisation of decision-making and bottom-up voice. Managers and entrepreneurs with such visions create organisational structures that allow a say for employees about the type of jobs that they offer and via the type of human resources management (HRM) practices they develop (Oeij et al., 2019). Systematic opportunities for shared learning and reflection are well embedded in these types of workplaces. They allow employees at every level to reflect on what has gone well and what can be improved in the future, to share knowledge and skills gained in the course of recent work experience, and to anticipate and reflect on the impacts of future challenges and change. This can be reflected in times and spaces where people at work can discuss ideas with their co-workers or in their team meetings (Dhondt et al., 2017).

Such cultural elements support employee-driven innovation. Employee-driven innovation and improvement emphasises the importance of aligning the knowledge and expertise in

the organisation with the tacit knowledge and experience of workers while valuing learning. It must be driven from the top and reinforced by consistent messages from leaders so that it enables employee-driven improvement and innovation. Inherent in these organisational cultures is strong engagement with the employees.

Cultural element 4: Co-created leadership and employee voice

Employee-engagement presupposes a less of a prescriptive, directive role of leaders, instead more of a more coaching and stimulating role. The progressive view of leadership is regarded as a creative and collective process where leadership is co-created through dialogue with and between employees, and where employees are empowered to take initiative and contribute to decision making. "Shared and distributed leadership" focuses on releasing the full range of employee knowledge, skills, experience and creativity. It means that workplace culture and practice provide all workers with the opportunity to take the lead in areas which reflect their own expertise or initiative, whether strategic, innovative or operational, while understanding and aligning their actions with those of others. This collaborative or co-created process of leadership creates shared direction and purpose through shared reflection and learning, and employee voice in decision-making (Dhondt et al., 2017), which is viewed as necessary for any type of successful transformation, including digital transformation.

How to achieve commitment from everyone in your organisation?

Change is rarely a linear exercise. It usually involves experimentation, failure and a willingness to see failure as an opportunity for learning and development. The change journey means making change happen with people, not to people. They have the knowledge, experience and potential for engagement that can make digitalisation happen and make it endure. Below there is a short checklist for change (Dhondt et al., 2017).

- Do the board and senior team understand that change will involve asking difficult questions and challenging established practices? Do you have their full support?
- Have you involved all the relevant stakeholders from the beginning? Does everyone understand how they can contribute to the journey?
- Have any potential sources of resistance been identified? What is the best way of dealing with resistance?
- What are the mechanisms for ensuring effective two-way communication throughout the journey? How will progress be evaluated? How will stakeholders be involved in shared learning and adjustments to change processes and goals during the journey?

- What does success look like? ? And how will success be celebrated?
- How will change be embedded and sustained?

Digital transformation, inclusiveness, and engagement of employees require an ongoing dialogue between stakeholders as an essential ingredient of the innovation process, both at the company level and the regional level. The coalition approach below is suitable for this purpose.

3.3 The coalition approach

One of the decisive factors for the successful implementation of interventions, renewal and change seems to be a broad social basis in regions and companies. This can be arrived at with the application of the 'coalition approach', a participatory method to guide the process from diagnosis to implementation of measures (De Lange, 1989; Oeij et al., 2006; see also Gustavsen, 1992).

The coalition approach can be integrated into the abovementioned mentioned steps. Once an analysis has been made about the state-of-the-art of the ecosystem, and the stakeholders with opposite interests are clear, it is possible to apply the coalition approach. One can imagine that a leading group of regional stakeholders want to strengthen collaboration and networks, and applies the approach to prevent the escalation of opposing interests. Something similar can be done at company level. Most likely management will take the initiative to discuss opposing views about the future direction of the company, preferably based on the type of 'problem' analysis we discussed earlier.

This approach will first be applied this to the regional level, and subsequently, to the company level.

Dialogue at regional level

The regional level is comprised of a variety of stakeholders, each with different interests. For reasons of clarity, we distinguish between two types of stakeholders. One group of stakeholders is that of business and industry with economic goals; the other group of stakeholders are the citizens and employees, where the focus of interest is on inclusiveness.

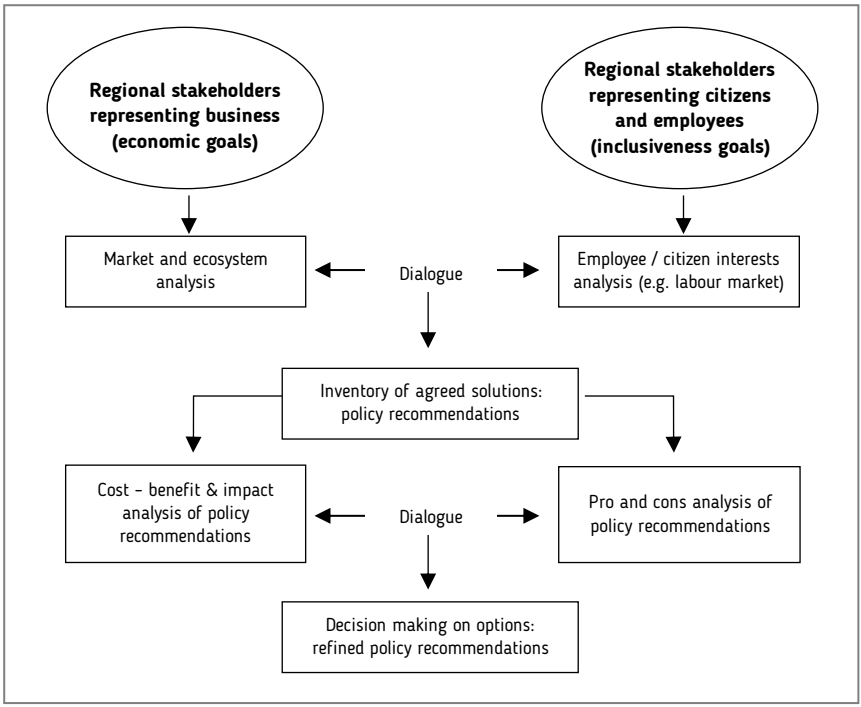


Figure 5: Coalition approach and dialogue at regional level

The interests of the business stakeholders are in how the ecosystem strengthens, for example, their market opportunities, and for the employees/citizen stakeholders how the ecosystem ensures inclusive goals like labour market opportunities.

Step 1: Identify strengths and weaknesses of the ecosystem

With the ten elements of the entrepreneurial ecosystem in mind, and their strengths and weaknesses in the respective region, each stakeholder group analyses which elements should be supported, with regard to digitalisation and the future.

Step 2: Assess recommendations per stakeholder

Each group develops recommendations at the level of the regional ecosystem. In the first instance, each group focuses on their own interests. (Possible overlap or shared interests of business and citizens and employees at the beginning of the process, are put on hold in this first step).

Step 3: Share recommendation with the other stakeholders

In a next step, these recommendations are shared and discussed (first dialogue), upon which each stakeholder group analyses the consequences of all of the recommendations for the future. At this stage, it is important for stakeholders try to take into consideration interests other than their own. After that, each party redefines the desired policy recommendations. This time the recommendations should better address the issues raised in the first dialogue.

Step 4: Select shared policy recommendations

A second dialogue takes place to share and discuss the redefined policy recommendations, with the objective being to select a set of common policy recommendations that should be brought into practice. This is a joint decision. It is likely that the selected recommendations still need to be elaborated and redefined, before implementation will be effective.

Apart from the desired goals to support digital transformation with inclusive growth, another result of applying the coalition approach is a manner to exert democratic rights of all stakeholders – namely their engagement in the dialogue – within an ecosystem, which in itself is an indicator of social cohesion. A warning to be made is that in the case of conflicting relations between stakeholders, it is very difficult (and perhaps too optimistic) to arrive at agreement, let alone create a coalition (Fisher et al., 1991).

Dialogue at company level

At company level, there are two main groups of stakeholders: management and employees. The method follows a similar approach. Current wisdom no longer views good employment relations practices that are purely hierarchical, or where there is an absence of channels for employee voice. Knowledge-intensive production is becoming increasingly more dependent on human factors as a critical resource. This, in turn, requires a voice for employees. The relational aspect of the employment relationship requires a 'mature' interaction and one way of doing so is to use a genuine process of dialogue (Herriot, 2001). Dialogue implies that parties have a respectful attitude towards the interests of the other party by seeking win-win options. Stakeholders have a shared interest in the digital transformation with inclusive growth. They can facilitate dialogue by applying the coalition approach as in Figure 8.

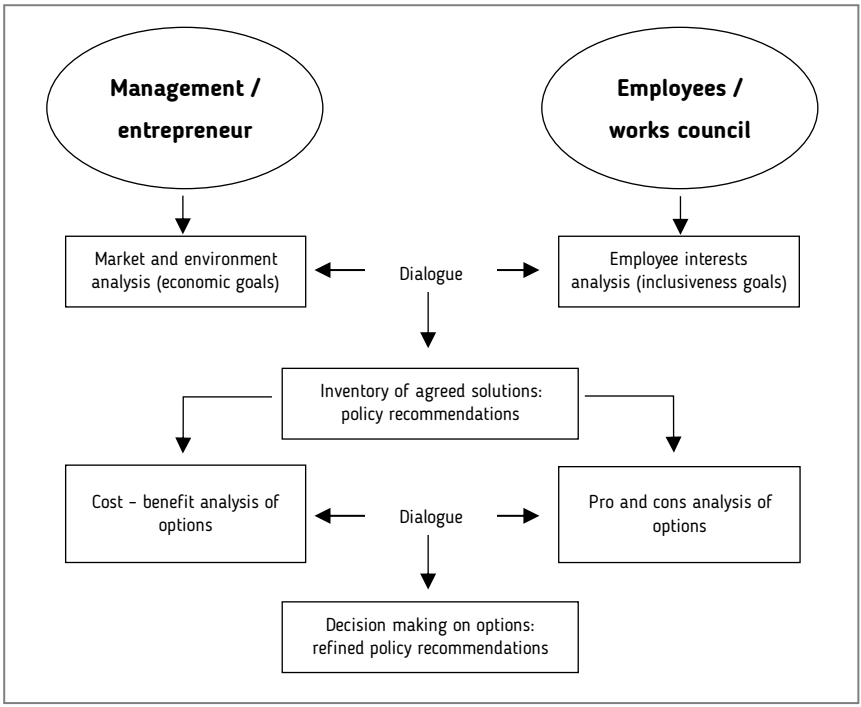


Figure 6: Coalition approach and dialogue at company level

Suppose that the former analyses about workplace innovation practices resulted in the identification of a number of potential solutions for a specific problem. Let us assume the company is a producer of parts for a specific market segment of electronic motors.

The company makes a large number of parts for a multitude of motor vehicles and supplies these parts to customers across a European supply chain. The issue is a logistical one, namely that too often parts arrive too late at destinations or are dispatched via inefficient routings. After management has analysed the situation, they found a software supplier who can deliver an off-the-shelf warehouse management system (WMS). This IT system can improve the efficiency of planning with a lower rate of 'mistakes' because it is driven by producing algorithms based on machine learning of the system itself. In terms of the staffing implications, a significant number of planning jobs will become obsolete. The management goal of to implement this WMS system is at odds with the goal of preventing job loss. The interest of the employees is partly their job and income security, but also in preventing the WMS system from eradicating human tasks that require a high level of planning skills.

The proposed four-step coalition approach is the similar step-by-step model as at regional level.

Step 1: Management and employee(-representative)e separately define criteria

The first step is that management and employees, each for themselves, define criteria that should be met by any intervention to combat the planning issues. Thus, they should not immediately embrace the WMS solution, but take a step back from the problem. Management could, for example, place an emphasis on productivity issues and employees on job certainty. But, as an example, apart from technological solutions, such the selection of the WMS system, there may be other potential solutions to the problem, such as the redesign the work processes so as to unlock organisational solutions and upskill the planners. This may generate new points of view that had not otherwise have been considered.

Step 2: Management and employee (-representative)e jointly exchange viewpoints

In the second step, parties enter the dialogue by exchanging viewpoints. A crucial competency here is that both parties can emphatically place oneself into the other parties' shoes. A number of options for interventions are short-listed that preferably fit within a win-win approach.

Step 3: Management and employee (-representative)e separately prioritise the options

The third step consists of studying the short list of options within one's own party. Stakeholders, however, also keep the interests of the other party in mind. Management will likely be performing cost-benefit analyses of the various options, for they are responsible for the continuation of the firm. Whereas employees are likely to focus on aspects like job security, employability, healthy work, fair workloads, etcetera.

Step 4: Management and employee (-representative)e jointly select agreed options

The final step is to re-enter the dialogue together with the aim of reaching an agreement in advance of making decisions. Formally, the chief executive officer of the company will make the final decision, but wise as they might be, letting the other party have a stake in the decisions as well.

Obviously, as said, the coalition approach can only be used in organisations where the employment relations are not polarized. But in such organisations true employee engagement will be absent. Otherwise, the deployment of a mediator is advisable.

Suppose that in the end a WMS-system is selected that allows planners to overrule the AI decisions of the system, provided that they can develop solutions that are as good as, or better, than the system. Further, that the WMS-system is used for 'batch logistics' and the skills of planners are dedicated to 'special cases'. The expected result is an efficient system that promotes the learning of new skills by planners; some jobs may be lost but the planners in these jobs are retrained for other work within the company. Let us assume that this intervention contributes to the digitalisation of the company and the inclusiveness of its workers, and that the followed method (i.e. engaging the employees in the process) provide to be helpful in guiding this process, then this can be regarded as a workplace innovation practice.

4. A FINAL REMARK

A Theory of Change (ToC) is a useful instrument to support practitioners to create a pathway towards digital transformation and inclusive economic growth. The purpose of this tool book is to support the regional (ecosystem) level and the company level. For the ecosystem level, it is suggested that a collaborative ecosystem approach is applied, and for the company level, the workplace innovation (WPI) approach, based of sociotechnical systems (STS) design is followed. Ethically, it is important to engage those who will be affected by digital transformation, at the regional and company level.

The ToC gives an account for applying the 'content' of the collaborative ecosystem approach by proposing to use the entrepreneurial ecosystem model, and at the company level the 'guide to workplace innovation'. The ToC offers a 'process' approach by explaining the basic steps of both methods and adds a coalition approach to facilitate a dialogue between stakeholders at both the ecosystem and company levels. Of course, the ToC is not a blueprint for every situation but a guide for practitioners, policy makers, consultants and other interested parties.

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CHAPTER 3

LEARNING FROM HISTORY: SUCCEEDING IN THE DIGITAL AGE

Carlota Perez

ABSTRACT

While the technological revolution that has brought the digital age is unique, just like the other great revolutions of industrialisation before it, there are certain patterns that recur across the history of capitalism that can be of great use for the challenges of the present. This chapter will share the lessons learned from such experience, especially those that seem to determine the requirements for the golden ages, such as the Victorian boom, the Belle Époque and the Post War prosperity. Following a summary of previous revolutions, the role of policymaking in successful transitions is examined. This is followed by practical suggestions to bring about sustainable growth in the EU's 'twin transition' of digital and green, from capturing the employment opportunities presented by lifestyle change to the role of education and training. It also looks at the potential inherent in devolving policy making to the regional and local levels, while also supporting its flourishing in the supranational arena. The contention is that the ICT revolution has the potential to bring about a sustainable global golden age for the information society, and that the most effective way of succeeding with the opportunities opened by this revolution is applying multi-level governance. Thus, seeing the 'big picture' becomes important for successful action on the local and regional level, as much as at the national and supranational ones. This chapter of the Toolbook is therefore not intended to be a specific list of action points. Rather, it is a state-level diagnosis for all policymakers and business leaders.

Keywords: *Technological revolutions; technological determinism; golden ages; government policy; regulation; green transition; devolution; institutional innovation*

1. THE TRANSFORMATIONS BROUGHT BY EACH TECHNOLOGICAL REVOLUTION

In the multitude of changes that have occurred in the economic and social spheres since the Industrial Revolution of the 18th century, there are some that can be seen to recur in a similar way in every major set of transformations (Perez, 2002). In the last couple of

decades, with the disruptive change brought by microelectronics, computers and the Internet, there has been a revival of interest in the study of such technological revolutions. However, in order to learn from such repetitions, it is crucial to correctly identify each revolutionary period.

As part of the historical work package for the Beyond 4.0 project, Perez and Murray Leach (2021) reviewed the different approaches to this task, historical and current. Different disciplines have prioritised different elements, from pathbreaking innovations to economic waves, and have recognised as few as two revolutions (the mechanisation of brawn and now brain: Brynjolfsson and McAfee, 2014) to as many as six (including the green transition : Mathews, 2013). Beyond 4.0 builds on the popular notion of Industry 4.0 (Schwab, 2016), taking a critical approach that brings in the work of the Dutch Transitions School (Geels & Schot, 2007) and, crucially, of neo-Schumpeterians (Freeman & Louçã, 2001; Freeman & Perez 1988; Perez, 2002). This latter approach considers not only the major technological changes but also their pattern of diffusion and the way in which financial and production capital —as well as government and society —respond, act and change themselves. It holds that we are still in the middle of the fifth revolution, in which ICT (information and communications technologies) is the driving general purpose technology. It is dated from the introduction of the microprocessor (a computer on a chip) in 1971, includes the technologies of 'Industry 4.0', and sees at least two more decades of potential still ahead in the diffusions of such technologies across society.

Following the neo-Schumpeterian classification reveals a historical pattern for each revolution of three distinct periods: installation, turning point and deployment (Perez, 2002). The installation period, led by finance, sees the 'creative destruction' times that bring great wealth to the few but increasing inequality to the many; it also brings the destruction of whole industries and regions and the rise of new ones. It ends in bubbles and crashes, recessions, resentment, rebellions, divisions, populism and the widespread questioning of the system. It is in the golden ages that follow these tumultuous 'turning points' that the legitimacy of capitalism tends to be restored via a proactive state that sets up a positive-sum game between business and society and which moves to reverse the inequality established in the first half of the period (Perez, 2002). shows the regular pattern of the five revolutions to date, leading up to the the possibility of a sustainable global golden age with the current ICT revolution.

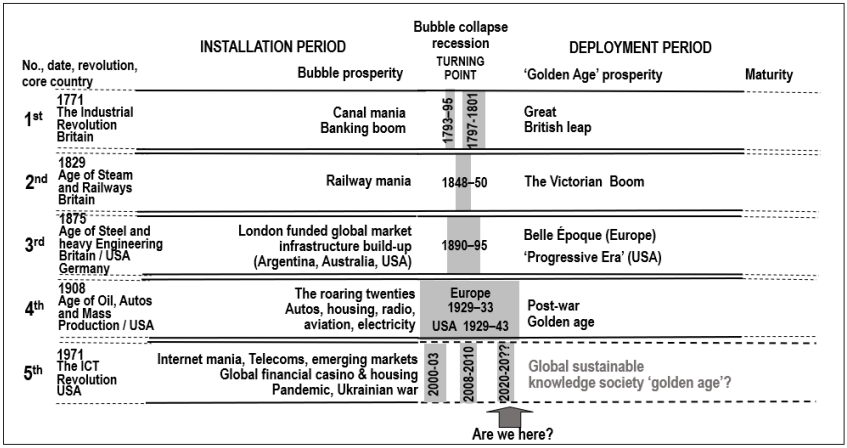


Figure 1: The historical record: Five technological revolutions and their recurring pattern

In what follows, it will be suggested that we are at the threshold of such golden age. It will be made clear that success is not automatic, and neither are the threats of unemployment from the new technologies inevitable (Perez & Murray Leach, 2018). Too often, future forecasting based on the history of technology and innovation slips unwittingly into technological determinism (Perez & Murray Leach, 2021). This chapter emphasises two primary elements of the transition process that counters this misunderstanding. First, it emphasises that technological revolutions are not merely about material technologies: crucially, they are a process of organisational, social and institutional change. Secondly, it argues that any such transition, whether it results in a true 'golden age' or less socially equitable outcome, is the result of a process of social shaping (Geels & Schot, 2007), both at the level of the firm and in the wider economy. Such a process, history shows, must involve government as the context shaper and active investor. It is the state that can induce a growth process which benefits business by generating/facilitating synergies in infrastructure, suppliers, available skills, etc. And it is the state that can ensure a fairer income distribution, in turn providing business with dynamic demand in the chosen directions.

As will be discussed below, the most effective way of succeeding with the opportunities opened by this revolution is applying multi-level governance (Crespy et al., 2007). Thus, seeing the 'big picture' becomes important for successful action on the local and regional level, as much as at the national and supranational ones. This chapter of the Toolbook is therefore not intended to be a specific list of action points. Rather, it is a state-level diagnosis for all policymakers and business leaders, with the aim of not obscuring the wood with the trees. For individual trees cannot grow unless they are nurtured in an

appropriate ecosystem; likewise, policies will not produce the intended results unless there is a deep understanding of their context.

What changes with each revolution?

One of the salient characteristics of a technological revolution is the introduction of a new infrastructure which expands and transforms access to markets. Canals and sailing ships dominated the first; iron steam-driven railways and telegraph the second (Mitchel, 1964; Mokyr & Strotz, 1998); leading to a global infrastructure that combined transcontinental steel railways, steamships, and transoceanic telegraph in the third (Kennedy 1971). The fourth saw the construction of great networks of highways and electricity, airplane travel, and the communications of telephone, radio and telex. In the present fifth the Internet-as-infrastructure has radically altered the way we both communicate and consume. Meanwhile, as with each revolution, advances now possible with the new technology are added to the existing infrastructures of the previous period, catering to the new ways of consuming – such as container ships – while also, in this revolution, transforming that existing structure to face the climate challenge - such as bullet trains and the promotion of the electric vehicle. The nature of these communications, transport and energy infrastructures influences the expansion of the economy and whether it will be mainly national – as were the second and fourth revolutions – or mainly global, as the third and the current fifth. However, as will be discussed, both periods of globalisation have also enhanced the possibilities of decentralised local development as a complement of global trade (Focacci & Kirov, 2021).

With each revolution there have also been changes in the ranking of countries, of economic sectors and companies. The more globalising the infrastructure, the more countries are incorporated into the capitalist economy. The first two revolutions were mainly generated in Britain, the centre of an empire with the pound sterling at the core of world investment and trade. The third revolution, from the 1870s, can be seen as the first globalisation (Zinkina et al., 2019). It saw the US and Germany overtakes Britain, while the Southern hemisphere was incorporated into global trade and several countries (Sweden, Japan and others) made a modernising leap. Today we are seeing a similar process, with China striving to overtake the US, Japan having reached second place in world ranking in the late 1980s, followed by the leap of the 'Four Asian Tigers' (Amsden, 1989; Wade, 1992). The world is now in geopolitical turmoil (the Ukraine-Russian war, tension between the US and China, the 2020-22 COVID pandemic), and it is not clear whether there will be a renewal of some form of Cold War, implying a redesign of the current globalisation pattern. Whatever the case, the nature of the ICT paradigm suggests that every country, every region and every city and municipality must identify its vocation and its direction to succeed in the resulting form of global economy.

Each revolution also sees a great shift in the optimal forms of organisation of production, along with types of management and the forms of relationship between companies. It is already clear that markets are now hyper-segmented and that, next to the commodity segment that competes in price, ICT has enabled the flourishing of numerous niche and customised products and services, the so-called 'long tail' (Anderson, 2006) It has also broken up the supply - or value - chains and spread them globally (Kaplinsky & Morris, 2016; Ponte et al., 2019). Meanwhile, the shift from tangible products to intangible services, such as that which has already happened with music and film (Haskel & Westlake, 2018), is accompanied by experiments in selling goods and services on a rental and maintenance model, as is being done by Rolls Royce with airplane engines (Brady 2002), by Michelin with tires, and by General Electric with hospital equipment.

It is now well known that rather than command and control pyramids with many layers, the most efficient and effective organisations in the digital age are relatively flat networks with several empowered nodes, guided by common directions and goals. Models such as Agile or 6-Sigma are giving method to such organisations (Denning, 2018); they are still mostly used in firms because, as has historically occurred, governments are very slow to adopt the new organisational models and tend to do so in the process of setting up the new institutional and regulatory context to unleash the golden ages.

Organisational changes also include the skill profile and the treatment of labour. The best-known historical case of radical change in this respect is the introduction of the moving assembly line by Henry Ford which led to a productivity leap in the 'division of labour' characterised by Adam Smith. In the new paradigm, we see a flattening of the managerial pyramid, the empowering of part of the labour force to participate in innovation and continuous improvement and the disempowering of others. Equally, there is need for higher skills on one end and deskilling at the other (Tidd & Bessant, 2020). Socio-political decisions will be needed to compensate those at the losing end.

Demand is as important as the changes in what and how goods are supplied. Historically, there have been two major areas of demand-pull. The political and geopolitical context sets the military, infrastructure, social and governance requirements of the state. For example, it was the huge procurement demands in WWII that convinced previously reluctant business leaders that working with the state created profitable synergies (Gross & Sampat, 2020). However, the most important shaper of opportunities in each golden age has been the changes in lifestyles (Perez & Murray Leach, 2020). These begin slowly in the installation period among the rich, the young and the more educated and spread widely during the golden ages. They define a wide range of opportunities for innovation and investment needs and create the majority of new jobs to replace those lost to creative destruction during the installation period. Urban Victorian living in the second revolution created massive employment in construction, furnishing, clothing, and multiple services together with education and entertainment. Cosmopolitan living in the Belle Époque of the

third technological revolution opened a world of opportunities related to travel and hospitality services, theatre, literature, hotels, cafés, restaurants, and multiple other activities serving life in the cities and global tourism (Rebanal Martínez, 2019). The suburban living of the post war boom created demand for the automobiles, electrical appliances and energy – that were produced by the big companies – next to the multiple services and retail trade provided at the local level.

But it all depends on social shaping. Without unemployment insurance, neither mortgages nor purchasing on credit would have been available for people on salaries and wages; without laws supporting strong labour unions, wages would not have gone up with productivity; without industry-wide unions and negotiations, companies would have competed on labour conditions and made it much more difficult to improve the lives of workers. And all those advances in welfare favoured consumption and increased demand. It was the essence of the 'positive sum game between business and society' that characterises golden ages (Perez, 2019). With each revolution there are many options and no technological determinism. After all, Hitler, Stalin, and the great variety of Western democracies used the same Fordist technologies to shape societies in different ways, even though they all favoured centralisation and homogeneity to get the most of mass production.

What are the opportunities provided by the current paradigm?

Once computers and the Internet facilitated communication and networking, stiff bureaucracies and autocratic governance became obsolete. As some of the more successful global corporations have shown, opening the way for participation, collaboration, customer orientation and creativity produce the best results (Denning, 2022). Even the introduction of robotics and artificial intelligence has been shown to work best in collaboration with human workers (Brynjolfsson & McAfee 2014).

For similar reasons with regard to (public) governance and administration, increasing federalism and devolution as far up and down as possible, to enable decisions at the most appropriate level, is likely to be more successful in a potential ICT-based golden age (Shin, 2019). Public sector skills, innovativeness, and intense communication with the governed within consensus-promoting institutions is now the most effective and efficient direction for change (Kattel et al 2022; Mazzucato et al., 2020). Government modernisation is not just about using computers and Internet, it is about making public services as easy as shopping in Amazon.

One of the most important changes relates to what could be called 'glocalisation' (Robertson, 1994). Every bit of territory can have a vocation in terms of specialisation in the global space. The digital economy allows a regional focus when it comes to

development. The global stage is no longer international as it used to be in mass production times; any region, any locality can compete in global markets on its own devices, with its own specialisation. This requires a radical change of attitude both at the supranational, national, regional, and local levels, involving sufficient devolution of decision power as well as resources. It also needs citizen and employer engagement for success. The combination of 'workplace innovation' and a 'collaborative ecosystem approach' (Oeij & Hulsegge, 2023, in this book) is the most likely to achieve success in every part of the national territory and therefore in the whole country.

An important opportunity in the European Union is the possibility of explicitly moving away from the energy and materials-intensive 'American Way of Life' that characterised the mass production revolution – especially the post war boom– by including the green transition in the 'European Social Model'. The goal would be generating what could be called the 'European Way of Life' for the EU could become the world leader not only in socially sustainable policies but also in environmentally sustainable products and services (Perez and & Murray Leach, 2018). However, emerging countries, especially China, have given a lease of life that consumerist and wasteful lifestyle by making it cheap to follow. Fortunately, in the advanced countries, the young, wealthy and educated have begun to at least establish some of the elements that make the urgently necessary transition to environmental sustainability a socially attractive, aspirational good life (Perez 2019). From eating less meat to venerating sustainable architecture, buying hybrid cars – or opting for a bicycle instead – and valuing experiences over products, there may be considerable debate over whether the supposedly sustainable is in fact less environmentally damaging at scale than its predecessor, but the push to 'do the right' thing by the environment sells products and changes ways of living (Friends of the Earth, 2017). The opportunity is there for European business to respond to those new requirements and provide the template for transforming the aspiration lifestyle across the world, while benefiting from exporting its products and services.

Obviously, the new technologies involve new risks. However, the threat to employment can be confronted with intelligent and human-centric forms of work organisation and through the complementary investment related to lifestyle changes and the green transition (Frey & Osborne, 2017; Perez & Murray Leach, 2018). For example, we are far from knowing how to regulate the inappropriate management of customer data as a form of market control, if such power is to be curtailed. Turning that threat into an opportunity is the challenge (Haskel & Westlake, 2018; Oeij et al., 2022).

2. THE ROLE OF THE CONTEXT AND OF POLICY IN SUSTAINABLE GROWTH

Fortunately for policymakers, while there are regularities to the dangers brought by each unique revolution, there are also regularities in effectively facing them. One such danger is the emergence of monopoly power as the new sectors establish themselves as the engines of growth, notably the large high-tech firms, such as Google, Apple, Amazon, Microsoft, Meta (Monge et al,. 2022). The specific forms such power takes and the appropriate way to face it on each occasion depends on understanding the technologies involved. Direct ways of protecting workers (Min et al., 2019) - from regulation of children's work and of working hours in the second, to accidents and health insurance in the third and the above-mentioned welfare measures in post-war boom – are one aspect of the response. The other has had to do with consumer protection both in terms of whatever harms could ensue from monopoly behaviour in health, unjustified prices or, as is happening in the current context, the invasive use of personal data (Custers et al., 2019). Effective regulation requires a deep understanding of the nature of the technologies involved and the way in which the company structures have become harmful.

Reining in excessive power

Consumer protection agencies have been a typical response from governments, but the multi-factor nature of monopoly power requires complex responses. Whereas in the US in 1911 breaking up the Standard Oil giant into several companies was the solution (Yergin, 1991), the telecommunications company ATT was allowed to remain the sole provider under strict supervision and regulation and on condition of setting up Bell Labs to fund innovation (Laplane & Mazzucato, 2020). As to organising trusts to stop prices from going down, the US government provided protection from cheap imports but also enacted anti-trust laws (Benton, 1909). In the same period, the Supreme Court in Germany declared cartels a legitimate form of protection and promoted them across many industries (McCraw, 1995) as well as the equivalent among, workers, farmers, and other groups, leading to the multi-party structure for participation and negotiation that has essentially survived to this day (Szakats, 1974), while morphing each time to adapt to the paradigm. Balancing the interests of business and society is the recipe for effective regulation that will lead to fairness and stability. But each case is unique and must be studied on its own, with as complete as possible knowledge of the nature of the technologies involved. The current abuse-of-data challenge is one of the most complex and difficult to confront (see for example Azhar, 2021; Monge et al., 2022).

Protecting the weaker parts of society

The stability of golden ages depends on striking a balance between the powerful and the weak, be it companies and workers, large and small companies, suppliers and producers – and between the latter and consumers (See et al., 2020). It is a difficult balance where governments have the crucial say and the relevant power. Given the access to information and the potential for innovation, the paradigm of this revolution particularly favours cooperation, participation and consensus for the success of each company, each sector, each nation, region and locality (Focacci & Kirov, 2021). The old model of command and control on the one hand and evasion and avoidance on the other is ineffective in a global economy where business is footloose in the world and governments are constrained by international agreements, institutions and regulations.

Investing in education, infrastructure and frontier innovation

The other essential element for stable growth and prosperity is achieving synergies for the benefit of business, which also benefit the majorities After WWII, public education and health services were prioritised in order to ensure a healthy and well-trained workforce, at the same time as respecting the right to well-being of the population – and incorporating the western working classes into the consumer role key to the success of the mass production revolution. Investment in infrastructure, communication, transport, trade, and travel and the funding of research and technology is no less crucial and are generally recognised as beneficial to all (Pradhan, 2019). Less recognised is the crucial role of market-creating investments by government in areas where business would not necessarily think to enter or to face/afford the risk (Mazzucato, 2013). Such are the cases of the Internet and the man-on-the-moon project, along with key innovations behind the Apple iPhone. And further back in history, we find the US highway system, the largest federal investment in history to date; and the transoceanic telegraph cable around the globe, funded by the British government for military and trade purposes as well as to govern the empire (Kennedy, 1971).

Providing clear directions: tilting the playing field

Synergies are also the result of providing a common direction for investment, through laws, regulation, taxation, subsidies, grants, procurement, and other means at the government's disposal. During the Victorian boom, the British central government promoted urbanisation as a complement to its goal as 'factory of the world'. It promoted the flourishing of urban centres in the industrial areas, through subsidies and regulation with specific construction and infrastructure investment requirements (Casson, 2009). This reduced the costs to industry, thus strengthening both its export capabilities and the

empire. In the third revolution from the 1870s, the US promoted the formation of a powerful and competitive national market complementing strong tariff protection with the use of its vast land possessions to subsidise the construction of coast-to-coast railways, to attract farming immigrants by offering land and to promote the increase of agricultural and industrial productivity by funding the 'land-grant universities' across the different states, with the explicit role of educating, doing research and providing extension services (Geiger, 2014). Similarly, the mass production golden age was propelled by two clear directions: suburbanisation and the Cold War with all the pertinent legislation, procurement and public investment needed to promote them (Leighninger, 2007).

In all those cases, business was encouraged to innovate and invest taking advantage of that directionality, knowing that there would be suppliers, outlets and other advantages guaranteed to facilitate their efforts and profitability. It also led workers and other personnel to train in those same directions, making the necessary skills available and well rewarded. Such synergies, in the context of the prevailing paradigm, are the basis for growth with increasing productivity, together with greater social wellbeing.

Facilitating the "Twin transition": Digital and Green

Yet directionality is not arbitrary and is not decided as a rabbit out of a hat; it is dependent on the potential of the technologies, on the geopolitical conditions and the natural resource context. Thus, the cheap steel that led to transcontinental railways as well as to farm machinery and heavy industry was behind the success of the specific forms of government support in the United States in the third revolution. Cheap oil that fuelled the automobile and electrified homes, together with the decreasing cost of automobiles, made possible the process of suburbanisation (Jackson, 1985) and the economic boom that resulted. It was the Cold War that drove mid-century military investment; the need for a strong navy that led to many of the 18th century manufacturing innovations in Britain (Mokyr, 2010). Waterpower and rivers made mechanisation and canal transport possible in the first revolution; abundant cheap coal moved the steam engines of the second and continued to move the steamships of the third, with sufficient availability of iron for cheap steel. The combination of cheap land and cheap – or slave – labour (Laurie, 1989) in the non-industrialised countries lay behind much of the supply and demand of the third and fourth.

Today, as recognised by the EU, we need a 'twin transition' (Muench et al., 2022). Innovation is digital, because information and communications are cheap; globalisation in one form or another is calling for an institutional geopolitical response while the resource limits and the challenges of inequality and climate change are indicating the directions: digital, green, fair and global growth.

Enabling dynamic demand through full globalisation

But in this case, as in the first globalisation, the positive sum arrangements are not only needed at the national level. Full global development is in the interest of the advanced countries and is a component of a potential golden age (Perez, 2013). The mass production of consumer goods is now mainly in Asia and, if it were to come back to the West, it would have to do so with robotics. Otherwise it might spread to Africa or Latin America. These continents, together with Central Asia, might also tend to specialise in natural resources, sustainably, to serve the needs of the green transition. Whichever route they take, employment in the advanced world is likely to depend on global demand for digital services, luxury goods, education and especially capital goods for investment across all developing countries. Full global development means demand in sustainable infrastructures as well as equipment for various production processes and perhaps for the development of massive maintenance and recycling industries, to stretch the life of scarce materials and create employment at home.

Thus, social sustainability, at local, national and global levels, is in the interest of business and of all governments.

Regulating global finance and recoupling it with production

The key to golden ages has always been the recoupling of finance with production. A healthy productive economy cannot thrive as long as the financial world continues in a casino mode, making money from money, concentrating on synthetic financial instruments, in the so-called derivatives or hedges, which do not produce any new wealth or in real estate and other static assets (Foroohar, 2016). Yet the democratic deficit brought about by globalisation (Della Porta, 2005) has meant that it is not in the power of the state at the local, regional or even national level to regulate and induce finance to invest in the real economy, without risking a race to the bottom. Perhaps the most difficult condition for bringing about a golden age is the supranational regulation (and perhaps taxation) of global finance.

3. REDESIGNING POLICY FOR A SOCIALLY AND ENVIRONMENTALLY SUSTAINABLE WORLD

The current wave of populist success in elections, as well as the increasing waves of migration are typical of late installation periods and turning points (Perez, 2002). The massive dislocation of industries, skills and regions brought by each technological revolution destroys the hopes that were created by the golden age of previous ones

(Schumpeter, 1943) and creates fertile ground for messianic leaders as well as for desperate violence and migrations. Without effective policies and institutional changes geared to solving the prevailing inequality and hopelessness there is no possibility of successful outcomes at any level. Creating the conditions for a sustainable, human-centric and resilient economy must be the explicit goal of innovation in policy and institutional design for governments and also for business. Technologies only set the stage and provide the tools; it is up to the leaders in the private and public sector to negotiate and reach consensus directions in which to shape those possibilities for maximum social benefit.

Enable lifestyle changes and better employment

As mentioned above, each golden age has involved a radical change in lifestyles that creates demand and opportunities for innovation, investment and therefore employment. While the new tech sectors tend to be high productivity, generating great wealth and growth, the majority of employment and production is spread across the economy in sectors that involve a range of company sizes and productivity levels. We see digital technologies in exciting new sectors such as high-tech artificial intelligence (AI) and emerging biotech, but also as a tool in the now generalised use of the Internet, mobile phones, QR codes and other facilitators of communication and trade. Next to the new digital world, there is also a vast new range of personal services in education, health, nutrition and other areas made possible by the digitally-underpinned platforms, newly installed types of organising based on digitisation in itself, that generate new employment and contribute to the new lifestyles (Lyons et al., 2018). At all levels of public action, the goal is to facilitate innovation and investment towards maximising prosperity in a human-centric way of organising production and the economy while reducing the unacceptable levels of inequality currently being witnessed.

Facilitate and support the green transition

This time, we also face the emergency of climate change and planetary limits, caused by the technologies of the previous revolutions. However, digital technologies have created the possibility for production methods and lifestyles that can be not only smart but also fair and green – without the drop in 'modern' living standards once associated with 'green' lifestyles. The implications of this double mandate include creating the conditions for the shift from products to services, for facilitating systematic reuse and recycling at the personal level (including sustainable forms of consumer behaviour) and the spread of maintenance and rental as forms of demanding and achieving the durability of products; moving the traditional health services from combatting acquired illnesses to care and preventive medicine, including healthy habits, exercise, good nutrition and so on.

Change relative profitability in favour of the green transitions

There is a vast range of areas where the public sector can contribute to social and environmental sustainability through 'tilting the playing field' so that it is more profitable to invest in socially and environmentally sustainable technologies than in the traditional ones. This can be achieved by a mix of measures, from new forms of regulation and taxation to public-private consensus building on 'missions' that involve public investment (Kattel & Mazzucato, 2018). Policies already in place include those orientated to the conservation of energy and materials; the facilitation and promotion of the circular economy and of recycling; regenerative agriculture, hydroponics and biowaste projects; and the revamping of city planning regulation to redesign mobility and architecture. All these and more exist and can be rolled out as standard.

Devolve power to the regions

Another positive feature of the ICT paradigm is that the very nature of globalisation in this revolution encourages 'glocalisation'. In contrast with previous infrastructures that required massive investment and sufficient demand to justify it, the Internet is increasingly ubiquitous as it moves from cables to mobile transmission and to satellites. This ubiquity of the trade and information infrastructure at decreasing cost opens a potential for multi-level governance: devolving power to the supranational and to the local. It opens a potential for localisation at the same time as it enables globalisation (Arkhipov & Yeletsky, 2020). This offers great possibilities for reducing the major regional inequalities inherited from mass production times. Taking advantage of this requires devolving responsibilities in development to regional and local governments, together with increasing the capabilities of their personnel and their economic resources.

However, ICT also enables 'surveillance capitalism' (Zuboff, 2019), which exacerbates the potential power of governments over citizens and of digital giants over the users of their platforms. Enacting legislation to avoid abuse at any level and by any agent is an urgent task.

Give priority to education and training

A final area of attention for all levels of government is the recognition of the role of education as the most important asset for every citizen. If homeownership was at the core of the post-war success, socially and economically, human capital is now essential for every person and for every business. It is also the key to good government (Kattel, Drechsler & Karo, 2022; Focacci & Perez, 2022).

While facing the challenges, be alert to potential changes ahead

Recognising the challenges posed by inequality, the options for using the new technologies in a more human-centric way, the need to change production and lifestyles to achieve growth within environmental sustainability and the advantages of promoting full global development are the central conditions for success in making the best of the potential of the digital economy (Perez, 2016). However, it will be the responsibility of business and governments at every level to do so, while being alert to the changing geopolitics and preparing for making the best of the likely redesign of globalisation.

4. CONCLUSION: THE NEED TO CREATE INSTITUTIONS CAPABLE OF PROMOTING CONSENSUS AT EVERY LEVEL

The transformations required to bring about the golden age of the information revolution imply reversing the current unacceptable levels of inequality and overcoming the risk of irreversible climate change. These are enormous challenges. They will demand the cooperation of all, aiming at multi-party negotiations (government, business, employer and labour organisations, and political parties) at every level, recognising common and differing interests and arriving at a positive-sum consensus (Esping-Andersen, 1996). An example of this is the 'positive-sum consensus' achieved for the Next Generation EU funds (Fuest, 2021).

A possible way to arrive at further common actions and goals could be identifying and setting up 'missions', with the participation of all those involved and affected (Mazzucato, 2021). History shows that each technological revolution opens different opportunities and has different requirements for successful businesses and governments (Perez, 2002). Although the early decades of diffusion tend to promote unfettered free markets to achieve the 'creative destruction' process, the resulting levels of social resentment and the rise of populist leaders call for the return of proactive governments. It is only then that golden ages can be unleashed. Understanding such requirements is the first step towards a successful deployment of the potential of the current ICT revolution.

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CHAPTER 4

SUPPORTING THE INCLUSIVE GROWTH OF ECOSYSTEMS IN THE CONTEXT OF THE DIGITAL TRANSFORMATION

Vassil Kirov, Gabriela Yordanova, Steven Dhondt & Peter Oeij

ABSTRACT

In this chapter we investigate which of the elements of the entrepreneurial ecosystem model have been crucial to contribute to economic growth and inclusiveness in the examined regions, selected to illustrate the diversity of employment models and levels of technological development. An important lesson from the research is that the technological transformation (may) lead to augmentation in some cases, but to substitution in others. Second, technologies are shaped socially. The history and the long-term matter and thus, the institutional shaping should take its time and perhaps there is no need for constant changes, but of consistent and long-term policy. Beyond this more general takes, on the basis of this analysis are formulated policy recommendations.

Keywords: *Digital Transformation, Entrepreneurial Ecosystems, European Union, Regions, Inclusive Growth*

1. INTRODUCTION

Since the publication of the work of Frey and Osborne (2013/2017), the debate about the future of work has become a trending topic, leading to the publication of hundreds or even thousands of books and articles[1]. For about a decade, the dominant discourse in this debate has been about the jobs' destruction and the end of work. Following the 2013 analysis of Frey and Osborne, who claimed that 47% of the jobs in the USA are at an imminent risk of automation, multiple academic authors and consultancy companies reports developed complex methodologies in order to predict the jobs and professions that will disappear. The major assumption within this stream has been that understanding that the technologies will substitute human labour and thus, make work redundant.

[1] For example, more than 10 000 results appeared on www.amazon.com for the search future of work (last accessed on the 5 February 2023)

However, in 2023 or ten years after the publication of the paper of Frey and Osborne, instead of witnessing the end of work, there is increasing evidence that employment levels in the developed world have never been so high (Eurostat, 2023[2]). The development of the debate provided arguments and evidence that technologies are not deterministic (Warhurst et al., 2020; Kornelakis et al., 2022; see also Perez' chapter 3 in this volume) and something more, they can be shaped by various policies and actors. Something more, in parallel to the job destruction, there are different processes taking place at the same time, including the job creation, job shift, and job change (Degryse, 2016). In this context a more nuanced approach to the digital transformation impacts has been needed, and this has been precisely the BEYOND4.0 approach.

In this context of technological change (or even technological revolution, see Chapter 3 of Perez in this volume), it has been interesting to analyse what exactly was happening in the different European regions. While different approaches and disciplines have tried to address the impacts of the digital transformation at regional level, our methodological choice was to use the perspective of Stam and Spiegel (2016) on the entrepreneurial ecosystem, defined as a "set of interdependent actors and factors that are governed to enable productive entrepreneurship within a particular territory". In the framework developed by these two authors, ten elements play a role in creating value through entrepreneurial activity: formal institutions, culture, physical infrastructure, demand, networks, leadership, finance, talent, knowledge & support services/intermediaries (Figure 1). Among the advantages of this approach have been the comparability among regions and the idea that the elements in an ecosystem are substitutable in such a way that there is no one "best way", but different possible pathways to a high-performing entrepreneurial ecosystem (Schrijvers, Stam and Bosma, 2021; see also chapter 1 in Oeij et al., August 2022).

More precisely, we have been interested in the impact of the digital transformation on the functioning of ecosystems, on inclusive growth, and the respective implications for the future of work. In this context, it has been important to investigate which of the elements of the entrepreneurial ecosystem model have been crucial in order to contribute to economic growth and inclusiveness in the examined regions, selected to illustrate the diversity of employment models and levels of technological development. That is why, in BEYOND4.0, we have selected several of these regions and within these regions looked at leading sectors, leading focal companies and business networks. The examples examined in the chapter are part of the empirical work, conducted in the framework of BEYOND4.0

[2] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Employment_-_annual_statistics#Employment_in_2021_compared_with_the_EU_target

project. More precisely, between 2021 and 2022 we carried out twelve regional case studies (Dhondt et al., January 2022) and 30 company case studies (Oeij et al., August 2022).

This chapter deals with the analysis of good examples and concludes with policy recommendations, developed on the basis of the empirical analysis.

2. IDENTIFYING THE ECOSYSTEMS

In the context of BEYOND4.0 there could be observed that some regions can record growth over long periods, while other regions have experienced decline. That is why we have been interested to understand why. For this, we would like to understand which ecosystem elements support inclusive economic growth at the regional level in the context of the digital transformation. The entrepreneurial ecosystems include a variety of actors, e.g. companies, regional/local governments, educational institutions, research bodies, funds and other financial players, and other stakeholders, that constitute regional networks. In each region, we have analysed two entrepreneurial ecosystems, one incumbent, and one emerging. Under incumbent entrepreneurial ecosystems we understand ecosystems existing for a long period of time that have shaped the economic development of a particular region, for example the emblematic cases of the steel industry in the Rhine/Ruhr region in Germany or the automotive industry in the West Midlands in the United Kingdom (Jaguar – Land Rover). The term emerging entrepreneurial ecosystem (Dhondt et al., 2022) refers to an ecosystem that still is in the process of being formed, hence not yet fully mature, and is created around/related to a specific theme or industry (e.g., in health, food, biotech, or pharma), or applies to new industries (e.g., smartphones, solar panels, wind farms, digital health devices). Emerging business ecosystems can be – but not necessarily are – characterised by a high number of growth-oriented start-ups.

BEYOND4.0 sought collaboration with scholars from Utrecht University for quantitative tools to measure the development of the ecosystems in general. They participated with a complex analysis, based on regional statistics in order to propose a classification of entrepreneurial ecosystems, based on the specific configurations of the ecosystem elements (Schrijvers et al., 2021).

To achieve a deeper understanding the ecosystem dynamics and mechanisms that might lead to growth, in the case of BEYOND4.0 we conducted qualitative research based on cases studies. The in-depth interviews as part of the qualitative data collection covered both 'incumbent' and 'emerging' ecosystems in six countries: Finland, Bulgaria, Germany, the United Kingdom, Spain, and the Netherlands. In total, we have studied eight different regions (namely two different (NUTS) regions in Finland and Germany) and fourteen ecosystems (six incumbent with two double cases and six emerging). This analysis allowed

a better understating of the relationship between the technology embedded in a particular sector and the development of the respective region. The shaping of the technologies has taken place in the context of the ecosystem, where in some cases the different stakeholders collaborated, but in other the efforts have been dispersed.

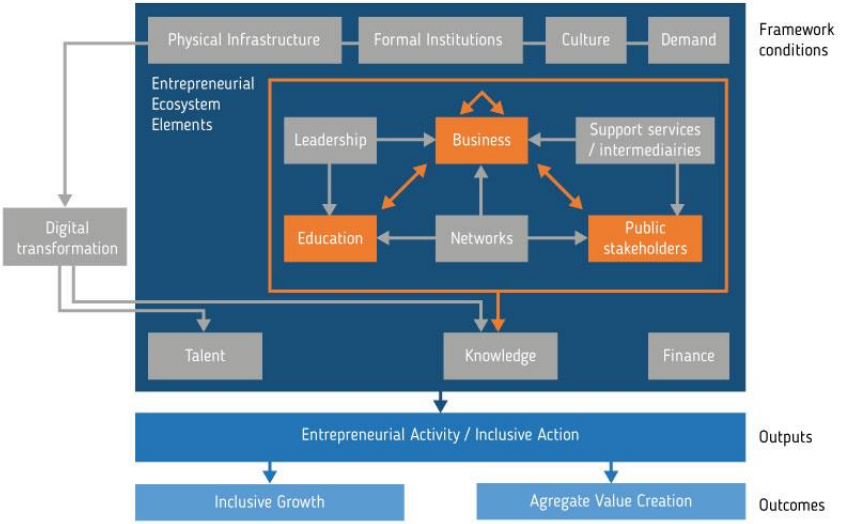


Figure 1: The elements of the ecosystem. Source: Dhondt et al. 2022, p.9[3]

The examined ecosystems differ in terms of the technology deployment (See Table 1). Four of the entrepreneurial ecosystems are at the centre of the digital transformation. The mobile technology sector of Oulu, Brainport and the ICT ecosystem in Sofia are major players in developing and application of digital technologies. The Sofia region is supplying ICT services to the whole of Europe and North America.

[3] Dhondt et al., 2022, p. 9. https://beyond4-0.eu/storage/publications/egional%20report:%20entrepreneurial%20ecosystems%20in%20six%20European%20countries/BEYOND4.0_D4.1_Regional%20report_six_countries-PC-18429.pdf

Table 1: BEYOND4.0 incumbent entrepreneurial ecosystems and description of major changes in the business ecosystem

BEYOND4.0 region	Dominant business ecosystem	Change 2010-2022
Salo, Finland	Mobile technology	The Nokia business ecosystem collapsed in 2011. The region shows a strong decline. After 2018, Valmet started with battery production, using Industry 4.0 technologies (robotisation, IoT)
Oulu, Finland	Mobile technology; Wood Processing	The region experiences the replacement of Nokia business ecosystem by the emerging ICT ecosystems and incumbent wood processing. Both new sectors develop new avenues with Industry 4.0 technologies (IoT, informatisation).
Sofia, Bulgaria	ICT sector	The continuous growth of ICT, branching out. This is not an industry sector, but the focus is on supplying industrial ICT solutions to the whole of Europe and North America. In this sense, they are driving Industry 4.0 efforts.
Duisburg, Germany	Steel sector	The sector experiences a steady decline of heavy steel, continuing restructuring. The new solutions lie in integrating digital solutions in the production systems.
Dortmund, Germany	Steel sector	The steel business ecosystem is not dominant anymore, new business ecosystems are on the rise.
Zuidoost Noord-Brabant, Netherlands	Advanced manufacturing	Advanced manufacturing has taken over the role as the dominant business ecosystem. This sector is at the core of the Dutch Smart Industry (or Industry 4.0).
Basque Country, Spain	Machine tool	This sector is also slowly declining, but still the most important business ecosystem in the region. The machine tool is representative of Industry 4.0 in Spain.
West Midlands, United Kingdom	Car manufacturing	This is a slow declining sector, but still the most important business ecosystem in the region. Car manufacturing uses a great degree of robotisation and other Industry 4.0 technologies.

Source: Dhondt et al. 2022, p.11

On the other hand, the Basque machine tool incumbent entrepreneurial ecosystem and the German Steel ecosystem see themselves mainly as consumers of digital technologies, as does the automotive ecosystem in the West Midlands in the United Kingdom. In all these ecosystems companies are far in automation, but digital technologies do not transform production systems. The level of adoption of these technologies depends very much on the concrete companies. The different uptake of these technologies is also reflected in the impact on the business models used in the ecosystems.

The analysis of the employment effects of the digital transformation (on the basis of EU LFS data[4]) have demonstrated that between 2008 and 2020 some ecosystems have recorded significant growth (as illustrated by the ecosystems in Sofia, Brainport and Oulu with respectively 78%, 23% and 10% or employment growth – See Figure 2). In other ecosystems (such as the steel in Germany or the mobile phones in Salo), the existing technologies, combined with the digital tools have led to job destruction. In other words, in parallel to the substitution advanced by Frey and Osborne (2013) there could be an augmentation pathway, i.e., technology enabling employees to do their work better. Logically, the question would be why? The examination of the respective ecosystems allows differentiating cases where their elements and actors collaborate versus cases where efforts have been dispersed (Figure 2).

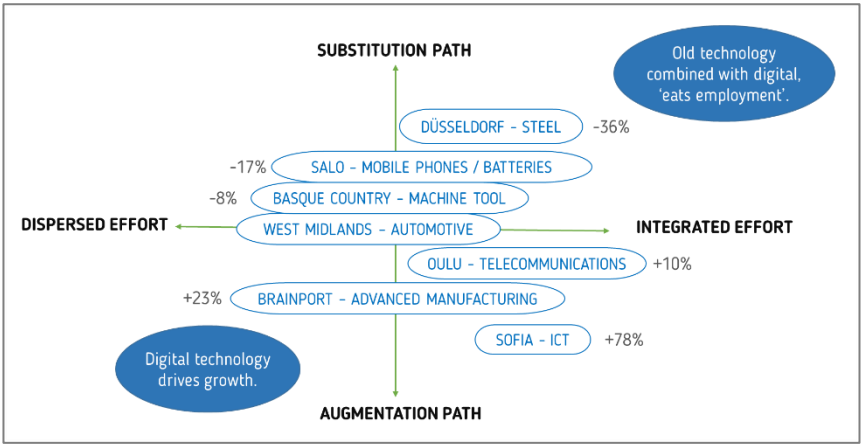


Figure 2: Employment effects of the Digital Transformation. Source: Steven Dhondt and Vassil Kirov (26 November 2021), Peaking behind the curtain. Organisation, technology

[4] European Union Labour Force Survey, available at: https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey

and policy in the 21st Century. Presentation for Technequality Scientific Conference, Brussels/Online

3. IDENTIFYING THE ELEMENTS SUPPORTING THE DEVELOPMENT OF THE ECOSYSTEMS

Going beyond the employment effects, during the project the researchers have analysed the situation in the ecosystems. More precisely, they have been interested to identify what elements of the ecosystem supported their development. The qualitative research allowed also to go beyond the classification and that is why respondents at regional or company level have been asked to formulate their opinion about the most important elements.

The synthesis analysis of the regions in terms of the ten elements indicates some important issues to be considered, as visible in Table 2. The respondents' opinion pointed out five important ecosystem's elements to be considered necessary and/or sufficient conditions of productive growth. These are as follows: talent, networks, finance, infrastructure, and formal institutions, and they are examined below in this section.

Table 2: Summary of the results of the qualification of the six entrepreneurial ecosystems (1=present, 0=absent): comparison of BEYOND4.0-results (BEY) to study by Utrecht University (UU) (Schrijvers, 2020) (blue text = difference in evaluation between UU and BEYOND4.0- team)

	Finland: incumbent IEE (Salo & Oulu)		Bulgaria: ICT IEE (Sofia)		Spain: Machine tool IEE (Basque Country)		Germany: Steel IEE (Duisburg)		UK: automotive IEE (West Midlands)		Netherlands: Brainport IEE (East North-Brabant)	
	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU
Formal institutions	Strong institutional context, but locally focused (exclusive)	1	Insulated IEE, not supported by institutional environment	0	Strong institutional context, well developed network and attitudes	1	Diminishing institutional support for traditional IEE	1	Strong institutional context, with complete coverage of support	1	Half directed institutional context, not focused on entrepreneurship	1
Entrepreneur-ship culture	Strongly developed in the two regions. Trust in entrepreneurship.	1	IEE is strongly entrepreneur focused	0	Strongly developed and supported	0	Fractured entrepreneurial culture mainly driven by anchor company	1	Traditional entrepreneurial culture, R&D and MNC driven	0	Collaborative culture, trusting relations	1
Physical and IT infrastructure	Strongly developed, multimodal	1	Developed through airport and IT connection	0	Strongly developed, multi-modal	1	Strongly developed, multi-modal	1	Strongly developed, multi-modal	1	Strongly developed, multi-modal	1
Demand	Markets are global, not building on local demand. For new products, local demand is important.	0	Only focus on international markets	0	Markets are global, not building on local demand	1	Markets are global, also building on local and national demand	1	Markets are global, not building on local demand	1	Markets are global, not building on local demand	1
Finance / financing	Broad financial support for start-ups, for scale-ups it is less sufficient	1	International and EU funding mainly, with issue of corruption	1	Well-developed and strongly funded financial system	0	Funding is at risk for making the necessary transition(s)	1	Well-developed, strongly funded financial system (cause: Brexit)	1	Well-developed and strongly funded financial system, not dependent on local funding	1

	Finland: incumbent IEE (Salo & Oulu)		Bulgaria: ICT IEE (Sofia)		Spain: Machine tool IEE (Basque Country)		Germany: Steel IEE (Duisburg)		UK: automotive IEE (West Midlands)		Netherlands: Brainport IEE (East North-Brabant)	
	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU
Talent	Mixed picture for education levels: tight for high levels, abundant for low skills	1	Strong supply of talent	0	Strong supply of talent and system to support it	1	Supply of talent is in a turmoil, with dwindling supply to the IEE	1	Strong supply of talent	1	Supply of talent is average, mainly by extraordinary demands	1
(New) Knowledge	Mixed situation with excellent knowledge supply in Oulu, less so in Salo	1	Local optima, but overall, not strong knowledge position	1	Strong knowledge system support for EES	1	System dominated by anchor company, limiting innovation direction	1	Strong knowledge system support for EES	1	Strong knowledge system support for EES	1
Services by Intermediaries	Strongly developed in Oulu, average for Salo	1	Strongly developed network of intermediaries	1	Strongly developed network of intermediaries	1	Strongly developed network of intermediaries , focused on Anchor co.	1/0	Strongly developed network of intermediaries	1	Strongly developed network of intermediaries, not limited to region	1
(Social) Networks	Well networked regions	1	Starting network development	0	Very strong, historical networks in the IEE	1	Very strong, historical networks in the IEE, dominated by Anchor company and partly EU focuses	0/1	Well networked region, but conflicting interests	1	Very strong, historical networks in the IEE	1

	Finland: incumbent IEE (Salo & Oulu)		Bulgaria: ICT IEE (Sofia)		Spain: Machine tool IEE (Basque Country)		Germany: Steel IEE (Duisburg)		UK: automotive IEE (West Midlands)		Netherlands: Brainport IEE (East North-Brabant)	
	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU	BEYOND4.0	UU
Leadership	Anchor company driven leadership	1	Entrepreneur driven leadership with foreign influence limiting clear local visions	0	Sector associations driven leadership	1	Anchor company driven leadership	0	Dispersed leadership, through OEM and networks	1	Business leadership	1

Source: Dhondt et al. 2022,pp.51-52

Talent

Talent is an essential element for the development of productive ecosystems, and this was underlined by our respondents in all the cases (Table 2). All ecosystems mention the availability of qualified personnel as a factor contributing to the current success.

An interesting example has been the case of Sofia, where we have studied the development of the ICT-sector from 2008 until today. As it could be seen from fig. 2, the employment in the sector has nearly doubled during the last decade. In this case the deployment of digital technologies has not affected employment negatively. On the contrary, digital technologies supported the augmentation path. The nature of the sector has also changed: from a fast re-engineering of hardware (See Focacci & Kirov 2021), to price-based competition for orders in the context to execution of very simple operations in software outsourcing in early post-communism for the same client offers, the sector companies increasingly collaborating as specialists in a global market. This has been supported by emerging network organisations. In this case, technology is not destroying jobs, but rather supporting the companies in specializing, and the employees to develop their skills sets in the context of companies' labour markets. The abundant supply of software engineers (talent) has been the major reason for the long-term growth of this ecosystem. The fact that on average ICT employees are paid up to four times the average salary in Sofia has made the sector really attractive, at a difference of other Balkan countries where youth trained in IT still tend to emigrate, searching better jobs elsewhere. However, in order to fully understand the situation, the talent should be contextualised. While at a general level countries like Bulgaria could not be "suspected" to succeed in ICT, because of the low level of IT skills (DESI index data[5] or RIS 2021 data[6] show an extremely low (normalised) score for digital skills in the overall population), on the other hand, the position for IT specialists far exceeds the position of all other regions in Bulgaria and even in Europe. Moreover, the talent has been mobilised also because of the development of other factors, as explained in the following sections, networks, finance and infrastructure. The emerging networks and the improving financial situation in the sector helped to keep talent in in the IT-intensive region of Sofia but in a context of increasing digital divide.

Talent in terms of skills, training, and education has been featured also in the context of the machine tool ecosystem within the Basque country, Spain. In this case, the Machine tool institute (IMH) and the network of vocational training centres have been able to supply the necessary skills, being deeply rooted in the territory, particularly due to the proximity

[5] The Digital Economy and Society Index (DESI), available at: https://digital-strategy.ec.europa.eu/en/policies/desi
[6] Regional Innovation Scoreboard 2021, available at: https://ec.europa.eu/research-and-innovation/en/statistics/performance-indicators/european-innovation-scoreboard/eis

of the educational centres to the companies. In addition, aspects such as up-skilling and re-skilling through master studies or specialisation courses in digital technologies are gaining importance in this region (Dhondt et al., 2022:107). At a difference of most of the examined ecosystems, counting on the development of local talent, In the Dutch case local stakeholders developed a strategy to attract international talents and helping in this way the ecosystem to outperform other regions in the world. The region requires an ongoing supply of very highly skilled (international) employees, because at present in the Netherlands there is a 'war on talent' in the context of a tight labour market for high-tech employees and where less than half (44.2%) of secondary or medium vocational education students (in South Brabant) opt for a technological profile in 2019.

Networks

Social networks are considered by respondents as a very important element in most ecosystems. More specifically, most ecosystem respondents refer to 'triple' or 'quadruple helix' types of networks between businesses, government, education/research, and society. As clarified by Oeij et al. (2022), many respondents stress the need for cooperation/collaboration (much less so, competition) between businesses within the region/ecosystem. This could refer to vertical cooperation in supply chains but also to horizontal forms of cooperation within and across supply chains. Examples are found in the Dutch ecosystem in the East of North-Brabant (Netherlands) and in the United Kingdom ecosystem in the West Midlands. The situation in Sofia is related to the fact that the ICT-industrial network operates as an insulated network from its broader environment. The broader network development will be a factor for the future.

According to the studies of Kangas and Karonen (Chapter 7 in this volume) and Dhondt et al. (2022:109), there has been a strong collaboration between the company Nokia and the University of Oulu. This collaboration was based on a long-term relationship and previous initiatives, such as the "Technology Village", that was established in 1982, when the city of Oulu, the University of Oulu, and a number of shareholder companies established Oulun Teknologiakylä. The purpose of this joint venture was to gather top technology experts in Oulu and accelerate the ongoing transformation of the economic structure in the region. The overarching theme was to launch an image of Oulu as a knowledge and competence centre for the Finnish electronics industry. The more developed collaboration began in the late 2010s. Gradually, on the basis of this collaboration, Nokia, the University of Oulu, the research institute VTT and new ICT-based enterprises started cooperating and formed a growing and innovative new economic ecosystem that successfully unified research, development, designing, manufacturing, and selling around electronics and mobile technology. As a result of this cooperation, one can point to the example of Technopolis (https://technopolisglobal.com/about-us), which today has 16 campuses that host 1,500

companies and 45,000 employees in six countries within Europe thereby helping to build communities.

In the Bulgarian case in Sofia, compared to a few years ago, companies have started to collaborate instead of only competing one another. Specialisation of companies and upgrade in value chains increased collaboration and partnerships developed based on specific competencies. In addition, the size of the companies stimulated them to collaborate in order to take together bigger orders. But collaboration has not only been developing among companies. The newly created state or municipal institutions also supported this collaboration. The newly created State Agency for Science and Innovations started creating interconnections between business, state and regional institutions and scientific organisations. On the other hand, the local government in Sofia nominated a vice-mayor in charge of the digital transformation in order to facilitate the communication between the ecosystem and public authorities. Clearly, a positive role in this process played the availability of EU funding that stimulated interactions among the stakeholders in the ecosystem

For the Basque country machine tool ecosystem, clustering became crucial. The fact that AFM Cluster, the organisation that represents the interests of Advanced Manufacturing in Spain, is located in Gipuzkoa in the Basque Country,-shows the importance of this industrial activity in the region. Founded more than 70 years ago, this cluster includes has an R&D research institute helping member companies in adapting and adopting new digital technologies, collaborating with the network of vocational education and training actors such as the IMH. As whole, the Basque Country has many employed in knowledge-intensive sectors and shows relatively high innovation expenditures. Public support drives most of the knowledge spillovers. Even if companies do drive several types of spillover, the guidance of major programmes is crucial to achieving the necessary new ideas.

In the Dutch case of the emergent ecosystem in aviation maintenance, the social network is supported by educational institutions. Cooperation and the existing network within the region of West North-Brabant were seen as very important–many network meetings. Parties are not open/transparent and hardly ever work together. It is very difficult for new parties to enter. In fact, there are three separate sub-ecosystems (logistics, maintenance and new materials) (Dhondt et al., 2022:122).

Finance

BEYOND4.0 research revealed that finance is an ecosystem element considered more important by the respondents than suggested in Schrijvers et al. (2021). There has been a strong emphasis on public financing of investments by national and EU levels in the ecosystem in some regions, with the German steel ecosystem as a prime example.

The Bulgarian ecosystem explicitly mentions EU funding as the main source of Finance. National funding is under development and not yet at the level of the other EESs. As showed by the research, the EU funding can play an important role in filling the gaps related to the finance as illustrated by the case of Sofia, where about 350 million euros have been invested through the JEREMIE programme[7] in the last 12 years. The launched by EU money venture capital funds made financing available and well used and helped private funding to be attracted.

For the Finnish ecosystem, research revealed that their companies increasingly rely on private actors that provide financing options for investment. However, the support has been perceived as insufficient for particular segments: scale-ups have difficulty finding sufficient support to grow. Within the Digital emergent entrepreneurial ecosystem, start-ups have had no major problems in obtaining capital for the start-up, but again, there is insufficient funding to scale up the activities. That is why, in many cases, the start-up company was sold to foreign investors instead of being further developed by its founders. In the digital health ecosystem, there has not been any major problem in obtaining capital for the start-up ideas. In addition to private funding, the City of Oulu also has been able to provide financial support, in parallel to various national and EU-level research funds, that have been available.

In the Basque (Spanish) ecosystem, autonomy in designing and implementing the region's industrial policy has offered companies a variety of flexible options for financing. In Spain, the presence of private equity firms, including in this ecosystem, has been gaining importance. Companies such as EASO Ventures and BERRI UP served as accelerators that showcase new funding sources. Additionally, access to new funding sources has been strengthened through accelerator programmes at both regional and sub-regional levels. In the regional sphere, the Basque Government maintains a line aimed at the areas of intelligent specialisation of the territory where, specifically and through the BIND4.0 programme, it favours the attraction of innovative business ideas and their acceleration.

In the Dutch case, aerospace is a traditional sector, depending on a lot of public funding. Without such funding, there would not have been an ecosystem, because payback period for investments is long, so subsidies and credit are essential. Furthermore, it is difficult to find new financing because of the long payback times and inflexible long-term contracts and closed innovation systems (defence). There is a need for more ambitious plans to attract financing. Local funders are reluctant to fund national projects.

[7] https://www.eib.org/en/publications/jeremie-a-new-way-for-using-eu-structural-funds-to-promote-sme-access-to-finance-via-holding-funds

Furthermore, the elements of Formal institutions and Physical infrastructure are considered 'necessary' (but not sufficient) conditions for the success of ecosystems. This is not the outcome of the Utrecht University-research (Schrijvers et al., 2021), where no condition was considered 'necessary'[8].

Infrastructure

Regarding the element of physical (and ICT) infrastructures, respondents from all regions/ecosystems are stating that the multimodal physical infrastructure (road, rail, waterways, air) is sufficiently well-developed in the region, even if most regions indicate congestion problems. With respect to ICT infrastructure, there also seems a consensus among the six countries that this is up to standard. One exception is that for the Dutch Aerospace ecosystem, where access to a landing strip and related facilities at the nearby, is a crucial factor for the existence of the ecosystem. The private companies are in the good graces of the Defence partner to get access to the facilities.

Oulu (Finland) has always been a region in constant economic transition, yet with a strong industrial basis to build on including big international operating companies. The Port of Oulu is the largest port in Northern Finland, and important for the global exports of final products. Railways and road transport are particularly important for domestic logistics. In Oulu, telecommunications facilities are good, and the anchor company Stora Enso has some own logistic systems to deliver products to the global markets. The main reason for Nokia's location in Oulu was the availability of suitable labour for production and the specialized electronics industry. This was driven by the University of Oulu's Faculty of Technology, its collaboration on the production of electronic measuring equipment for industrial purposes and an overarching goal of building an electronics industry hub in Oulu.
The Basque Country is well connected with other regions in Spain and internationally via road and (high speed) rail networks. The Basque Country has three airports and two important commercial maritime ports. According to the Digital Economy and Society Index of the Basque Country (which measures connectivity, human capital, use of internet services, integration of digital technology and digital public services), the region stands out as a leader among the EU countries as a whole.

For some ecosystems (e.g. the Ruhr region in Germany), there is an explicit mention of the geographical advantages of where the region is located, with respect to access to

[8] This is probably due to the fact that the scores of these elements are calculated relative to the EU median. In general, the level of these elements is measured at a high statistical level in Europe, which is why scoring above the EU median is not necessary to have a good ecosystem.

trimodal transport options via water, road and rail. For the Sofia region, the software activities are local but with strong connections to the international clients or mother firms. The international airport is supportive of this purpose. The whole region may be evaluated as having a less supportive infrastructure. The ecosystem has less need for intermodal infrastructure support to optimise its performance.

Formal institutions

Formal institutions matter for how the ecosystem functions and what kind of output it produces (Stam, 2015). This element is often only mentioned by respondents as a 'hygiene factor': the interviewees in the ecosystems do not consider it a very important element, and this is likely related to the fact that the quality of the formal institutions is generally up to standard in the regions in the study. We already saw from Schrijvers et al. (2021) and other analysis (Focacci & Kirov, 2021) for the Bulgarian ecosystem that this element is problematic for companies. The BEYOND4.0-information shows that businesses have to deal with an institutional environment in which corruption and unsupportive public policy play an important role. The businesses in this Bulgarian incumbent ecosystem manage to 'circumvent' the negative impacts of this context. The companies (and other stakeholders) operate as insulated from their institutional context and are able to do that because of the international firms that dominate this IEE. These companies do not want to get entangled in these local issues. However, these phenomena are a major barrier to the ecosystem development. Respondents agree that the development of the ecosystem is taking place despite the formal institutions, not because of the institutions and their support. A limiting factor is that Bulgaria is also a centrally governed country, which does not allow regional support systems.

The reverse is the case for the Dutch IEE, in which there is already significant institutional support. From the discussions with the interviewed companies, it would seem that less support for entrepreneurship seems available in the future. The comments from the Dutch Brainport region were that they found too many impediments in the institutional environment (e.g., much insistence on new environmental rules (PCBs) and putting a lot of risk on management) to support entrepreneurship.

The Finnish incumbent ecosystems have been focused locally. In this sense, the stakeholders have not been prepared to support the industrial networks attract more international talent. The anchor company Stora Enso and Nokia comply with national regulations and tax policies. At the local level, there is constant communication with the municipality, which tries to take into account Nokia's wishes. Oulu infrastructure has been supportive of the company. Telecommunication facilities are good, and the company has some logistic systems of its own to deliver products to the global markets. The government

is not very flexible when it comes to employment-based immigration. The visa processes are too slow and prevent hiring a highly skilled labour force from abroad.

The Basque Country scores relatively well on the Quality of Government; with an index score of 63.3 in 2019, the Basque Country counts as best performing region, above national and EU levels. The region continues to be one the main actors in the development of the examined ecosystem, as it drives programmes for professional education (IMH), for research, for funding and for strategic programmes to support the machine tool sector.

4. FROM PROJECT FINDINGS TO POLICY RECOMMENDATIONS

To understand the future, there is a need of a larger perspective related to technology, more than just task perspective. Growth in Europe is dependent on how regions use the opportunities to conquer new markets and develop new products/services. The same technology can have different uses and be adapted into different products and services. There are different scenarios, a region can be resilient or turn into an economic disaster and that is why a social and policy shaping is needed to ensure socially inclusive outcomes, especially in the context where the digital transformation has been exacerbated by the Covid-19 pandemic.

The question here is to what extent the research on ecosystems could provide useful policy recommendations. An important lesson from the research conducted in the framework of BEYOND4.0 is that the technological transformation (may) lead to augmentation in some cases, but to substitution in others. From this perspective, regions should be careful about the support and development of ecosystems and sectors with a potential to grow.

Second, technologies are shaped socially. This means that there is a space for regulation at different levels and by different actors/institutions. The history and the long-term matter and thus, the institutional shaping should take its time and perhaps there is no need for constant changes, but of consistent and long-term policy.

The importance of the ecosystem approach, understood as collaboration between varieties (of relevant stakeholders) also underlines the collaboration efforts and the need to "expand" the list of the collective actors/groups that are benefitting from the transformation following the appropriate policies at various levels.

Beyond this more general takes, on the basis of this analysis there are number of policy recommendations:

Preparing, attracting and preserving talent

As mentioned above, the respondents in our research share the opinion that talent availability has been the main explanation for entrepreneurial success. Something more, performance of the ecosystems can be explained to access to sufficient talent (Dhondt et al. 2022). However, the different ecosystems have provided different ways of tackling the talent issue. The two major pathways have been to develop talent locally or to attract talent internationally. In the case of the Brainport ecosystem, there has been a lot of policy support to attract international talent. In the case of Sofia, the talent has been meaning the existence of pool of labour force with excellent IT skills that allow companies to understand and integrate the newest digital technologies. This pool has been developed domestically, but in the future companies might need also international talent. In this context, the stakeholders of the European ecosystems should focus on a dual strategy of developing local talent and attracting talent from other regions and countries.

Boosting networks: a long-term mission

The other important ecosystem element has been the development of networks and networking that can facilitate the collaboration between the actors of the ecosystem. In this perspective, the creation of conditions that could support the collaborative efforts is essential. This could take different forms, but should be based on a long-term consistent effort. As illustrated by the case of Sofia, the programming of European and national funding programmes could include as a precondition the involvement of the crucial ecosystems' stakeholders. In addition, regional and local authorities and governments could create arenas (discussions, forums and so on) where ecosystems stakeholders can meet discuss, know better each other and build trust in the long-term.

Crafting conditions and building on knowledge

The research has been showing that there is no need to manage the digital transformation (Dhondt et al. 2022: 98). Instead, the attention should be stimulating companies to invest more in the adoption of technology and the application of new business models. The creation of knowledge goes hand in hand with the development of talent. The creation of new knowledge could involve universities and research centres on the one hand and companies on the other. In this perspective, networking is crucial and initiatives of local authorities and the municipal Sandbox in Sofia, can certainly help. But beyond networking, the development of knowledge requires targeted investment in key technologies that are part of the smart specialization of the respective regions. And here European policies could help those EU regions that lag behind in the development of knowledge economy.

Developing Infrastructures is needed also in the context if the digital transformation

The BEYOND4.0 research has clarified that the infrastructure has been a necessary element for the successful development of entrepreneurial ecosystems. For certain, in the context of the digital transformation, digital infrastructure has become a crucial element for success. The availability of fast and reliable internet has been pointed out as a precondition for the development of the Bulgarian ICT ecosystem. But other infrastructure elements may play also a role in order to connect companies and clients. Regarding the element of physical (and ICT) infrastructures, respondents from all regions/ecosystems are stating that the multimodal physical infrastructure (road, rail, waterways, air) is sufficiently well-developed, even if most regions indicate congestion problems. Concretely, within the ecosystem perspective, regional authorities should analyse well what are the concrete needs of the companies in order to target efforts and investments there. Sometimes, such efforts do not require substantial finance; there could be an optimization of the public transport network to allow employees to get easier to particular office areas or development of concrete transport connections that could ease business exchanges of the ecosystem with international partners.

Formal institutions – competence and rule of law

The formal institutions could support the development of entrepreneurial ecosystems; even if there have been ecosystems that developed despite the formal institutions. But the expectations of the actors have been that institutions at various levels should support the relevant ecosystems. However, the development of formal institutions is not only in the hands of regions. But on the other hand, the research has showed that formal institutions could have diverse role within the same country. And something more, institutional innovations could be developed. In this respect European regions should stay curious and sensitive about such institutional innovations that can inspire other.

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CHAPTER 5

DIGITAL TRANSFORMATION AND INCLUSIVENESS: THE SOCIAL NEED FOR INCLUSIVE POLICY APPROACHES

Asier Lakidain, Egoitz Pomares And Alfonso Unceta

ABSTRACT

Traditionally, innovation policies have had a narrow dimension. Understanding digital transformation as a societal grand challenge, in terms of inclusiveness, innovation policies demand a more broad-based approach. The introduction of new 'intelligent' technologies opens the opportunity for inducing the construction of a more meaningful, participatory and innovative workplace. Thus, this chapter presents alternative approaches to undertake changes in a coordinated, consensual and government supported way, with the purpose of adopting to these processes of social transformation in the most inclusive possible manner. Taking workplace innovation programmes as a reference, which already has a long-standing tradition in Europe, a way of articulating these policies by incorporating a variety of agents with common objectives is presented. In addition, the chapter points to the conditioning factors that makes the design and implementation of such actions possible.

Keywords: *Innovation policy; soft regulation; policy instruments; digital transformation; inclusive R&D; workplace innovation; quality of working life; societal grand challenges*

1. INTRODUCTION

Historically, technological developments applied to productive functions have produced changes in social configurations. Technological factors are a relevant vector in conditioning social dynamics. As Chapter 3 (Perez) argues, we currently find ourselves in a context in which new digital technologies for communication, transport and for the usage of energy resources have the capacity to transform the ways in which we interact and consume. This is true not only for consumers, but also for productive and working environments. The new digital technologies have the potential to reduce market costs significantly, so their use typically implies changes in production processes, in jobs, and in organisations in general, as introduced in Chapter 2 (Oeij & Hulsegge). However, the social costs of massive

technical change are a separate, and often less studied, issue that states take on through welfare intervention (Emery & Trist, 1973).

The consequences of these changes are not always favourable for workers. In fact, a historical analysis suggests that the adoption of new technologies tends to destroy many jobs and skills in the early stages (Perez & Murray Leach, 2022). Later, in the medium to long term, organisations and governments are able to develop ways of adapting to the already-not-so-novel technologies and a new *regime* is established, in which new jobs are created, tensions between work and social relations are reduced, and shared understandings of the ways to take advantage of the new tools, without the disadvantages emerge.

There is a long-standing tradition of analysis and practice around the challenges presented by technological transformations applied in work environments. The Tavistock Institute of Human Relations (UK) paved the way for experiments with organisations in the years following the Second World War. This tradition has its basis in the study of the interaction between the abilities of human beings and new technologies that would change the way we live and work (Mumford, 2006). In the 1950s a new understanding of human relations in work contexts implied that these were heavily mediated by technological elements, thus producing a kind of coexistence between humans and technology that the former could shape towards better working and living conditions. For example, Trist and Bamforth (1951) showed that by redesigning work processes, and thus the use of tools, it was possible to improve the labour and living conditions of British coal mine workers. Three decades later, Morgan (1993) expanded on their contribution in the study of micro-processing technologies, thus showing that a significant leap in technology -i.e., computer chips- could be accompanied by an equally significant and socially favourable change in the organisation of work. Orienting these organisational changes towards democratisation and decentralisation of work processes, Morgan's argument outlines, would lead to a situation in which wellbeing is also built into work.

In terms of policymaking, what this tradition shows is that innovation is not an end in itself, but rather a means to influence other things. The examples above illustrate that technological change opens opportunities to implement changes in individual companies towards making the workplace a relevant contributing factor to social wellbeing. Undertaking such change is a challenge for managers and employees of all kinds, as it requires the active involvement of both groups as well as of the unions. Often resistance emerges, both from management (Totterdill, 2015) and from workers. However, the evidence shows that there is a need for innovative frameworks that are capable of transforming the ways in which organisations use new technologies, as workplace innovation holds the potential to limit the risks and enable better living conditions (Pot, 2011). Thus, the greater goal is the implementation of these changes in multiple organisations, that is, the development of wellbeing at work through common policies.

A clear example of this can be found in government programmes fostering innovations in workplaces from an inclusive perspective. By programmes we mean a distinct type of public policy that can be understood as a "fixed-term institutionalised activity in which, first, development is guided by a shared framework which applies to several companies at the same time while, secondly, the content of the framework has been agreed by management and personnel of the companies in question, together with main stakeholder groups such as central government, the social partners and researchers, consultants and other experts; and thirdly, the companies involved engage in exchange of information, interaction and cooperation" (Alasoini, 2011; p. 30). Such programmes have been applied at different stages in some of the countries and regions analysed in the Beyond4.0 project, such as Finland, Germany, the Netherlands, United Kingdom, and the Basque Country (Oeij et al., 2021)

Thus, 'programmes' represent a form of policy instrument that establishes broad, non-coercive policy frameworks. Programmes have been recognised as a soft form of regulation, in contrast to stiffer forms, e.g. legislation and tax policies. The three main types of policies are commonly referred to as 'sticks', 'carrots' and 'sermons', the latter being associated with soft policies (Bemelmans-Videc et al., 2003). In this regard, it can be said that Europe has its own blueprint of soft policy-making, especially in the areas of social policy (Trubek & Trubek, 2005) or employment (Jacobsson, 2004), through the so-called "Open Method of Coordination" (OMC). OMC is an influential set of mechanisms designed to operate at EU level in order to trigger the diffusion of policy experiences among member states and, as a result, enable 'mutual learning processes' between them (Borrás & Jacobsson, 2004). Such sermon-like mechanisms require determined political efforts to build broad coalitions, which are necessary to undertake the search for new paradigmatic solutions to confront technical change in the most advantageous way for both business and workers (Alasoini, 2016).

In this context, the role of government bodies takes on a distinct prominence, as it is their task to design policies that encourage consensus and broad adherence to innovative organisational forms. The state should be seen here as an active agent in the generation of innovations, beyond the assumptions that assign it a mere 'corrective' role in markets. Indeed, it is the ability to establish directionality in innovation policies that earns the state a distinguished responsibility (Mazzucato, 2016), also in the organisational forms that promote success and innovation through inclusivity. The saliency of this dimension can be concurrent with the 'inclusive growth' framework of the Beyond4.0 project, which emphasises the engagement of employees with digital change, on the one hand, and the labour market participation of traditionally vulnerable groups, on the other hand, as a means to improve the living conditions of broad swathes of society. The state has the capacity to promote broad and high-quality participation in labour markets, which translates into increased competitiveness and living conditions.

This implies broad-based innovation policies, which include worker participation and collaboration inside the company as a way to adopt technical change while inducing and facilitate worker participation in the innovative results. They are thus a fruitful approach that government bodies at various levels should consider. Broad-based policies involve investing in local innovation assets to enhance the growth potential of regions. They represent a shift in the understanding of the sources of innovation, as they include both tangible (technological) and intangible elements (work and organisational forms) (OECD, 2020). These policies have already been put to practise with successful results, in Finland most notably, where the public innovation agency launched a programme to fund companies willing to embark on workplace innovation processes. The assessment of the programme showed that there is no "trade-off between higher productivity and better quality of working life" (Beblavý et al., 2012:64). By offering open, non-coercive measures, innovation promotion becomes 'broad': it encompasses a wide variety of factors and underlines the importance of directionality and collective decision-making.

These broad policies entail "an interconnecting link between traditional objectives and targets in the development of working life, on the one hand, and corresponding objectives and targets in the development of products, services and business operations on the other" (Alasoini, 2012). The rationale for encompassing such wide perspectives, i.e. work processes and business operations, rests on the assumption that they involve a positive sum game between the workers and the business that employs them, as well as a contribution to regional and national economic success. In this chapter we would like to highlight the essential role that innovations in the workplace have within general efforts to promote inclusive futures, on the one hand, and suggest a general framework of policy instruments to enable approaches to technological change, that are both inclusive and economically successful. Our argument builds on practices that other authors have already developed over the last two decades, but we believe it is necessary to bring together all the elements required to facilitate broader and more robust policies.

First we will outline the evolving role of the state and societal actors regarding the so-called 'grand challenges' that we are facing today. To do so, we will make specific reference to the interplay between innovation policy and socio-technical systems. After that, we will address the core policy instruments that can be effective towards greater inclusivity in the upcoming technological transformations.

2. INCLUSIVE APPROACHES TO WIDE-RANGING ISSUES: THE MOBILISING CAPACITY OF THE STATE

The grand societal challenges currently impacting Europe primarily concern policymakers and elected politicians. At European level, each region is confronted with context-specific

issues that condition the way in which policies are organised. The European Commission (2020) has made efforts to establish the digital transformation and the green transformation as the two grand challenges of the present time. Acting to address both of them holds the potential to spark greater actions towards wellbeing, also in workplaces.

From a knowledge perspective, these challenges are inherently complex and have multiple causes, and designing solutions to tackle them effectively, evidence shows, cannot be left to a single authority. This is because the expertise needed to address various causes is distributed among numerous actors and organisations, making it difficult for a centralised authority to decide about a distributed issue (Cairney et al., 2019). As intuitive as it may sound, only the last two decades have seen perspectives on distributed policymaking arise, and there are numerous blind spots that governments have not yet been able to cover. One of the most persistent, and closely linked to policies aimed at fostering inclusive technological transformation, is the difficulty governments have in making public policies more preventive rather than simply reactive. Implementing preventive policies has been attractive to policy makers for decades, as it reinforces their position as good managers of societal affairs (Billis, 1981). However, promoting preventive public policies does not fit well with the habits of some governments. In most cases, this is due to the technically overwhelming scale of the tasks, uncertainty around the available evidence, emergence of politically sinuous ethical dilemmas, and the need to hold someone accountable for decisions (Cairney & St Denny, 2020). As a result, a large part of public policies has so far been reactive. Innovation policies can be understood under this lens as well, especially those oriented towards workplace development, since 'technological' and 'product' innovation have attracted most of the attention in the past (Pot et al., 2016).

From a practical perspective, on the other hand, grand challenges heighten the need for stable communication between public and private actors at various levels. Often the collective challenges we refer to are shared across many countries and regions, but solutions can rarely be generalisable. The nature and scope of the problems may differ, as may the causes and actors involved, and the different technologies adopted in the diversity of sectors involved. This means that a policy designed for one region may make little sense in another. Grand challenges, unlike other enduring problems, "force us to consider factors that help to explain why solutions can be more successful in one place compared to another, and why some solutions spread beyond their place of origin and scale up, while others remain trapped by local contexts" (Coenen et al., 2015:491-492).

Thus, grand challenges represent an opportunity for new actors to enter the design of policies that are highly dependent on the specific contexts in which they are implemented. This represents a shift from vertical modes of innovation policy design in which the distinction between decision-makers and decision-recipients was predominant. The emphasis must now be on role modulation, both on government bodies and on private and third sector organisations. The interaction between different kinds of knowledge and

interests opens up the possibility of a higher degree of policy specificity as well as disagreement in the design process. As Kuhlmann and Rip (2018:3) briefly put it:

"Grand Challenges [...] pertain to heterogeneous elements and forces, which have to be mobilised, guided, and integrated, and include social innovation. Many different actors need to be involved, and the perspectives on what is the problem and what constitutes its resolution differ across various societal groups, [...] so Grand Challenges policies have to cope with contestation, non-linearity, and bifurcations in developments."

The involvement of wide kinds of actors implies changes in the way innovation policy is conceived by heterogeneous partnerships. Researchers and businesses are involved in around 80% of policy initiatives aimed at addressing grand challenges in OECD countries (Howoldt & Borrás, 2022). However, it is well known that getting the best results out of a business organisation depends on the way work is organised and in the participation of the employees. Equally, since most policies, especially those that involve the grand challenges, affect society directly, their design requires the participation of as many individuals as possible. The degree of inclusiveness of innovation policies is determined by the degree of adoption by the organisations that shape -and are shaped by- such policies, which includes businesses, researchers, civil society organisations, unions and any other stakeholders affected. This ensures high levels of policy legitimacy and accuracy: decision-makers and decision-recipients are largely the same actors and, in turn, policies are implemented in a way that is consistent with the regional context in which they are designed.

A clear example of this can be found in the way programmes fostering innovations in workplaces are designed from an inclusive perspective. Already in the 1990s Naschold (1993;1994) developed a comparative assessment model that included the dimension of "participation", which was understood as the importance of broad participation at the labour level. This question was later developed by Alasoini (2016) to also include aspects such as gender and age perspective in the targeting of development activities at company and workplace levels. Both authors underscore that wide participation at company level is a fundamental component of inclusive and innovative workplaces.

It follows from this that inclusiveness, meaning the participation of workers in innovative and developmental activities and projects as well as the integration of decisions among all the stakeholders, is more likely to achieve success as well as worker satisfaction.

3. USING A MIRROR INSTEAD OF A FLASHLIGHT: CHANGING CURRENT PRACTICES IN ORGANISATIONS

Currently, most organisations are hierarchical structures inherited from mass production times in which employees have limited options to exercise agency over their work and are determined by managers (Dhondt et al., 2021). Today's intensive use of digital technology at work requires employees to be able to adapt to rapid change, but they cannot always make full use of their personal agency due to the old organisational structures and the old habits. This has a direct impact on whether they will be innovative and productive as well as on how people think and live, outside work. This is so because the workplace has a socialisation aspect strongly mediated by technology (Ibid.). At EU level this has been verified by the European Company Survey, which concludes that "organisations that regularly interact with staff and use a variety of means to do so, and where workers influence management decisions, are more likely to introduce innovations in the market, compared to those characterised by the absence of such practices" (Eurofound & Cedefop, 2021:4; 2020).

Typically, innovation policies have sought to foster innovations related to products and business operations, as a way to act upon the overall R&D output of regions. However, this approach falls short from stimulating the "organisational and communal forms that serve to bind" innovation activities (Alasoini, 2012). Today's work environments are still contexts dominated by human labour, although highly dependent on the advanced use of technology. A valuable way of understanding how people and tools coexist at work from a human-centric perspective is offered by the socio-technical systems (STS) practices. These can be defined simply as "social and technical aspects engaged in goal-directed behaviour" (Sony & Naik, 2020:1). However, there is further complexity as well as utility to the concept. STS perspectives are commonly used to understand the human relations that take place within companies, which represent a powerful framework for reflecting on existing workplace arrangements. As guidance, we take the definition of STS provided by Borrás and Edler (2020:3), who depict them as:

"*articulated ensembles of social and technical elements which interact with each other in distinct ways, are distinguishable from their environment, have developed specific forms of collective knowledge production, knowledge utilisation and innovation, and which are oriented towards specific purposes in society and economy*"

This general definition emphasises the two fundamental aspects of contemporary broad-innovation policy already highlighted above, namely the organisation of work around, new forms and the establishment of directionality in the use of technology (Boekholt, 2010). Unlike previous forms of innovation stimulation, in which the directionality of the search for new ways of doing things was left to the discretion of management, i.e. top-down, the

human-centric innovation of the digital era, in turn, requires this dynamic to include worker participation within the firm and public policy action outside the firm. A much broader consensus is required if successful socio-economic results are to be obtained from the incorporation of the new technologies and the need for continuous improvement with them. Such an approach implies placing good quality jobs at the heart of public policy efforts. With that as one of the main goals, workplaces become a strategic field of action.

Furthermore, it is critical to note that other types of actors, such as organised society, are also an essential part of the innovation policy focus and yet they have largely been left out of the game. This means that a significant amount of human capital, which has the potential to help develop more comprehensive actions to face the grand challenges, is being untapped. Fortunately, this trend is now slowly being reversed (Howoldt & Borrás, 2022).

The human-centric perspective offered by looking at organisations based on STS prompts us to think about some concrete actions that can be developed. Firstly, in line with our main argument, efforts to promote the autonomy of people in the workplace must be supported by public institutions. They have the resources and legitimacy to promote coordinated actions (Warhurst, 2022). Secondly, these efforts should be aimed at finding shared interests between employees and employers. Specifically, we refer to interests in the meaningfulness of jobs and the use of work tools, which make it possible for employee satisfaction to be high and for the company's performance to improve significantly. Third, policy makers and organisational managers need to recognise the relevance of the ecosystem in which they operate, where there are influential actors on the technological and organisational sides of work. Indeed, the literature suggests that disregarding local community or formal workers' representatives can undermine the effectiveness of human-centric efforts (Guest et al., 2022)

Actions taken within organisations have a direct impact on the ecosystem in which they are located. In terms of technological adaptation, it is important to consider that people and work tools are interconnected, but that only the well-being of people and their willingness to strive for better performance depends on the meaningfulness of work.

That is why a broad based innovation policy approach "is also an important means of improving employee well-being [...] by contributing to employees' sense of coherence, i.e., helping employees see their work as comprehensible, manageable and meaningful" (Alasoini, 2012:12). Inclusive approaches to far-reaching issues, such as digitalisation, must integrate features that make it possible to determine progress in three aspects: mobilisation of actors and resources; support for the creation of spaces for the consensus of actors with a legitimate interest; and the more social aspect of integration from diversity, i.e. workplace development and participation in R&D activities (Alasoini, 2016). It is with such practices that the maximum success can be achieved in terms of the quality

and the cost of products and services and therefore the success of the companies and of the regions where they operate.

EVIDENCE FROM BEYOND4.0

The BEYOND4.0 project has produced original research in some European regions with a notable tradition of workplace development, such as Oulu in Finland, Duisburg and Dortmund in Germany, North Brabant in the Netherlands, and the Basque Country in Spain:

- **Finland.** The national government first began promoting programmes for companies across the country in the 1990s through the Ministry of Employment. Today, Tekes, the Finnish Funding Agency for Innovation, is the entity in charge of promoting workplace development, which encourages the pursuit of broad-based innovations. The implementation of a programme of this kind by the municipality of Oulu and the collaboration of Nokia and other technology companies has ensured that the Oulu region has retained the technological and inclusive capacity it had before Nokia's transformation that took place a decade ago (Dhondt et al., 2022).
- **Germany.** Beginning in 1974 with the launch of the federal-level programme "Humanisation of Working Life", technological modernisation, first, and organisational modernisation, second, have historically been the priorities of German programmes (Fricke, 2003). Today, German companies face the challenge of finding the necessary talent to address the digital transformation (Oeij et al., 2022a), which influences their ability to be innovative.
- **The Netherlands.** The implementation of workplace development in the Netherlands demonstrates that there are multiple ways of bringing together public policy and company practices. Instead of a specific programme designed by policymakers, employers' associations, trade unions and research organisations teamed up to promote social innovation actions at workplaces, which have been supported by the government afterwards (Pot et al., 2012). However, this type of arrangement has the risk of being less stable than government programmes, as the findings of this project indicate (Oeij et al., 2022b)
- **Basque Country.** The Basque province of Gipuzkoa has deployed workplace development programmes aimed at business associations, trade unions and regional innovation organisations since 2014. Kickstarted by the Provincial Council, these programmes provide funding and guidance to improve worker participation in innovation activities, company strategies and inclusive decision-making (Pomares, 2020). Given the high reliance on knowledge-intensive jobs in Gipuzkoa, companies in the region will need to find ways to be more inclusive to improve their competitiveness in the coming years (Oeij et al., 2022b).

For European regions where workplace development is not yet part of the policy realm, the findings of the BEYOND4.0 encourage the alignment of companies to the whole entrepreneurial ecosystems in which they operate (Oeij et al., 2022a).

4. BROAD BASED INNOVATION POLICIES: WHAT ARE THEY IN PRACTICE?

Unfortunately, supranational coordination in Europe with regard to working life improvement has been elusive so far, thus our emphasis on the regional branches of the state. European policymakers have been generally reluctant to promote policies that intervene in the organisation of companies and "workplace innovation has fallen through the gaps" between several policy topics (Pot et al., 2017:16). As a result, workplace concerns have remained in the periphery. Such policies have found fertile ground in a handful of countries where there have been stable practices promoted by each national government, such as Finland, Sweden, Norway or Germany (Alasoini et al., 2017), which from the second half of the 20th century, even in a world context where Fordist policies reigned, began to implement development activities with the capacity to experiment on a national scale.

This way of inducing change in work organisations has been formulated by means of 'programmes'. Although they can take different forms, they generally aim at strengthening coalitions between private and public actors for workplace development or other spaces of collaboration. There is a broad array of actions that suit the aims of programmes. The role of the state can take several forms. As Table 1 shows, there are different types, ranging from hard direct regulation, led by coercive legislation to establish concrete forms of work organisation, to voluntary frameworks where the adherence of a critical mass of organisations is sought (Pomares, 2020). In the EU, soft and indirect regulation, i.e. through the provision of general policy frameworks and recommendations, has traditionally been the most commonly used format. A soft approach is particularly adequate when "the objects for change (companies) are heterogeneous; processes leading to desired changes (workplace innovations) can take different shapes; and means used in the promotion of changes (the introduction of new organisational and management practices) are of a sensitive nature" (Alasoini, 2011:29). However, there are other options for inserting such instruments into broad-based innovation policies, as shown in Table 1 below.

Table 1: Different policy approaches to promote workplace innovation

	Indirect approaches	**Direct approaches**	
Hard policies	*Hard/Indirect policies* Directives or binding rules which focus directly on workplace innovation through some other policy area (e.g. product market, labour market or occupational safety and health)	*Hard/direct policies* Directives or binding rules which focus directly on workplace innovation (e.g. work-related, organizational or management practices)	
Soft policies	*Soft/indirect policies* General policy frameworks and recommendations, conferences, "good practices" guides, etc.	*Soft/meso-level policies* Educational and training programmes, coaching, research learning networks, etc.	*Soft/direct policies* Subsidised consultancy, development and action-oriented research projects, tax credits, etc.

Source: Alasoini et al., 2017

Two aspects are relevant for the implementation and social effectiveness of this type of indirect soft policies: design, on the one hand, and implementation, on the other (Alasoini, 2016). Regarding policy design, there are three essential issues to be considered by policy makers (Alasoini, 2011). First, design decisions could be inspired by desirable practices carried out elsewhere, but they must also fit the local context in which they are to be implemented. Due to the voluntary nature of the programmes, congruence of interests and knowledge of what those different interests are as well as the peculiarities of the local context is essential in order to achieve the intended objectives. This requires a clear assessment of the situation that needs to be changed, which is entirely context-specific. Second, closely related to the above, it is necessary to find appropriate mechanisms to ensure that the organisations involved in the programmes find ways to carry out change processes based on the participation of multiple actors. Third, the design must take into account the eventual scaling up of new solutions found in programme practice and their socialisation with other companies and organisations that have remained on the sidelines, since the solution, it is assumed, holds broader social impact.

In addition to the knowledge elements that condition the design of programmes, there are pragmatic issues that must be considered regarding the implementation of this type of

policies aimed at social transformation processes. As Werbeloff et al. (2016) demonstrate, it is key to understand the ways in which new organisational practices arise are adopted in a certain system. Thus, policymakers must consider "how individuals and groups leverage resources to transform or create" new patterns (Ibid:120). In this sense, programmes have to foster the strategic agency of the actors who adhere to them. By strategic agency we mean the ability developed through practice that individual and collective actors acquire to "navigate and respond to the opportunities and constraints of their context, and what initiatives (or combination thereof) can facilitate innovation diffusion" (Ibid:120). Strong strategic agency capacities allow actors to dissect the elements that contribute to path dependency and, thus, act upon them. As a result, the virtue of these approaches lies in the installed capacity acquired by the actors who decide to be part of the change process.

In a broad sense, we assert that efforts to design and implement policies that serve to address inclusivity in contexts of digital transformations are, in essence, efforts to change the way government bodies and organisations 'see' and 'behave'. They require transformations to achieve transitions to more inclusive, sustainable, and prosperous scenarios. But achieving such transformations is often difficult and complex. It is therefore a matter of transforming the 'regime' responsible for organising the way policies are designed and implemented.

5. CONCLUSION

Throughout this chapter we have argued for open public policies as a response to the grand challenges currently present in Europe. One way to approach the transformation process is the promotion of human-centric adaptation processes, in which inclusiveness is at the centre of policies. This requires enhancing the knowledge of the policy makers and practitioners involved. The social spillover from the adoption of innovative practices in relation to digital transformation simultaneously improves the productivity and well-being of workers, and enhances the state's leadership role in situations in which the market does not respond spontaneously (Rodrik & Sabel, 2022). Recent evaluations of existing workplace development programmes show that adherence to these principles increases company turnout and employment figures (Dhondt, 2022), resulting in a net-positive investment for society.

This entails a change in the orientation of innovation policies, traditionally narrowly oriented, towards broader schemes that allow for a more systemic approach to the challenges of present-day society. Thus, soft policy instruments, such as programmes, become relevant because of their dual nature. On the one hand, they seek to involve as many actors as possible and, on the other hand, they enable the search for paradigmatic

solutions that can be disseminated to the society as a whole. As a result, workplace development programmes are an essential policy component for ensuring the inclusive growth of European companies and regions, as they contribute to achieve economic success while enhancing social adaptation to new technologies.

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CHAPTER 6

INTERACTING SKILLS: HIGH ROAD STRATEGIES FOR COMPANIES FOR DIGITAL TRANSFORMATION

Sally Wright And Sally-Anne Barnes With Clara Behrend, Michael Kohlgrüber And Adrian Götting

ABSTRACT

Understood as skilled labour, talent is one of the systemic conditions included in Stam's model of entrepreneurial ecosystems. In line with the 'high road perspective', employers need to harness the skills of their workers in order to achieve both the economic and social goals resulting from successful digital transformation. The skills categorisation developed as part of the BEYOND 4.0 project forms the basis of the theoretical framing for this chapter. The categorisation includes newly emerging skills and skills that are becoming increasingly important in light of digital transformation. The categorisation distinguishes between four transversal skill categories: digital skills on the one hand and personal, social and methodological skills (taken together, also described as non-digital skills) on the other. In addition to these transversal skill categories, job-specific skills related to concrete work tasks and work experience are also seen as playing a critical role. Using the lens of interacting skills, this chapter draws on findings from empirical data from Work Package 6 *Understanding future skills: empowering groups* to propose one way for companies to develop innovative solutions for the digital transformation. The premise of the chapter is that the uptake and adoption of new digital technologies requires a new approach to thinking about skills. Five practical actions or steps that HR professionals and functional managers in companies can take when developing and implementing company-based skills initiatives in response to digital tranformation are presented.

Keywords: *digital skills, skill supply and demand, digital transformation*

1. INTRODUCTION

Using a new approach to thinking about skills, this chapter offers practical strategies for companies to support the uptake and adoption of new digital technologies. It uses the lens of interacting skills as one way for companies to develop innovative solutions for digital

transformation. Understood as skilled labour, talent is one of the systemic conditions that, along with framework conditions, are included in Stam's model of entrepreneurial ecosystems (Stam, 2015; Stam & Spigel, 2018; Stam & van de Ven, 2021). In line with the 'high road perspective' set out in the Theory of Change (ToC) in chapter 2, employers need to harness the skills of their workers in order to achieve both the economic and social goals resulting from successful digital transformation.

The chapter draws on empirical data collected during the qualitative research undertaken in six countries and regions from across Europe, and 30 companies located in twelve selected regional ecosystems. The companies were selected as exemplary cases because of their positions in the studied incumbent and emergent ecosystems. In Work Package (WP) 6 of the EU project BEYOND4.0 *Understanding the future skills: empowering groups*, empirical data on skills were drawn from the company case study reports, interviews with company representatives, and company surveys with managers and employees. Analysis of these data shed light on how, by adopting the lens of interacting skills, companies can translate their strategies into actions when integrating and implementing new digital technology.

A number of practical actions that companies can take when developing and implementing company-based skills initiatives in response to digital transformation are identified. Overall, it enriches the skills debate offering a possible pathway to achieving high road status.

2. SKILLS CATEGORISATION

Based on a review of extant literature as part of WP6 *Understanding the future skills: empowering groups*, a categorisation of skills was developed to distinguish between digital, non-digital transversal, and job-specific skills (see Kohlgrüber et al., 2020, 2022). Figure 1 shows the skills categorisation used for analysing skill demands for digital transformation in the BEYOND4.0 project.

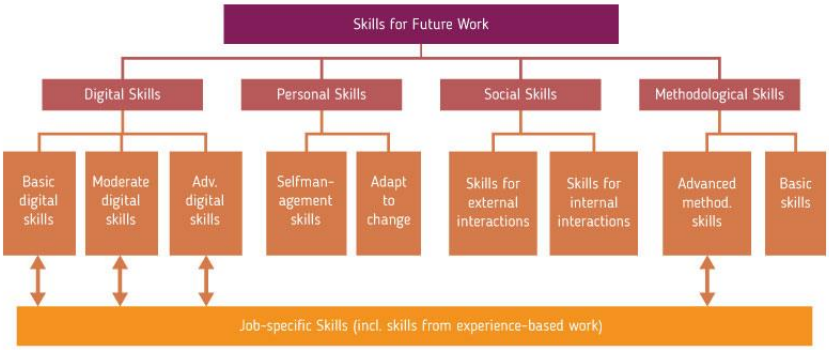


Figure 1: The classification of skills for future work

Digital skills are further categorised as basic, moderate and advanced skills. Advanced digital skills are typically needed by workers in IT-specific occupations but are increasingly required in other occupations. While many other non-IT specific occupations increasingly require moderate, rather than basic, digital skills, sometimes digital skills incorporate skills needed for researching and developing digital technologies (Vuorikari et al., 2022).

Non-digital skills are categorised as social skills (communication, collaboration, leadership), methodological skills (problem-solving, creative thinking) and personal skills (adaptivity to change, self-management, entrepreneurial thinking) (Janis & Alias, 2018).

While there is a consensus that digitalisation of work will require constant up-skilling and/or re-skilling of workers, Dhondt, Kraan and Bal (2021) identified what appears to be contradictory opinions about whether digitalisation will mean that future skills use is likely to change towards more generic skills, or, on the other hand, more specialised, technical skills. Based on our empirical evidence, it was found that **several single skills categories are needed for coping with new technologies and changing work organisation**.

Regarding the individual skill categories, it was not surprising to find that the research confirmed that at **all level, digital skills will continue to remain important in the future**. Various examples and observations garnered from the research support this finding. The examples ranged from the basic digital skills required to use smartphone-like devices to steer machinery; to moderate-level digital skills required to use software like Microsoft Excel; up to examples illustrating the demand for advanced digital skills when developing tailor-made software solutions for factory set-ups in steelmaking or advanced manufacturing. To put it simply, **digital skills will be required in more jobs for more tasks**.

Crucially, however, **digital skills on their own will not suffice**. Some examples of why particular skills are important for digitalisation include:

- **Social skills** have become increasingly important in more jobs. Digitalisation in companies requires demanding interdisciplinary teamworking skills and communication as workers are increasingly involved in collaboration with colleagues from other teams/occupational disciplines, who may have different communication cultures. While intensive customer contact requires advanced communication skills and negotiation skills.

- **Methodological skills** arise mainly from the increasing need for problem-solving skills, creativity in finding new solutions, and analytical skills in digitalised work environments. At the same time, basic skills such as language skills, literacy and numeracy are also increasingly needed for migrant workers and low-skilled workers so they can adapt to digitalised work.

- **Personal skills** are important as digitalisation brings with it accelerated technological and organisational changes. Skills like adapting to change, self-organisation and self-reflection, identifying own skill gaps and being open and able to learn new things has become increasingly required in digitalised work environments.

While **job-specific skills** are not explicitly considered as relevant for the digital transformation in literature, they remain important, as it continues to be indispensable for workers to have in-depth knowledge of production processes so they can understand, control and improve these processes in the best possible way. However, these tasks increasingly involve digital support via sensors and require skills to evaluate the data generated by these digitalised processes.

Crucially, the digital transformation requires not only single skill categories but also an **interaction between different skill categories to complete job tasks**. This means that skills from at least two apparently separate skill categories are needed to perform a task, and so these different categories of skills must be combined with each other to be able to perform the task competently. Therefore, a novel approach that extends the analysis from a siloed approach that considers single skill categories to a more holistic approach that looks at the interaction of different skill categories. That would mean that different skills are needed to perform a single job task (e.g., process control in manufacturing), whereby the skills are directly intertwined or interacting. This holistic approach of interacting skills is useful for understanding the impact of digitalisation at company level (as well as the regional level).

At a company level, the research confirmed the importance of specific combinations of skill categories for the success of digitalisation processes within the companies (Oeij et al., 2022). The case study companies had all invested in robotics, AI, Big Data and other data analytics, and connected technologies, where social skills, such as communication skills and methodological skills, such as critical thinking skills, all become relevant only in combination with technical skills (which referred mainly to job-specific and digital skills). Similarly, a number of experts participating in the research reported that "a bundle of skills" or "hybrid skills" were essential for digitalisation and discussed the relevance of the interactions of skill categories. For example, in both Finland and the United Kingdom, it was noted that jobs in the health care sector increasingly require a high level of expertise in both health care (job-specific skills) and ICT/digital skills.

Tasks which require job-specific and/or methodological, social or personal skills are increasingly supported by digital tools. This makes **the combination of digital and non-digital skills fundamental**, for example:

- When job-specific skills interact with digital skills because the need for tasks involving using digital technologies is emerging;
- When technology-oriented jobs (for example, engineers) in production now entail dealing with customers directly (often online) because digital technologies facilitate the customisation of products and services;
- When increasing interdisciplinary teamwork requires both the skills to understand and make use of new technology as well as the social skills to communicate and work with people from different teams/ occupational disciplines; and
- When digitalised processes are shaped by experienced workers who can benefit from digitalisation when they bring together their digital skills, their job-specific knowledge, experience and skills, and their openness to change and innovate.

In addition to digital skills, social, methodological, personal and job-specific skills are also increasingly needed to work in digitalised workplaces.

Digital *plus* job-specific skills – increasing demand for combining digital skills and work-based experience, such as with specific production processes now equipped with new sensors and digital systems

While job-specific skills do not feature in the literature as playing a major role for digital transformation, in most cases, **job-specific skills, especially within a particular job in one specific company, will stay fundamentally important during digitalisation**.

As new digital technologies permeate an increasing number of jobs and tasks, combining digital skills with job-specific skills is becoming increasingly important. From the research evidence, interacting skills result from high degrees of automation in the case study companies. Automation does not limit interacting requirements to highly skilled workers but to all levels of workers. The data also show that **digital skills need to be added to the job-specific skills, not the other way around.** The consequence is the **need for new skilling and recruitment strategies by the companies.**

Digital plus job-specific skills: German steel ecosystem

As numerous different types of sensors and other digital tools are being introduced into the steel-making process, steel plant operators are increasingly required to make decisions based on digital systems at the same time as drawing upon their own job-specific skills (developed from practical knowledge and work experience).

In the incumbent steel ecosystem in the Rhine-Ruhr area in Germany, digital control of the different steps of the steel-making process has been standardised, and an increasing number of operators, technicians and engineers now use at least one kind of digital device or more when doing their work. Consequently, highly skilled professionals, especially engineers and high-skilled technicians, need to understand and modify specific software solutions in the steel-making process, thus needing a combination of their job-specific and advanced digital skills.

In contrast, technicians need to be able to interpret digitally-monitored sensor readings and understand digital networks and related cybersecurity issues. Furthermore, more technicians need specific basic programming skills.

Digital *plus* methodological skills – increasing demand for using digital tools for problem-solving, critical thinking, and decision-making

In the context of digital transformation, **a high complementarity between digital and methodological skills is recognised**. For example, the international PIAAC study[1] explicitly analyses ´problem-solving´ in technology-rich environments, exemplifying the interaction of methodological and digital skills.

Information-processing skills have been identified as fundamentally important for digital transformation, as they are seen as the foundation for the development of more

[1] Programme for the International Assessment of Adult Competencies (https://www.oecd.org/skills/piaac)

advanced cognitive skills. Additionally, **combining digital and problem-solving skills, critical thinking, and analytical skills become more important in complex digitalised work environments.**

Information processing skills: German logistics ecosystem

An interviewee in the German logistics ecosystem observed that in the future, employees would be expected to possess skills in handling data and demonstrate proficiency in evaluating data. For example, highly qualified logistics employees of the future will need to act as data scientists in the sense that they will need a profound understanding of how data can be turned into usable business intelligence.

Other methodological skills are also directly related to digital skills. For example, the handling of big data means that companies also urgently need people who have the skills to evaluate and combine data at a very high level of abstraction, making complex analytical thinking necessary to use the advanced digital skills needed for big data analysis.

Problem-solving skills: Finnish warehousing ecosystem

In Finland, experts mentioned problem-solving as important for further implementing higher degrees of digitalisation (such as automation) in warehousing logistics, where the highly complex digitalised processes create challenges for automation and further digitalised processes from their complexity. Finding solutions for these complex problems and improving technology implementation requires both methodological and digital skills on the part of the employees.

Entrepreneurial skills: Bulgarian outsourcing ecosystem

The need for combining digital skills and entrepreneurial skills, such as knowledge about business models, was reported by the experts in the business process outsourcing sector in Sofia, Bulgaria.

Experts identified the requirement for IT specialists working in the sector to have not only good IT skills but also an understanding of the needs and business model of their clients.

Ultimately, people are needed who can understand how different digital processes come together and how they can be used in the best possible way in a specific complex company setting.

Digital *plus* social skills – continued demand for communication, team-working and leadership skills for digital collaboration across and between different disciplines or professional groups

The OECD identifies **social and emotional skills as crucial to enabling the effective use of digital technologies by all individuals in their daily lives** (OECD, 2016a, p.4). Digitalised working environments also increase the demand for combining digital and social skills. Social skills such as coordination and collaborative skills have been found to complement digital skills. For example, OECD research shows that higher use of digital skills at work is associated with tasks requiring more interaction with co-workers and clients, problem-solving, and less physical work (OECD, 2016b:10).

With the digitalisation, **interdisciplinary teamwork** is becoming more frequent, especially when teams are working on digital solutions from different perspectives. These work arrangements make digital skills necessary to deal with the technological side and social skills to make the teamwork successful. **As communication takes place through digital media more often, communication skills are used in combination with specific digital skills**.

When the COVID-19 pandemic hit, digitally-aided communication became increasingly relevant for workers across a wide range of occupations, so the interaction of digital and social skills became increasingly important as many people started working from home for the first time.

Digital *plus* social skills: German steel ecosystem

A trade union representative in the German steel ecosystem provided one example of combining digital skills and customer contact. Engineers now have a higher degree of direct contact with customers as digital technologies mean that customers can influence production process specifics. Thus, their digital skills of handling the digital technologies of production adaptation need to be combined with the social skill of customer communication. The increase in demand for these types of social skills is so strong that education programmes in the company are being adapted for engineers and medium- to high-skilled technicians.

Digital *plus* social skills: Finnish wood procurement ecosystem

In one international company in the Finnish ecosystem of wood procurement, digital skills and communication and negotiation skills became important for employees working in harvesting and transportation as their jobs require them to manage the subcontractors using company-wide software. Similarly, clerical employees in wood-procurement industries need to be multi-talented, which includes social skills such as communication and negotiation skills.

So, the interaction between social and digital skills was reinforced during the COVID-19 pandemic. The situation under lock-down conditions required many workers to change to remote working, which among other changes also included a shift from face-to-face to virtual meetings. Employees had to acquaint themselves with online digital tools such as MS Teams or Zoom to organise social interaction. On the other hand, social skills for interacting via these digital tools and the specific requirement to make this type of communication productive needed to be adapted (such as handling emerging conflicts in teams). Our analysis identified that this interaction of social skills with digital skills emerged as important during the COVID-19 pandemic across all ecosystems.

Digital *plus* social skills: UK digital health care ecosystem

In the UK health care sector, the shift to remote working required workers at every skill level to not only become proficient in using digital tools such as Microsoft Teams or Zoom to participate in virtual meetings but also to use these tools to schedule medical appointments, make diagnoses, and develop treatment plans.

While digitalisation of health records was already underway before the pandemic, arranging treatment for patients without face-to-face interactions required a new level of interaction of social skills with digital skills; digital combined with communication skills, in particular.

Digital *plus* personal skills – continual demand for personal skills to adapt to technological change.

Among the empirical examples of the interaction of different skill categories is the recurring need for interacting digital and personal skills. Continuous change and adaptation of new technology within digital transformation processes demands workers to keep up with change and being able and open to change and learning. The personal skill of **adapting to new situations often comes along with the need to use new digital technologies**. Also, the skill of being able to reflect on one's knowledge and skill

gaps is increasingly needed in digitalised work environments and becomes more relevant for all skill levels.

Digitalisation is associated with uncertainties for many workers so they need to be **open and able to adapt to change** and continually learn new things. At a more fundamental level, basic methodological skills such as **numeracy, literacy and language skills** are to be understood as prerequisites for digital skills.

Digital *plus* basic methodological skills: Germany steel and logistics ecosystems

From the point of view of the Steel and Logistics ecosystems in Germany's Rhine-Ruhr region, language skills (in this instance, German language skills) are needed so that workers can undertake digital (and other) skills training. Moreover, while some migrant workers have well-developed digital skills, a language barrier can make it difficult for those without German language skills to find jobs or, if they do, to effectively communicate with their colleagues and supervisors. An example of this problem was mentioned by a German expert when discussing the large proportion of applicants from migrant backgrounds, it was observed that while digital skills would be important, there was a step before that, namely the language component. This was identified as an issue in Duisburg, where there is potential for quality people, including skilled workers, yet this was not possible due to the lack of (German) language skills. Instead of being able to employ migrant workers in skilled jobs, they tend to end up in unskilled positions. They are often prevented from utilising their digital skills due to deficits in their corresponding basic methodological (language/communication) skills.

3. THE 'HIGH ROAD' APPROACH TO DIGITAL SKILLS

There are indications from the BEYOND 4.0 research that digital transformation asks for both very specific interacting skills, that is those skills that are only needed in a particular company setting and job, as well as more general interacting skills that seem to be transferable.

While the specific interacting skill needs are most likely to be supplied by company in-house training and on-the-job learning, more general interacting skill needs need to be incorporated into curriculum and training offers from the VET (vocational and educational training) and higher education systems.

Education and training systems often cannot keep up with the pace of technologies and their impact on skill requirements. This sometimes leads to situations where skills are already outdated before workers complete their VET training. While policy initiatives to tackle skills at the regional level are in place in the regions, **unless companies work closely with education and VET providers and regional authorities, it is likely that the skills required to adapt to digitalisation will remain lacking**.

Below is one example of how stakeholders from different sectors of society (e.g., public, education and an emergent sector - private economy, health, etc.) co-operate at the regional level and respond to region-specific skill needs beyond company-specific solutions. Such an approach is close to the concept of "regional skills ecosystems", where the importance of the context in which skills are developed and used is recognised.[2]

Finnish healthcare ecosystem

In Oulu, a hospital, a university, and a university for applied sciences developed and established a campus to develop an ICT-based health sector in Oulu and the development of the 'future hospital'. This campus allows training programmes combining skills from the IT and the health sector.

It is also important to develop further possibilities to provide continuous and lifelong learning. In particular, **the teaching of digital content being taught within companies to compensate for skills gaps left by the VET system**.

When looking at the supply side of interacting skills in the ecosystems, innovative types of training that was developed to impart these interacting skills were found. Often, this takes place **when companies have the resources and in-house capabilities to train their employees** or **where such skills can be acquired through on-the-job learning**. In some instances, **skills are provided through regional or local skills ecosystems, which was only possible because there was a very close exchange between VET providers and local companies**. This made it possible for those who have leeway in the ecosystem to collaborate in developing targeted training offers.

Another example of how stakeholders co-operate at the regional level and respond to region-specific skill needs beyond company-specific solutions is set out below.

[2] Regional skill ecosystems are defined as regional or sectoral social formations in which human capability is developed and deployed for productive purposes (Finegold 1999).

Targeted training offers: ETHAZI programme in the Basque Country

The ETHAZI programme[3] in the Basque country is part of a key initiative of the European Commission, the Centres for Vocational Excellence. A particularly noteworthy aspect of these centres of excellence is that the curriculum is designed so that learners can acquire both occupation-specific vocational and other key competencies.

ETHAZI is a high-performance programme, a system of 'collaborative learning based on challenges', also known as problem-based learning. The model comprises eleven steps, based on teamwork, rotating challenges, learning as evolution, moving towards social innovation and self-managed teaching teams. The high-performance programme is a learning model designed to respond to local and future competence needs.

The ETHAZI model can be understood as a programme that focuses on the interaction of different kinds of skills, namely digital, personal, social, methodological and job-specific skills

Another challenge for companies is to **find suitable applicants from the labour market**. While there are recruitment challenges independent of those specific to digitalisation, **difficulties in recruiting workers with the right combination of skills leave companies with little choice but to increase their focus on in-house workforce training and development**.

For many companies, certain skills cannot be bought in the labour market. It is **work-based experience that is needed**, which shows the importance of upskilling and retraining, rather than replacing, current members of the workforce.

Companies increasingly rely on **lifelong learning** and **in-house training** given the challenges of digital transformation. This is also reflected in the ways interacting skills are acquired. It applies to the combination of digital and job-specific skills, which can often be company-specific or even process-specific. Here, the structure of a dual education system offers the possibility to combine job-specific skills taught by the VET system with the specific skills that play a role in the company.

[3] https://tknika.eus/en/cont/proyectos/ethazi-3/

4. PRACTICAL TIPS FOR PRACTITIONERS

Based on the above, set out below are a number of practical tips for HR professionals and functional managers about how to implement strategies in their companies to deliver both the digital, and non-digital skills needed for digitalisation.

1. Consult with workers well in advance of introducing any new technologies into the workplace. Don't just consult with workers who are directly impacted. Also discuss the new technology with workers in other departments who work across teams in the organisation.

2. Undertake regular audits of digital and non-skills requirements at the individual worker-level, team-level, and across the organisation to identify skills gaps.

3. Conduct an evaluation when new technology is introduced, ensuring to seek input from all workers impacted by its introduction. You may also wish to seek the views of customers, clients, contractors and other stakeholders so you can better assess whether the new technology has contributed to productivity, innovation and/or worker wellbeing improvements.

4. Build relationships with local training providers in your regional ecosystem, and when possible, work with them to shape, and if possible, customise, digital and non-digital skills training so that it better meets the needs of your organisation.

5. Develop on-the-job or workplace training that incorporates practice exercises that combine digital and non-digital skills. And if possible, put in place a system where more experienced workers 'buddy' or 'mentor' less experienced workers so that methodological and job-specific skills are transferred within the workplace.

5. SUMMARY

A new approach to thinking about skills – the lens of interacting skills – is one way for companies to support the uptake and adoption of new digital technologies. In line with the 'high road' set out in the Theory of Change (see Chapter 2), employers need to harness the skills of their workers in order to achieve both the economic and social gains resulting from successful digital transformation.

Crucially, digital skills on their own will not suffice. In addition, social skills, methodological skills, personal skills and job-specific skills are also important for the digital

transformation. Moreover, the interaction between different skill categories is required to complete job tasks.

On the demand-side, a series of examples were presented demonstrating the importance of the combination of skill categories.

On the supply-side, education and training providers often cannot keep up with the pact of technologies and their impact on skill requirements. A range of approaches offer a better way to supply skills, particularly interacting skills. In line with the 'high road' perspective learning on the job should be designed to offer company-specific additional training modules with the integration of job-specific and digital training. While project-based learning in companies or regional training programmes should be designed to combine digital with methodological, social and personal skills training.

The last section of the guide presented five tips to help HR practitioners and functional managers adopt the interacting approach to skills in order to address digital and non-digital skills in their workplaces.

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CHAPTER 7

CREATIVE DESTRUCTION: CONSEQUENCES OF THE COLLAPSE OF NOKIA PHONES IN OULU

Olli Kangas And Esa Karonen

ABSTRACT

This chapter analyses the rise and fall of Nokia Phones in Oulu. Oulu grew to be the stronghold for Nokia's research and the development of mobile phones. In its best days, Nokia corresponded to 20% of the total local employment. In the early 2010s, Oulu was hit by the collapse of Nokia Phones. The company fired more than 2,000 high-tech engineers. However, Oulu rapidly rose from the ashes of Nokia Phones, and by now, the high-tech sector is bigger than during the heyday of Nokia. The chapter offers and analysis of the policy measures taken and the outcomes of the incumbent and emerging ecosystems. For destruction to be creative, certain conditions must be fulfilled. A necessary condition is a skilled labour force to establish new innovative enterprises on the ruins of the previous ones and create new ecosystems. In both cases, this condition was fulfilled in Oulu. In addition, other intervening factors must contribute to successful development. The resilience in Oulu resulted from an innovative collaboration between the local government, employment services, other public authorities, universities, university hospital, and private sector entrepreneurs. The core of the revival is the shift from manufacturing high-tech products to providing digital applications and services, as the expansion of the digital health and social service technology, expanding IoT or banking clusters shows. The target group of the chapter is the decision-makers and stake-holders interested in abrupt structural changes and strategies to mitigate the situation challenging livelihood of thousands of households.

Keywords: *creative destruction, Nokia Phones, emergence of high-tech ecosystem.*

1. INTRODUCTION

Great transformations always have winners and losers, and the devil often takes the hindmost. In the wake of significant changes, old social institutions vanish, and new ones will gradually take shape (Schumpeter, 1942 [1994]). The question is, to what extent and

how can destructive forces and process forces be harnessed to make the destruction creative? In this chapter, give description about such a case. Our historical analysis is about the rise and fall of Nokia Phones in Oulu. Oulu is the capitol of the Northern Ostrobothnia region. Oulu is 600 kilometres to the North from Helsinki and 250 kilometres to the South from the Polar Circle. 200,000 people live in the city of Oulu.

Oulu was the stronghold for Nokia's research and the development of mobile phones. In its glory days, Nokia and its sub-contractors corresponded to approximately 20% of the total local employment. In the early 2010s, Oulu was severely hit by the collapse of Nokia Phones. In couple of years, the company fired more than 2,000 high-tech engineers. The closure of the phone production was a massive blow in the vicinity. Unemployment increased, and there were uncertainties about what would happen after the fall of the biggest tree in the high-tech electronic ecosystem. However, catastrophic expectations of the future of the Oulu region were not realised. The recovery took about five years. By now, the high-tech sector is bigger and more robust than during the best year of Nokia Phones.

In subsequent sections, we recount the emergence and collapse of the entrepreneurial ecosystem that developed around Nokia Phones in Oulu. We analyse the policy measures taken and the outcomes of the incumbent and emerging ecosystems. The Oulu case shows how it was possible to build a new flourishing production ecosystem on the ashes of Nokia Phones and regain high-tech employment in half a decade. We ask what conditions were sufficient and necessary to rectify the destruction successfully. We relate the role of Nokia Phones in the Finnish national economy in general and the Oulu business ecosystem in particular. We evaluate how the high-tech 'miracle of Oulu' was created after the collapse of Nokia Phones and what the central elements of this rapid recovery were in this Ultima Thulean vicinity.

The remainder of this chapter is structured as follows. In the following section, to place the Oulu case in a wider perspective, we briefly describe the overall situation in Finland and the mode of the country's economic ecosystem. Next, we provide a short historical review of the rise of the electronics industry and Nokia Phones in Oulu. Thereafter, we briefly describe consequences of the collapse of mobile phone production. The penultimate section discusses the measures that created the 'miracle of Oulu'. The final section concludes the development of new business ecosystems after the collapse of the dominant actor in the system, summarises the central findings, and discusses the possibilities and challenges of the high-tech economic ecosystem in Northern Ostrobothnia.

2. FINLAND IN A PERSPECTIVE

Finland has a small and open export-oriented national economy heavily dependent on foreign trade. Due to this unilateral dependence on foreign trade, international economic cycles tend to strongly impact the Finnish economy (Kangas, 2019). Traditionally, wood processing, paper mills, and electrical and metal manufacturing dominated Finnish exports. In the early 1990s, traditional industries encountered severe problems, exports declined, and GDP growth was negative for several years. However, the situation changed rapidly in the latter part of the 1990s, when the Finnish information and communication technology (ICT) sector experienced explosive growth caused by Nokia's phone industry. In the mid-1990s, Nokia's share of the total value of production and hours worked in Finland was close to 10%. Five years later, it was already about 20% (Pohjola, 2014). By then, Nokia was the largest mobile phone producer in the world. At best, the share of the global phone market was almost one-third. The company had approximately 25,000 employees in Finland. Nokia Phones run in severe problems and began to streamline its activities and reduce the number of employees. By 2020, Nokia employed 6,000 persons in Finland.

In this study, we use the concept of entrepreneurial ecosystems (Stam, 2015 and 2019; see also Dhondt & al., 2022). According to their definition, ecosystems do not follow administrative geographical boundaries; they often do so. The Nokia/Oulu case is illuminative. While Nokia Phones was a global company with its own broad international networks, Nokia also created its own entrepreneurial ecosystem in the Oulu region. Tens of subcontractors and thousands of employees were linked to Nokia Phones. In Oulu, the boundaries of the Nokia-based entrepreneurial ecosystem were created by the dynamic interactions between various intertwined actors: the Nokia company, sub-contracting enterprises, local authorities, employment services, educational system, social and health care sector and trustworthy state institutions. In well-functioning entrepreneurial ecosystems, those different parts interact effectively.

In Finland, municipalities have a great deal of autonomy, as defined by the Constitution of the Republic. They can collect their own taxes and decide the proper level of taxation and how the collected funds are distributed. Thus, the municipality creates local institutional settings for enterprises, and the central government forms a general framework for business ecosystems with its decisions on taxes, employment services, and subsidies to municipalities. In such cases, the boundary of entrepreneurial ecosystem is often a municipality. All of these aforementioned elements were important for the growth of the Nokia high-tech ecosystem. These elements and their seamless interactions were even more crucial when the Oulu high-tech ecosystem was rebuilt on the ruins of Nokia Phones.

3. THE RISE AND FALL OF NOKIA PHONES

Traditionally, paper mills were the backbone of the wood-based ecosystem in Oulu. After WWII, the need for advanced technology to monitor and measure production processes in paper mills rapidly increased. Consequently, the wood processing enterprises expanded their activities also to the electronics industry. The fledgling electronics ecosystem was boosted by the establishment of the University of Oulu (in 1959). The wood-processing industry and the university began collaborating to develop industrial electronic equipment (Nieminen & Salo, 2018). And then came Nokia!

The collaboration between Nokia and the university was close, and Oulu gradually became an important hub for research and development in electronics. There were a couple of facilitators in the expansion of Nokia electronics in Oulu. The boost of the ICT sector was fortified when the State Technical Research Centre (VTT) began its operations in Oulu. In 1974, the VTT established two laboratories for electronics research. The other was the Technology Village (the Technopolis, founded in 1982). The idea of the Technopolis was to concentrate electronics companies close to each other in the university's neighbourhood to get advantage of scale in research, development, experimentation, manufacturing, and financing.

In its heyday, the Nokia-driven high-tech ecosystem employed as many as 14,000 people (16% of total employment) in the Oulu area (Herala et al., 2017). Oulu was a stronghold of Nokia Phone's research, development and manufacturing prototypes. The main reason for Nokia's location in Oulu was the availability of a skilled labour. In the digital mode of production, the Ultima Thulean position of Oulu was not a problem. Oulu is well connected in terms of physical infrastructure (roads, airports, harbours, and telecommunication facilities).

Gradually, Nokia Phones began to suffer from its success, growth and size. The focus became unclear, and many new innovations (e.g. touch screen and mobile banking) were rejected and never taken into production. Instead of investing in research and development, the company concentrated too much on bulk production. Problems with this business-as-usual approach became acute in early 2010 when Nokia Phones were merged with Microsoft. Consequently, Nokia Phones closed its activities in Oulu and fired more than 2,000 engineers (Simonen & al., 2016).

In the early 2010s, Oulu, with its 200,000 inhabitants, severely felt the economic impact of the collapse of Nokia Phones. However, rather than crumbling, Oulu experienced remarkable renewal during the late 2010s. (Figure 1) presents a summary of unemployment and employment development in Oulu. As the figure shows, there was a steep increase in unemployment and shrinking employment from 2008 to the mid-2010s.

After 2015, employment grew and unemployment decreased. The trends for males and females are almost identical, indicating that the crash hit and the aftermath recovery benefitted equally for both genders.

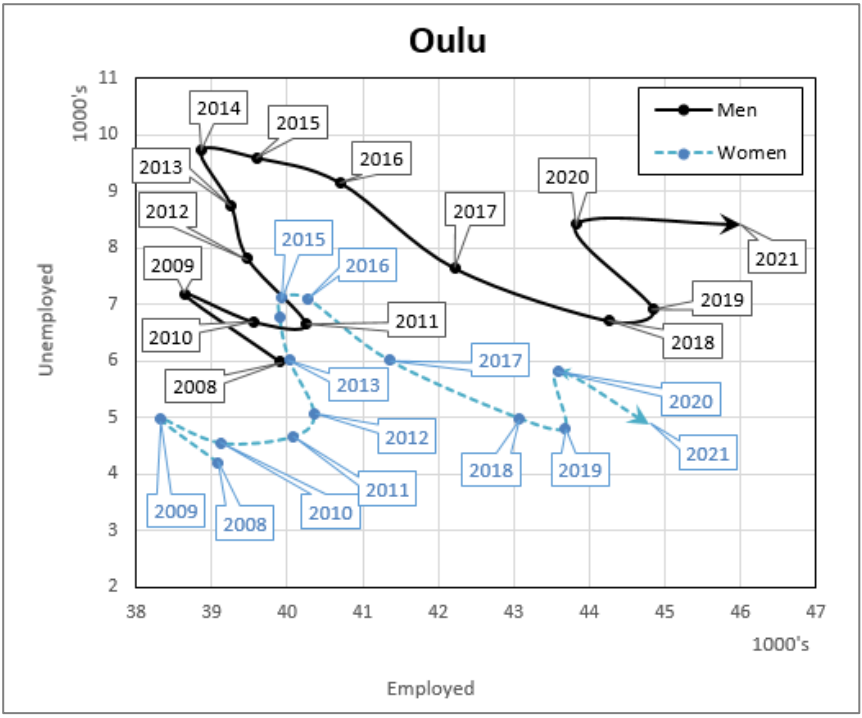


Figure 1: Employment and unemployment in Oulu, 2009 to 2021. (Source: Statistics Finland, 2022a; researchers' calculations)

4. OULU – PHOENIX FROM THE ASHES OF NOKIA PHONES?

Oulu soon recovered from the collapse of Nokia Phones. Since the mid-2010s, high-tech employment has grown rapidly, and by now, the number of employees in the high-tech sector is greater than during the best Nokia days. In comparison with the rest of the country, the electronic production intensity in the Oulu region is five times, research and education three times higher (Eurostat, 2021).

In the Oulu region, a number of high-tech enterprises did not belong to the Nokia-based entrepreneurial ecosystem. Thus, the fate of Nokia Phones did not affect all actors in the digital sector. It is also important to emphasise that shutting down the mobile production did not stop Nokia's activities in Oulu. Nokia is still one of the most important employers in Oulu, with 2,300 employees. The Oulu Nokia factory designs and manufactures various products, including infrastructure, equipment, and versatile services, for telecommunication processes such as base stations, future 5G (and 6G) products, autonomous intelligent (AI) vehicles, and AI-driven air interface design. There is close collaboration between Nokia and universities. In 2017, Nokia and the University of Oulu signed a formal agreement on collaboration regarding 5G R&D. A couple of years later, this collaboration led to the Oulu University-based 6G Flagship program.[1] The emergent 6G is a research and development ecosystem that builds on the participation of industry, businesses, and academic stakeholders. The ecosystem creates integrated systems (processes) with numerous applications, such as digital medicine, remote surgery, and autonomous transportation (6G Flagship, 2023).

Nokia is only one part of the story. A substantial number of new small and medium-sized enterprises emerged from the shadow of Nokia Phones. Some of them are linked to international companies that invested in Oulu and started their development and production there. However, most companies were brand new. Over the last decade, more than 500 new firms have been established. Most of them do not collaborate at all with Nokia. But also for them, Nokia remains indirectly important. Nokia brings credibility to Oulu and indirectly benefits all companies.

In the economic activities of new enterprises, the emphasis is shifting from the manufacturing of devices to combining research, planning, and manufacturing high-tech devices with adequate services. Increase in high-tech employment phenomenological. From 2010 to 2020, the number of employees in the industry declined by 10%, whereas during the corresponding period, the number of employees in information and ICT systems increased by 42%, amounting to approximately 10% of the total employment in Oulu (Statistics Finland, 2022b).

Many new enterprises (for example Haltian, established in 2012; about 100 employees) have produced and developed the Internet of Things (IoT) and other digital services. Open IoT platforms are implemented in the management of the public and private real estate,

[1] The Academy of Finland's Flagship Programme is an instrument that supports high-quality research and increases the societal impact emerging from the research. The Finnish Flagships represent an effective mix of close cooperation with business and society, adaptability, and strong commitment from host organisations. The Flagships create future expertise and sustainable solutions to societal challenges and promote economic growth by, for example, developing new business opportunities (Academy of Finland, 2022).

such as schools, kindergartens, shopping centres, sports facilities, meeting halls, and offices. Digitalisation has rapidly expanded to the health sector (hospital of the future housed by the Oulu University Hospital, OYS) and social services. One rapidly growing sector is the OuluHealth ecosystem.

The spearhead of the OuluHealth ecosystem is the Future Hospital OYS 2030 program. The main idea behind this initiative is to modernise the OYS to utilise the most advanced technologies, such as 5G/6G, IoT, Artificial Intelligence, and big data analytics applied to analyse extraordinary Finnish health-related registers. Digitalization facilitates more personalized, preventive, and predictive healthcare services and opens up innovative ways for diagnosis, therapy and care by merging personal health data that individuals themselves collect by their activity bracelet, heart rate monitoring devices, sport watches (for example Polar) or smart rings (for example Oura-Ring; company established in 2013; about 300 employees) tracking sleep and physical activity. (Heap-Perälä, 2022; OuluHealth, 2022). Approximately 100 high-tech enterprises are involved in developing programs, health technology, and services in the Oulu region. In the last decade, the number of employees in this sector has increased by 28%. By now, over 2,000 people are employed in the digital health ecosystem.

The expansion of the high-tech digital sector in Oulu is a good example of how the seeds of emerging business ecosystems are in the old ones and how different enterprises intertwine to form these old and new ecosystems. One example is the biggest domestic bank, OP-Bank. In the early 2010s, the OP announced the opening of a new branch of digital banking. Currently, the planning and development of digital banking services employs over 400 ICT specialists.

5. PREREQUISITES OF THE RECOVERY: WHAT WAS DONE

The collapse of Nokia's phone activities in Oulu was not wholly unanticipated. Even when Nokia Phones were doing well, representatives of the Oulu municipality, other public authorities, and some private sector actors began to think about alternative future scenarios, that is, Oulu after Nokia Phones. In 2009, the first 200 Nokia experts were offered a termination package if they left the company. These were the first signals that something was happening in Nokia Phones. Thus, when the crash occurred, Oulu was prepared to some extent for it.

When the crash came, Oulu got the status of an area of abrupt structural change. Economic support from the European Globalisation Adjustment Fund (EGF) and the

National Centre for Economic Development, Transport, and Environment (ELY[2]) helped start developmental projects to mitigate the dire situation. The targeted sources of support aimed to develop tailor-made employment and economic and regional restructuring measures to prevent the collapse of the regional economy. Although funds came from outside the region (from the central government and the EU), managing and finding proper ways to tackle structural change was the responsibility of local actors.

There were several business development actors: some were owned by the municipality of Oulu, some other public authorities involved, and some private actors. The problem was that the actors were segregated into their own silos and did not have a clear vision of common goals. To overcome this problem BusinessOulu was established (2010). BusinessOulu is a public utility of the Oulu municipality. It is responsible for implementing the city's industry and employment policies by promoting activities for enterprises, employment, and businesses in the region, according to the principles agreed upon by the City Board (BusinessOulu, 2022).

Initially, the aim was to gather various actors under the same roof. The goal was to nudge and support the establishment of new businesses. Another aim was to support the growth of the existing companies. The third task was to persuade businesses outside Finland to establish their activities in Oulu. Nowadays, the responsibilities of Business Oulu have grown significantly, and they comprise communication and marketing related to the public image of Oulu. Actions relate also to the question of how to provide employees with the required professional skills. To facilitate that goal, employment and business services are located in the same building. BusinessOulu exemplifies the crucial role of local policies that are business-friendly and offer infrastructure, support, professional services, a network of peers, and capital to start a business. In addition, the role of cultural support is essential, as one interviewee succinctly stated:

"One of the most important things in the Oulu region is the strong work ethics and strong bonds between various actors. The role of these trust networks has been vital in creating the 'miracle of Oulu'. If something is agreed upon, one can trust that agreement will be maintained. Trust is the key."

In addition to BusinessOulu, the municipality, together with other public and private stakeholders, established a special cooperative group composed of all the relevant actors in the area: representatives of the business ecosystems, the university, the polytechnic,

2 The Centres for Economic Development, Transport, and the Environment are local offices of the Finnish government that are placed in each of the regions of Finland. Finland has 15 ELY Centres in all. They are tasked with promoting regional competitiveness, well-being, and sustainable development as well as curbing climate change.

employment services (TE-office), the City of Oulu, and the Council of Northern Ostrobothnia [*Maakuntaliitto*].

The enterprise incubator *TAKOMO* (Forge) was established to help people start their own enterprises. The enterprise 'forge' was in use for 5-6 years, over 100 new start-ups were established, and a new ecosystem consisting of small- and medium-sized high-tech enterprises began to take shape. Nokia's generosity helped the process – Nokia gave some of its patents to newly established enterprises to use. Nokia also established its own *BRIDGE* programme to help dismissed employees. Among other things, the *BRIDGE* provided employees with further education and a farewell package corresponding to 5–15 months' salary. For many former Nokia employees who have chosen entrepreneurship, the package was a significant source of business finance. One of the founders of a company that now employs approximately 100 persons said in the interview:

"We had a realistic view that nobody would come here to the North and save us. If we wanted jobs, we needed to create them. When Nokia Phones collapsed, we were 2,000 unemployed engineers. However, the atmosphere was innovative rather than depressed. On the same evening we were fired, we established our own enterprises. We were 15 engineers who took the farewell package to start our own business."

In addition, the Public TE Office developed tailored education courses (*KEKO*) for unemployed Nokia engineers. The problem was that many of them had profound but narrow skills and knowledge. The aim of *KEKO* education was to provide both theoretical studies and job-specific developmental tasks. Through development, new job opportunities were found in other branches of the industry. For example, OP-Bank, the wood processing multinational StoraEnso, and many other existing companies utilised the skills of Nokia engineers. The emerging Oulu health ecosystem also benefitted from the supply of redundant engineers (OuluHealth, 2022).

The Oulu region looks resilient and has coped with the destruction of the collapse of Nokia Phones. In summary, destruction seems to have been creative. Indeed, as one of our informants boldly expressed, "The best thing that has happened in Oulu is the collapse of Nokia Phones".

6. CONCLUSIONS: LESSONS LEARNT

Our historical review shows that the germs of the new electronic ecosystem were in the incumbent wood-processing industry preparing electronic devices for process monitoring. Gradually, the activity bifurcated into the expansion of the Faculty of Technology at the university and the growth of Nokia Phones in Oulu. The closing of Nokia Phones did not

mean that Oulu would be without Nokia. Nokia telecommunications and wireless production systems remain in Oulu, and their activities are expanding. Nokia itself is its own incumbent ecosystem with business activities on each continent. The legacy of Nokia Phones offered a boost for new enterprises producing high-tech devices, ICT/digital services, and health technology. In sum, Oulu is a good example of Schumpeterian creative destruction.

For destruction to be creative, certain conditions must be fulfilled. A necessary condition is a skilled labour force to establish new innovative enterprises on the ruins of the previous ones and create new ecosystems. In both cases, this condition was fulfilled in Oulu. However, this is not the only condition. In addition, other intervening factors must contribute to successful development. Table 1 summarises the key factors that contributed to creative destruction.

Oulu is located far from larger cities, and commuting is not a solution. People have to save themselves. The resilience in Oulu resulted from a strong collaboration between and innovative actions taken by the local government, employment services, other public authorities, universities, university hospital, and private sector entrepreneurs. The core of the revival is the shift from manufacturing high-tech products to providing digital applications and services, as the case of the health technology, expanding IoT or banking clusters shows. Furthermore, most of the companies follow the high road strategy. Needless to say, technology and digitalisation was mainly used are to created jobs after the disappearance of Nokian Phones. However, there were also wider goals that were related to the livelihood, resilience and sustainability of the Oulu area and people living there. In most enterprises, technology is used to create better jobs and working conditions, and recruiting and HR practices. In Oulu, the underpinning strategy was to seek balance between economic goals, social cohesion and trust. (Osterman, 2018 and Oeij & Hulsegge's chapter 2 in this volume)

The incumbent ecosystem facilitated the emergence of the ICT-based ecosystem, which consists of innovative technological enterprises, the healthcare sector, and technologies wherein digitalisation serves social and health care, property maintenance, banking services. The important thing is that the technological side and technological know-how are insufficient. There must be strong, substantial knowledge (e.g. of healthcare, maintenance services, and banking services).

Table 1: Description of the elements contributing to the 'miracle' of Oulu after the collapse of Nokian Phones. (based on Dhondt et al., January 2022; Stam, 2015)

Elements	
Formal institutions	Rules and regulations: trustworthy and predictable national institutions, seamless collaboration between local municipality and central level actors (e.g. Employment Services); collecting crucial actors under the same roof (BusinessOulu); close collaboration between the public and private sectors; strong bonds between actors; networks of mutual trust.
Entrepreneurship culture	Strong entrepreneurial culture; strong work ethic; establishment of accelerators nudging start-ups (e.g., Takomo forge, Terva, BusinessOulu).
Physical infrastructure	Transport/mobility: Geographically, Oulu is far away but well-connected (railroad, port, airport, roads); digital infra (due to Nokia) was excellent; educational institutions: Oulu University and University of Applied Sciences are technologically oriented, close collaboration between the university (including University Hospital), private enterprises, the State Technical Research Centre and the Technopolis.
Demand	Regional demand and purchasing power: regarding Nokia and other global actors, the regional demand and purchasing power are not important, whereas fledgling enterprises were more depended on the local circumstances. However, gradually their orientation has grown to be more global. Some services, e.g. digital banking and social and health care services are dependent on the local demand.
Finance	Financing has often become a bottleneck for emerging enterprises. Various stakeholders in the Oulu region financially supported the 2011 and 2013 start-up activities. The City of Oulu established the Northern Start-up Fund. In the second phase, the ERDF and some private equity funds established the Northern Start-up Fund to finance new enterprises. Furthermore, the National Centre for Economic Development, Transport, and Environment provided extra funds to promote the development of new businesses.
Talent	The University of Oulu, the Technical university and their collaboration with high-tech enterprises (e.g., Nokia) were the catalysts in creating the technical hub before and after Nokia Phones. Universities are involved in co-creation (research, development, and production) with enterprises in general, and the role of the university and the University Hospital is pivotal in health technology (e.g., G6 flagship)
New Knowledge	Innovative sector is strong. Investments in R&D and new knowledge in electronics in the Oulu region are five times, research and education three times higher than in rest of

	Finland. The educational system is excellent, but it cannot satisfy the growing demand for a skilled labour force. The Technical University is specialised in offering further education and lifelong learning.
Intermediaries	Formal institutions and their interaction providing support and business services for the sector were have been very strong.
Networks	Oulu is big enough to provide benefits of scale but at the same time small enough that "everybody know everybody", which contributes to the culture of trust, partnerships, co-innovation. The Technopolis facilitates change of information and open innovations in the sector.
Leadership	The shared vision is to provide combined services: manufacturing of high-tech devices is not enough, there must be strong knowledge of the substance (e.g. on health care or property maintenance) to provided adequate services. The electronic ecosystem serves the other ecosystem in the region (wood processing, chemical industry, social and health care, banking, public services etc.)
Productive entrepreneurship (output)	Economic growth generated by the ecosystem is substantial, both nationally and locally. By now employment in the high-tech sector corresponds to close 20% of the total employment. Salaries and wages in the sector are good but not extremely high compared with the other sectors. This is due to collective wage negotiations and international competition.
Inclusiveness (outcome)	The emergence of the post Nokia Phones high-tech ecosystem has fortified local social cohesion and generate new jobs with better and more innovative work. Although most of the new enterprises lack specific policies to include vulnerable groups they follow the 'high road strategy' tailoring working places according to the needs of the employee; striving for more equal gender balance.

Our historical narrative shows that distinguishing incumbent and emerging ecosystems is often challenging. Incumbent ecosystems are innovative, expand their activities to new areas, and create products sold in new markets. Gradually, old ecosystems are transformed into entirely new ones. Oulu has gone a long way from being a centre of the tar business to a hub for high-tech electronics. Oulu achieved success. However, the flip side is that many of those enterprises that have contributed to making the miracle possible suffer

from a chronic lack of skilled labour. Future generations and cohorts are diminishing. The educational system cannot satisfy the growing needs of highly skilled labour force. Therefore, many enterprises are outsourcing their activities outside of Oulu and Finland. Fundamentally, the million-dollar question is how to solve this dilemma and rescue the 'miracle' of Oulu.

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CHAPTER 8

A SCENARIO APPROACH TO STIMULATE DIGITALISATION AND INCLUSIVE ECONOMIC GROWTH

Peter Oeij And Gerben Hulsegge

ABSTRACT

This chapter describes a scenario approach to develop policy recommendations at the level of an entrepreneurial ecosystem with the relevant stakeholders. It contains four steps: 1] analysis, 2] scenario selection, 3] selection of actions, 4] action plan. The purpose of BEYOND4.0 is to enable digital transformation and facilitate inclusive growth. Society can, however, create opposing contexts to strive after this purpose. It makes a huge difference if digitalisation becomes less predictable and if the world becomes more conflicting, compared to a situation in which digitalisation is rather well predictable and the world is more harmonious. The first situation is named the 'contested terrain' scenario, and the second one is the 'common ground' scenario: these are examples that can be used for a scenario study. Applying the technique of backcasting, participants in the workshop are invited to develop policy recommendations for each scenario, with the desired purpose, such as inclusive growth, as 'the end in mind'. The scenario approach can be used by anyone who has a responsibility for policy making at the level of ecosystems.

Keywords: *scenario approach, scenario, ecosystem, backcasting, workshop*

1. SCENARIO AS A TOOL FOR CHANGE

Introduction

A scenario is an internally consistent and challenging description of possible futures. Scenarios are intended to represent the range of possible future developments and outcomes in the external world (Van der Heijden, 2005). While scenario planning is a way to deal with future uncertainties, this chapter applies scenarios as a form of backcasting (explained below). Scenarios haven been proven to support business and entrepreneurial success, for instance, in the case of the British-Dutch multinational Shell Oil Company (De

Geus, 1999). The approach of Shell spread as on oil stain through the world of business (Van der Heijden, 2005).

Scenario planning is making assumptions on what the future will be and how your business environment will change over time in light of that future; it is more precisely identifying a specific set of uncertainties, different "realities" of what might happen in the future of your business. The goal is to identify weaknesses and possible adverse effects in advance and anticipate measures for these adversities by planning and adapting so that your business can deal with them most effectively. Often scenarios are used in a business context, but here we apply it in an ecosystem context, namely to improve 'entrepreneurial ecosystems'. Entrepreneurial ecosystems are environments in which several actors collaborate to improve its outputs and outcomes: entrepreneurial activity and inclusive economic growth.

Backcasting is a planning method that starts with defining a desirable future and then works backwards to identify policies and programs connecting that specified future to the present. The fundamental question of backcasting is: if we want to attain a certain goal, what actions must be taken to get there? (Robinson, 1990:822–823). While forecasting involves predicting the future based on current trend analysis, backcasting approaches the challenge by discussing the future from the opposite direction; it is "a method in which the future desired conditions are envisioned, and steps are then defined to attain those conditions, rather than taking steps that are merely a continuation of present methods extrapolated into the future" (Holmberg & Robèrt, 2000:6).

In this chapter, the future is defined as the goal to which BEYOND4.0 wants to contribute, namely successful digital transformation and the realisation of inclusive economic growth (see Chapter 1). We describe tools for and analysis of the possibilities to achieve this goal. During our project, we developed two scenarios, namely one in which the future is harmonious, 'Common ground', and another in which the future is conflicting, 'Contested terrain'. The assignment was to maximise the chances of achieving digital transformation and inclusive economic growth in each scenario, and develop policy recommendations at the regional level to do so. The variables influencing these goals were connected to the elements of the entrepreneurial ecosystem model (Box 1 below; also see Chapter 1). We applied the backcasting method in the project and shall describe this method as a guide for users.

This chapter contains the presentation of the scenario approach as a method. By way of example we describe how the method was used in the BEYOND4.0 activities.

Target groups

The target groups for the scenario building exercise in this chapter are mainly the stakeholders at the entrepreneurial ecosystem level, such as regional administrators, politicians, development agencies and the core companies. However, applying this method at the level of industries / industrial sectors and the level of (larger) companies is possible in a similar way and can be very useful as well. In these two latter situations, the elements of the entrepreneurial ecosystem model should be adapted to these respective levels. The future of an ecosystem is dependent on effective policy. To maximise successful inclusive growth of an ecosystem, a multi-party approach is recommendable. The implication is to involve actors who can co-determine and object to the formulation of policy. In selecting participants, it is wise to consider how they can contribute to the desired result of the scenario exercise and which kind of results might be relevant to them ('what's in it for them?').

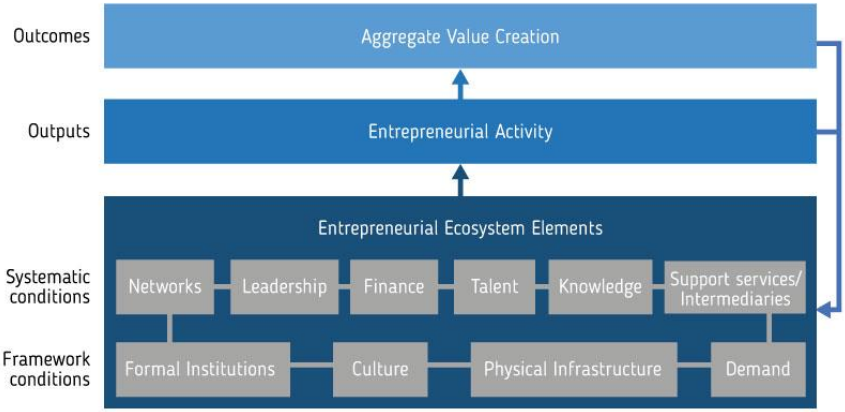
At least three types of stakeholders can be distinguished concerning matters of policy (Van den Berge et al., 1997) 1 [the leading target group(s), namely anyone who benefits or suffers from policy results]; 2 [administrators, who strive after specific goals based on programmatic or strategic interests]; and 3 [professionals, who design, implement and execute the policy decisions]. Among the stakeholders in group 1 are the entrepreneurs and employees of the ecosystem. Of course, other regional actors will also be affected by ecosystem policies, such as educational institutions and regional service organisations. Regional administrators and politicians, together with business leaders of the ecosystem, are the obvious actors to organise a scenario approach like this.

Theoretical background and concepts applied in BEYOND4.0

The collaboration between partners influences economic and social development in a region. The **BEYOND4.0**-project uses the concept of **entrepreneurial ecosystems** (Stam, 2015) to describe this collaboration. Prosperous regions show the strong collaboration of networks of organisations and policy actors to generate new knowledge, company innovations and social results. There are different pathways for successful ecosystem development, with policy recommendations that can be derived from these pathways. These pathways or patterns can be regarded as ecosystem strategies for successful, productive entrepreneurship and provide indications for regional policy options (Dhondt et al., January 2022).

Ten elements play a key role in creating value through entrepreneurial activity: they are divided into four framework conditions: formal institutions, culture, physical infrastructure & demand; and six systemic conditions: networks, leadership, finance, talent, knowledge & support services/intermediaries (See Box 1).

Box 1: The entrepreneurial ecosystem model and its ten elements, and how that relates to entrepreneurial activity (outputs) and inclusive economic growth (outcomes)



The entrepreneurial ecosystem and its elements, based on Stam (2015)

Description of the elements of the entrepreneurial ecosystem model for the ecosystem (based on Dhondt et al., January 2022; Stam, 2015)

Elements	
Formal institutions	Rules and regulations; enable voice for entrepreneurs; tax regime. Regional-specific elements
Entrepreneurship culture	Entrepreneurial activities, start-ups, accelerators, risk-taking culture
Physical infrastructure	Transport/mobility, digital infra, accessibility, educational institutions
Demand	Regional demand and purchasing power
Finance	Investors, banks, venture capital/angel investors, governmental support for innovation
Talent	Labour market, enough labour supply, (interregional) labour mobility, skill development
New Knowledge	Innovative sector; investments in R&D and new knowledge
Intermediaries	Institutions, supporting and business services for the sector
Networks	Partnerships, co-innovation / co-creation / open innovation in the sector
Leadership	Vision, technological entrepreneurs present, ecosystem strength compared to other competing ecosystems

Productive entrepreneurship (output)	Economic growth generated by the ecosystem; income and wealth, employment and their growth; 'high road strategy'
Inclusiveness (outcome)	Social cohesion, support for vulnerable labour market groups, generating jobs; 'high road strategy'

BEYOND4.0 investigated, partly via workshops in different entrepreneurial ecosystems, how **digital transformation** affects the choices made in these ecosystems. These choices will affect primary entrepreneurial and social outcomes. The explanation of the central concepts is as follows:

Digital transformation. Digital transformation is studied as using robotics (if relevant), digital technology and data analytics to make data-driven decisions, improve operational efficiency, streamline work and gain (or retain) a competitive edge in business. Digital transformation affects ways that technology can be used to streamline workflows, make business processes more agile and improve customer experience. Technologies associated with digital transformation include cloud computing, big data analytics, artificial intelligence (AI), blockchain, machine learning (ML), the Internet of Things (IoT) and 5G. The ecosystem model identifies the main drivers of change within companies and the region. Digital transformation is affected by the ten elements of the model in different ways. Digital transformation brings with it, next to opportunities, uncertainty and risk.

Entrepreneurial outcomes. BEYOND4.0 defines entrepreneurial outcomes as the rise of new start-ups, the support to start-ups to become scale-up companies and to have a rise in business output and employment in general. Apart from that, economic performance and growth, in general terms, were discussed as well.

Inclusive growth. 'Inclusive growth' is about improving the situation of weaker groups in society or in the labour market. We focus inclusive growth on the following topics: 1] better work and human capital (e.g. skills requirements; 2] work content; health at work (Occupational Safety & Health, OSH); 3] improve social inclusion (e.g. labour participation; gender balance; (un)employment); and 4] more equal (re)distribution (e.g. income and wealth by skills, by gender, by age; high vs low paid jobs; regional income). All this is in view of the structural change and dynamics caused by digital transformation.

High Road. Generally, we understand a high-road situation as a company environment focusing on economic growth and inclusiveness. Technology and digitalisation are not only used to substitute jobs. Instead, technology is used to improve working situations, working conditions, and recruiting and HR practices. The strategy seeks a balance between economic goals and social cohesion. This does not mean that high road environments are always the best or most ideal situations, but that these are environments in which a human-centric approach is active and provides citizens and workers with means and

resilience to better cope with socio-economic conditions and impacts of digitalisation. The high road is not the same as high pay. For example, if low-skilled people with moderate incomes have decent jobs with fair pay, this can also be a high-road situation (Osterman, 2018; Totterdill et al., 2020).

Four steps of the scenario approach

The scenario approach contains four steps:

Step 1. Analysis: to make an analysis of the strong and weak points of the ecosystem, in relation to the ten elements in Box 1. This is mainly (desk) research with additional interviews with key stakeholders of the ecosystem.

Step 2. Scenario selection: to determine the main trends in the region. In the example of this chapter we describe two scenarios which we applied in BEYOND4.0. These are described below. Applicants of this method can, however, choose to develop alternative scenarios if these suit better with the ecosystem under study. This is mainly desk research and discussion with experts.

Step 3. Selection of actions: the task is to design measures or policy recommendations that effectively deal with a scenario and its trends, to ensure entrepreneurial growth and inclusiveness. This is the core of the scenario approach in this chapter, and is executed via a workshop.

Step 4. Action plan: to make a plan to carry out the measures / policy recommendations. This is the responsibility of the initiators, namely the regional administrators and politicians, together with business leaders of the ecosystem.

2. INPUT TO THE WORKSHOP: TWO FUTURE SCENARIOS

The workshop as a method

For BEYOND4.0, we applied the workshop as a method that focuses on participatory, small-group activity and problem-solving via pair and small-group discussions. (Due to the COVID pandemic, all workshops were held online). Because of the “active” rather than “passive” nature of participation, larger numbers of persons are stimulated to share their insights and expertise in other ways, such as via preceding questionnaires or interviews. A workshop is a working conference in the sense that it is an instrument for change and to connect stakeholders, who are dealing with complex issues and relevant topics in order to

achieve specific results, with people constituting a temporary organisation (Van den Berge et al., 1997). Sometimes more than one workshop is needed to achieve the desired results. In the case of BEYOND4.0, three rounds of workshops[1] were designed to understand the past, present and future of entrepreneurial ecosystems, and develop policy recommendations at the regional and national level (Oeij et al., October 2022).

In this section we pay special attention to the core of the four-step scenario approach (see Figure 1), namely the workshop (step 3). Step 1 (the analysis) requires an analysis of the quality of the ecosystem and to assess the weak and strong points. This can serve as an agenda to discuss possible directions for policy making (see e.g. Dhondt et al., January 2022). Step 2 (scenario selection) demands to imagine the future environment of the ecosystem, in terms of possible trends that, for example, can be positive (opportunities) or negative (threats). In either situation, certain measures may be needed to ensure entrepreneurial activities and inclusive economic growth. For BEYOND4.0 we developed such scenarios, which will be discussed below. Following step 3 is the action plan (step 4), which is to ensure that the initiators take action to implement the selected measures during the workshop (step 3).

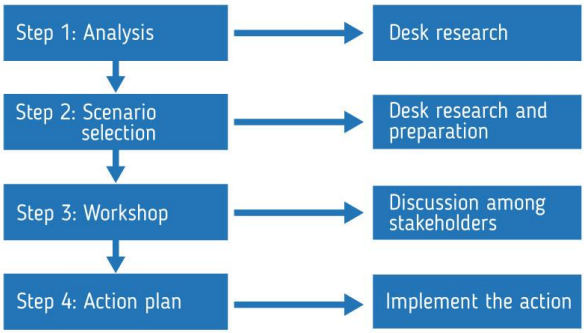


Figure 1: overview of the four steps

Input for the workshop (Step 3)

To prepare the participants for the discussion during the phase of the scenario workshop (Step 3), input documents are preferably produced. The documents should include the

[1] In BEYOND4.0 workshop 1 dealt with the evaluation of Step 1, the Analysis of the ecosystem; Workshop 2 dealt with discussing the scenarios (as in Step 3); and workshop 3 dealt with the formulation of policy recommendations (also part of Step 3 in the approach developed in this Chapter).

assessments and analysis of the situation of an ecosystem as determined in Step 1. Box 1 (above) provides basic information about the ecosystem model and its elements (Stam, 2015). Each of the elements (or framework and systematic conditions) was studied to understand how they relate to the outputs and outcomes; in our case, this was inclusive economic growth against the background of digitalisation. The effect of digitalisation on economic activities, economic performance, innovation and work and skills was investigated (Dhondt et al., January 2022). By example, the research that we carried out in BEYOND4.0 was based on interviews with ecosystem stakeholders, representatives of companies within the ecosystem and literature. The type of research activities that were used as input for the workshop was (i.e. Step 1, Analysis), among others:

- Desk research to determine the historical development of the ecosystem;
- Desk research and interviews and/or a workshop with key stakeholders of the ecosystem to determine weaknesses and risks for future development, as well as opportunities (related to the ten elements of the entrepreneurial ecosystem model);
- Desk research and interviews and/or a workshop with key stakeholders to determine the outcomes and outputs of the ecosystem regarding digitalisation, entrepreneurial activities and performance; inclusive growth; and presence of a high road perspective;
- Optional: assess current regional policies and formulate in a group discussion with expert to develop policy recommendations (again related to weaknesses and strengths of the ten elements);
- Develop contextual scenarios of the future. We will discuss these below.

Scenarios for the future

One way to answer what kind of recommendations are needed that improve entrepreneurial activities and inclusive economic growth is by using the methodology of future scenarios. Participants of the workshops – most likely stakeholders of the ecosystem – are presented with plausible future scenarios and are being asked what will change in their situation and what are then the subsequent actions with regard to the ten elements of the ecosystem model? Participants should in the workshop focus on what they think need to happen to deal with each of the scenarios. Scenarios are therefore changing contexts that force stakeholders to consider the choices and collaboration they face today.

From the input provided in advance, i.e. the analysis of the entrepreneurial ecosystem context, the participants are aware of the strengths and weaknesses of their region. Before

applying the scenarios, a discussion could be held to indicate what the main direction of the strategy should be for their region. The follow-up question then is: do your choices and recommendations change if the 'future' becomes very different?

To build scenarios of the future, we need to understand what the main driving forces are of this future. The main question is: What will affect the ecosystems in the near future? How this was done during the BEYOND4.0 project is explained below. Before we discuss that, we will give a short overview how to design a scenario project in general. One approach (see Box 2) applies the following six steps divided into three phases (Nekkers, 2020).

Box 2: An approach in six steps

Phase One: diverge

1. Prepare the scenario trajectory:

- Why and what is the purpose?
- What is the scenario question for the ecosystem?
- What is the time horizon and who should participate?

2. Explore:

- The environment of the ecosystem
- Relevant trends and developments for the future of the ecosystem
- Major uncertainties with the biggest impact
- Most important choices to be made

Phase Two: structure

3. Build the scenario framework:

- Distinct strategic choices from environmental issues that cannot be influenced
- Determine the number of dimensions of your framework. A 2x2 table of dimensions is preferred as this is less complex than applying a higher number of dimensions (i.e. number of scenarios)

4. Build the scenarios:

- Is a scenario an analytical piece, a narrative or perhaps an image?
- Are the scenarios plausible, relevant, and radical / disruptive?
- Are the scenarios of the future positive or negative, or a mix of both?

Phase Three: converge

5. Using scenarios:

- What do scenarios teach us? What is their impact? What chances emerge for the ecosystem?
- Which scenario is most desirable?
- What is the vision and strategy that can be linked to this scenario?
- Given this scenario: what must we keep, develop or get rid of?
- Developing measures, actions, action plans
- Report on the threats and opportunities, listing of choice options, assessment of alternatives, recommendations of the scenario team, carry out the selected recommendations in practice

6. Monitoring and scanning:

- How the world is changing and what it means for the chosen scenario and the ecosystem
- Evaluate the results of recommendations, measures and action
- Return to step 1 if necessary

In this chapter we will, however, not describe all these steps in detail in how we developed the scenarios for the BEYOND4.0 project.

Assumptions about the future

Using scenario development (De Geus, 1999; Nekkers, 2020; Van der Heijden, 2005), two driving forces were derived from expert discussions in the example of the BEYOND4.0 project. In the BEYOND4.0 analysis of regions and policy options (Dhondt et al., January 2022), team members of the BEYOND4.0 team contended that there are two dominant driving forces that define the future of ecosystems and, consequently, the entrepreneurial ecosystem's economic and inclusive growth outcomes. These dominant driving forces were developments in digitalisation on the one hand and the development of the societal climate on the other.

Two driving forces:

1. Digitalisation: companies and organisations like to see that digital change is predictable and controllable. This may be the case, but also not the case.

This first dimension reflects that companies and organisations like to see that digital change is predictable and controllable. Digitalisation may become very unpredictable, but it could be that technological changes may be more predictable. It is not so much the technology itself that is the issue, but the fact that companies (and other stakeholders) cannot foresee the possible demands these technologies put on companies. Companies that do not know if technologies lead to more productive outcomes may be hesitant to invest, even if their competitors are investing. We foresee two futures in which digital technologies become either very predictable and one in which uncertainty of benefits becomes large.

2. Cultural climate: companies and organisations like to see a cultural and social climate that is supportive of their purposes. However, polarisation already exists and may become worse in the future.

This second dimension relates to the context of collaboration between stakeholders and companies in specific regions. Entrepreneurial ecosystems rely on contexts in which stakeholders can predict how their counterparts will react and behave. Stakeholders like to see a cultural and social climate that supports their purposes: harmonisation and collaboration. However, our European societies are already experiencing polarised cultural environments in which distrust between different social groups may worsen.

The present ecosystems are based on choices made in the past. Apart from choices made by individual actors within the ecosystem (like the core companies), such choices can be connected to the elements of the entrepreneurial ecosystem model. When both 'drivers' change, the past choices in the entrepreneurial ecosystem may not be valid. The assignment to workshop participants is to determine the choices about the ecosystem elements, given the fact that all stakeholders want to keep the entrepreneurial and inclusive social outcomes as they are today and preferably even better.

Figure 2 shows the two driving forces and how they can be used to identify future states-of-play ('scenarios'). It allows assessing to what degree ecosystems will face digitalisation and polarisation and what needs to be done for economic and inclusive growth within ecosystems.

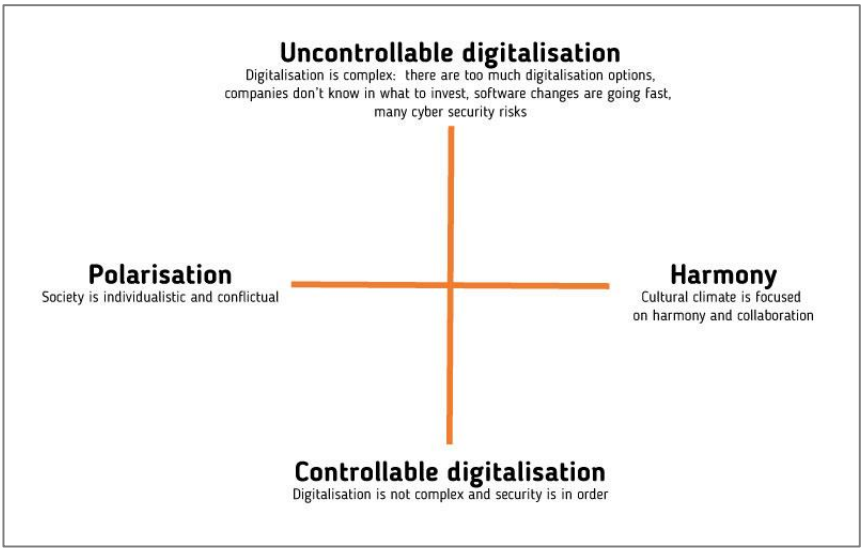


Figure 2: The digitalisation and culture dimension as driving forces (Oeij et al., October 2022)

Each quadrant of Figure 2 presents different implications for the economic and inclusive growth outcomes. For the workshop, participants could discuss two different scenarios considering the following opposite situations[2]:

Scenario A: Common Ground scenario: Harmonisation and controllable digitalisation

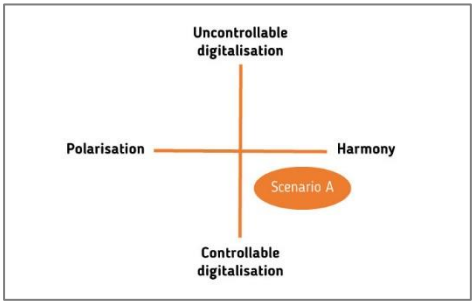
Scenario B: Contested Terrain scenario: Polarisation and uncontrollable digitalisation

We explain in Box 3 these scenarios with narratives. Participants of the workshop could be asked during the workshop to reflect on what these scenarios mean for the current arrangements in their ecosystem.

[2] Two quadrants are not designed as scenarios because they are either less realistic, or do not add much extra to the two opposite scenarios. As such they are seen as not helpful to create policy recommendations.

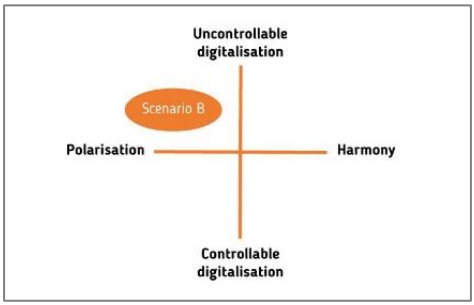
Box 3: Narratives of the scenarios

Narrative of Scenario A: Common Ground



"The cultural climate of society is focused on harmony and collaboration. This makes it easier for companies and other stakeholders within ecosystems to collaborate. Support from institutions and policymakers at region, national and EU level are in order. The digital transformation has gone step-by-step, less uncertainty, and organisations have had sufficient time to digitalise and change their business models. There are no large cyber security risks."

Narrative of Scenario B: Contested Terrain



"Society becomes more individualistic and conflictual. People and companies collaborate less intensive, and focus on their own goals. Policymakers struggle with each other, which makes it hard for companies to get support. It is hard for ecosystems to flourish. Digitalisation is becoming more and more complex, and uncertain, making an ecosystem-approach even more important. There are too many digitalisation options (e.g. machine learning, cobots, block chain), AI becomes more and more a black box, companies do not know in what to invest, software changes are going fast, lot of digital competitiveness, many cyber security risks. Business models need to change fast to deal with digitalisation."

Preparation and execution of the workshop

Preparing a workshop is a crucial step and is in itself a form of scenario planning. The workshop organisers must have a clear picture of the end result: ask yourself, what do you want to achieve in the future? For the BEYOND4.0 project, the desired results were policy recommendations for different policy levels, namely regional, national and European.

This requires planning how to get there. For this purpose a set of coherent research activities were planned and carried out, to conceptualise, investigate and analyse a robust understanding of digital transformation in ecosystems, and their socio-economic effects (Warhurst et al., June 2020). Subsequently, by comparing the different ecosystems, it was possible to learn which elements of the ecosystem model worked well for certain regions and this enabled to conceive a variety of possible recommendations across ecosystems.

The preparation of the workshop included the following steps in BEYOND4.0:

- Select and invite relevant stakeholders of the ecosystem. Among them are business representatives, entrepreneurs, administrators, policymakers, representatives from knowledge institutes and education, financial and other service institutions, employer organisations and unions, and labour/employment agencies;
- Produce an analysis (input report) of the ecosystem and its elements; introduce the scenarios;
- Produce policy recommendations or statements for discussion;
- Define an agenda and a programme; design the workshop process; divide the roles; formulate the expected input of participants during the workshop;
- Design a trajectory which from a to z, includes the start, analysis, evaluation, policy recommendations, implementation, evaluation, and follow-up actions until the end. It is important that participants will know what will be done with their input, what are the next steps after the workshop, and what are the intended results.

The mentioned steps are not exhaustive. In BEYOND4.0 the following activities were carried out during (and after) the workshop:

Activities in the workshop

1. In the workshop the workshop leaders described:

- The ecosystems and its main strengths and weaknesses;
- The current state of the ecosystem with regard to digitalisation, entrepreneurship, and inclusiveness;
- The scenarios and its components, and its narrative.

2. After these introductory steps the participant groups discussed:

- What the scenarios mean for entrepreneurial activities of the ecosystem;
- What the scenarios mean for inclusive growth;

- What needs to be done to ascertain a high-road ecosystem with entrepreneurial and inclusive growth based on the elements of the ecosystem model; The ten elements of the ecosystem model concentrated on 1) capital & investments; 2) labour & skills; 3) knowledge development and sharing.
- In the end policy recommendations at the organisational, regional and EU level were defined.

To stimulate the discussion, it is helpful to present a set of statements that may trigger possible action repertoires in the participants. The following text box indicates possible core ideas of these action repertoires for the common ground and contested terrain scenarios (these are examples from the BEYOND4.0 study):

Box 4: Examples of statements

Common Ground

Companies should focus more strongly on eliminating any discrimination in the labour market.
Regional development funding should be completely private.
The education system should focus on technical skills, not on ICT or soft skills.
Employment services should direct themselves primarily to the long-term unemployed.
Regional support agencies should develop more initiatives for long-term international cooperation

Contested Terrain

Public national and regional funding should rise to reduce innovation risks for companies.
More regional services are needed to support cooperation and technical support to companies.
Regional support agencies should focus on short-term international cooperation.
Skilling, upskilling, and reskilling are core company training issues. No external support is helpful.
Employment services should have programmes to reduce very short-term unemployment.

In the common ground scenario, the BEYOND4.0 workshop leaders suggested to the participants that stakeholders and companies need less funding and those actors need to shift their attention to the longer term. In the contested terrain scenario, they suggested to the participants that more public support is needed and that the perspective is short-term. The idea of these statements was that they helped the participants to be more precise in their reactions. The workshop leaders did not want the participants to agree on vague notions. The participants needed to make their opinions explicit and agree in the discussion on their positions.

In Box 5 an example of a recommendation is given, that resulted from the BEYOND4.0-workshops about the element of 'talent' in the ecosystem. Talent proved to be scarce and there was much competition for talent. To make the recommendation as concrete as possible, the workshop leaders requested participants to address these issues: Inclusive outcome: 1] what should be the productive entrepreneurship aspect; 2] what must be improved; 3] who do you see as responsible agent(s); 4] mention the EU dimension of your recommendation.

Box 5: Example of a formulated Policy recommendation about 'Talent'

Talent: *A broad approach is needed to engage stakeholders (educational organisations, employment organisations, industry representatives, social partners and governmental bodies) in attracting talent and enhancing the skills of employees, students and job seekers (technical skills [job-specific], ICT skills, 'soft' skills [social, personal and methodological]). In itself, this is not a new issue. However, more collaboration and cooperation involving companies (especially SMEs and start-ups) are needed. Educational programmes must be connected to the newest technological developments and innovations to minimise the gap between company practices and the educational curricula, but also have more attention to soft skills (creativity, critical thinking) (methodological skills). The talent base, including different educational levels, is crucial for ecosystems to move forward. There is a shortage of skilled labour (medium and high-level) in almost all studied ecosystems. This issue of talent is not restricted to employees alone. Entrepreneurs must also become more 'digital savvy' to understand the entrepreneurial possibilities and requirements to sustain their businesses, especially SMEs and 'traditional' entrepreneurs.*	
Inclusive outcome	Prevent/reduce labour market polarisation; stimulate diversity; more girls opting for technological skills
Productive entrepreneurship aspect	Ensure that business models are future-proof and include opportunities based on digitalization
What must be improved	The collaboration between agents that have a stake in qualified labour supply
Responsible agent(s)	Education, governmental bodies, industry representatives and companies
EU dimension	Retention of competitiveness, resilience, sustainability and social cohesion

Based on recommendations like these, the organisers of the workshop should together with other regional key stakeholders develop a concrete action plan to follow up on the recommendations (Step 4). In such a plan for action one should at least pay attention to these topics:

- Describe the problem and objective of the ecosystem.
- The actions needed to improve entrepreneurial activities and inclusive economic growth based on the recommendations.
- The responsible actors for each action.
- The needed resources including financial investments.
- Planning and deadlines.
- Plan how and when to evaluate whether the objectives have been achieved, and monitor the measures taken.

3. FINAL REMARKS

Scenarios can be helpful in developing policy actions to direct developments in ecosystems towards desired outcomes. In this chapter, we propose to use a backcasting technique in which we gave the example of a desired future of digital transformation with inclusive growth by analysing two opposing scenarios, a 'common ground' and a 'contested terrain'. How can ecosystems reach the goal in these different contextual scenarios; what must be done in the case of a harmonious society and what must be done in a conflicting society?[3] Both scenarios force workshop participants to be prepared for alternative realities and thus enhance the resilience of policy-making, preventing responsible actors from lumbering with their own tunnel vision (confirmation bias). They must be invited to think 'out-of-the-box'.

3 Designers of scenario workshops like these can use the concepts of sociotechnical systems design and workplace innovation practices, which are described in the chapter on the Theory of Change (chapter 1). These concept can be part of the solutions, and are applicable to the level of ecosystems and the level of companies within ecosystems.

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THE PRACTICAL SIDE OF DIGITAL TRANSFORMATION: A TOOL BOOK FOR PRACTITIONERS

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BEYOND4.0 studied the situations of twelve ecosystems in six countries, and of 30 companies, with the intention to understand the development of digital transformation and its socio-economic consequences, i.e. the economic and social effects on inclusive economic growth.

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