WORK 4.0

Rethinking The Human-Technology Alliance

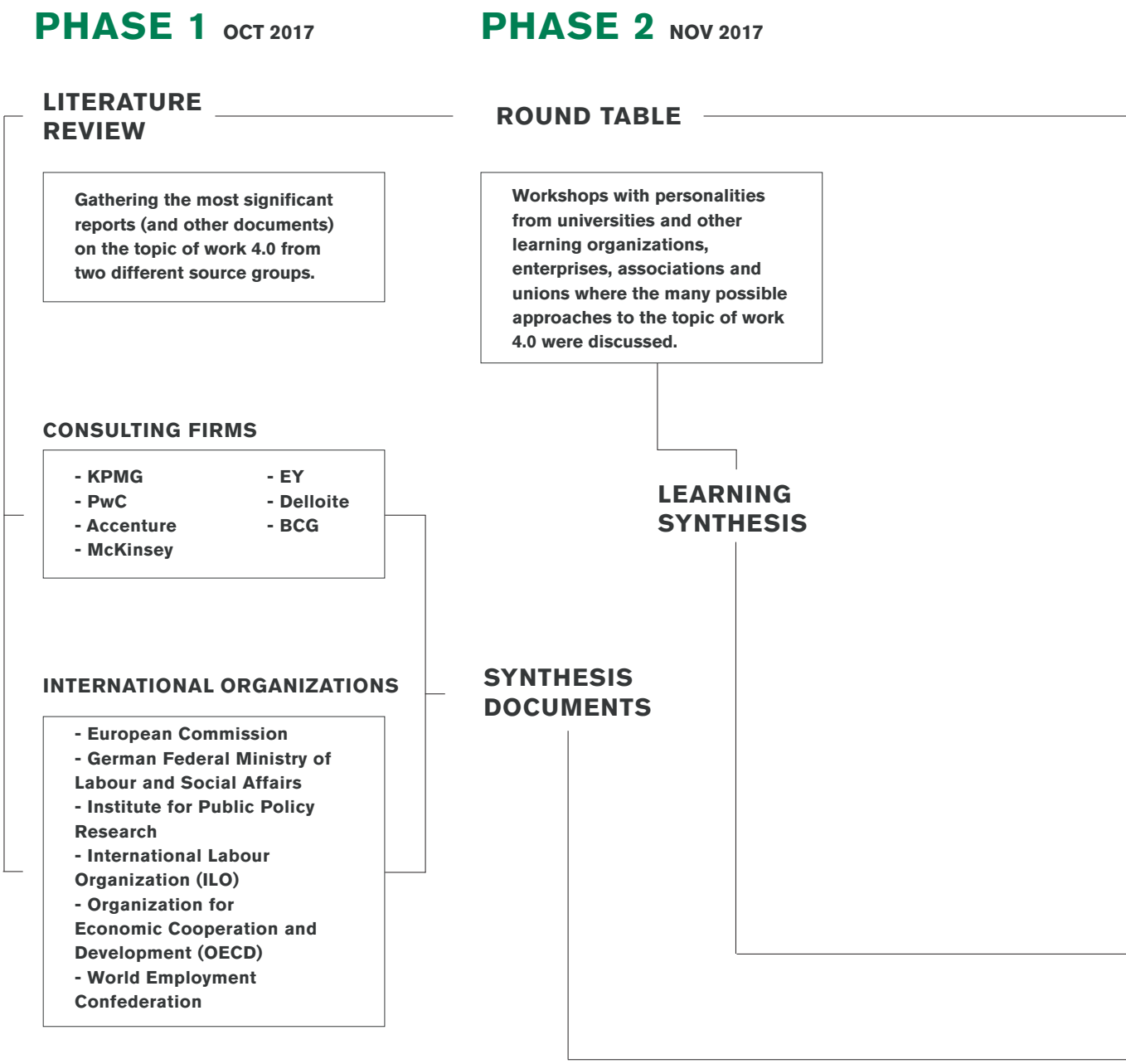
SUMMARY REPORT

COTEC Portugal
Somos Inovação

INDEX

METHODOLOGIES

This summary report by COTEC Portugal brings together contributions from the three COTEC associations: Italy, Portugal and Spain.
Dedicated to specific topics, each organization undertook different actions and perspectives to study and investigate the topic of Work 4.0.



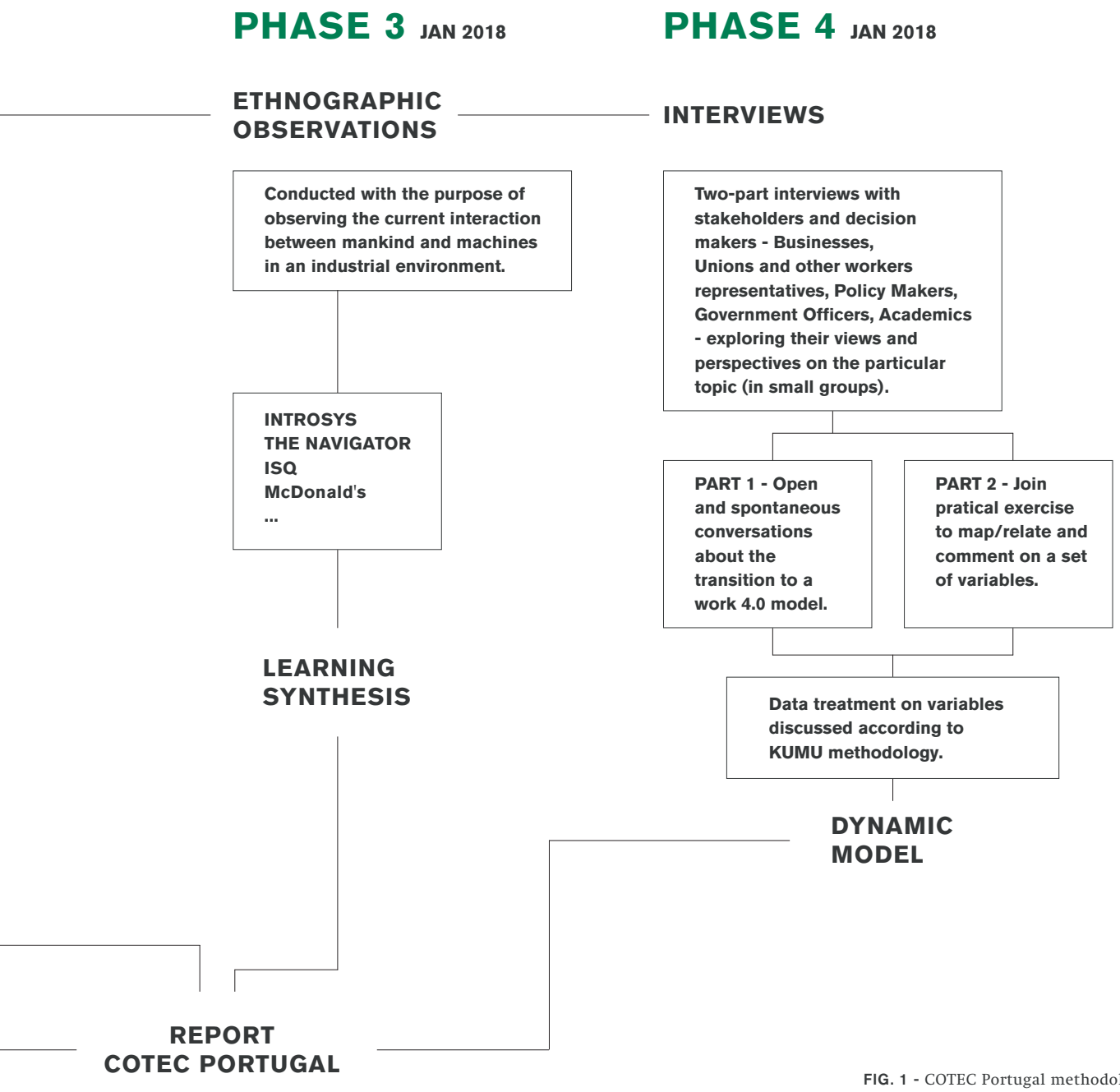


FIG. 1 - COTEC Portugal methodology scheme

PHASE 1

LITERATURE REVIEW

Gathering the most significant reports (and other documents) on the topic of work 4.0 from two different source groups.

SYNTHESIS DOCUMENTS

PHASE 2

WORKSHOPS & INTERVIEWS

Consulting knowledgeable experts: scientists, technologists and managers of business firms.

In order to gather different points of view and prospective evaluations of some of the most relevant players in the processes that relate technology innovation with employment.

RESULTS REPORT

PHASE 3

FIELD INVESTIGATION

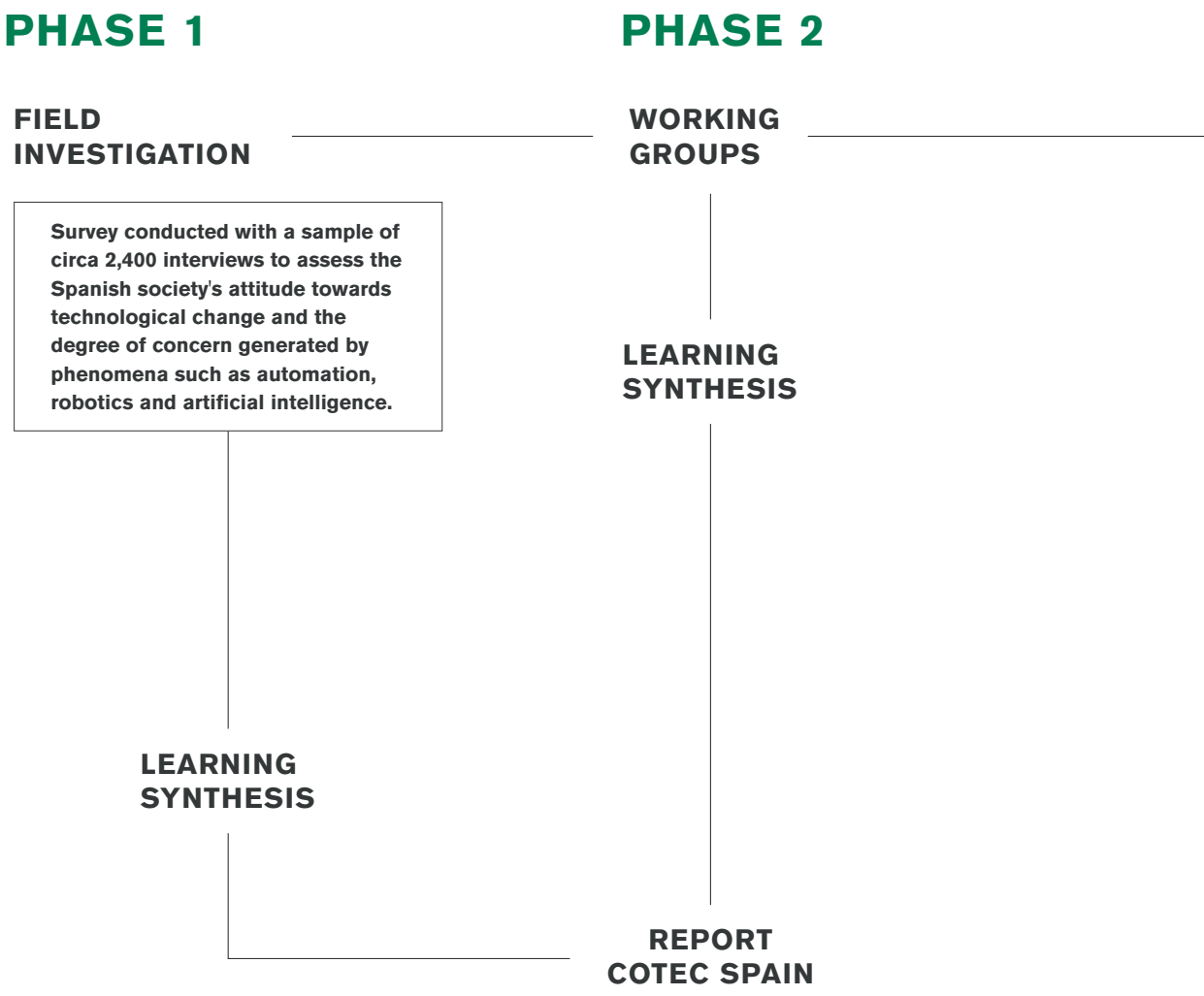
Survey conducted with a sample of nearly 3000 Italian citizens of various ages, education levels, income levels, location, regarding their Culture of Innovation.

To understand the attitude of Italians towards the future of work, putting into evidence the impact that emerging "disruptive" technologies might generate on the future of work, especially in industrial and service sectors, in both qualitative and quantitative terms.

RESULTS REPORT

REPORT COTEC ITALY

FIG. 2 - COTEC Italy methodology scheme


PHASE 1
PHASE 2
FIELD INVESTIGATION
Survey conducted with a sample of circa 2,400 interviews to assess the Spanish society's attitude towards technological change and the degree of concern generated by phenomena such as automation, robotics and artificial intelligence.
WORKING GROUPS
LEARNING SYNTHESIS
LEARNING SYNTHESIS
REPORT COTEC SPAIN

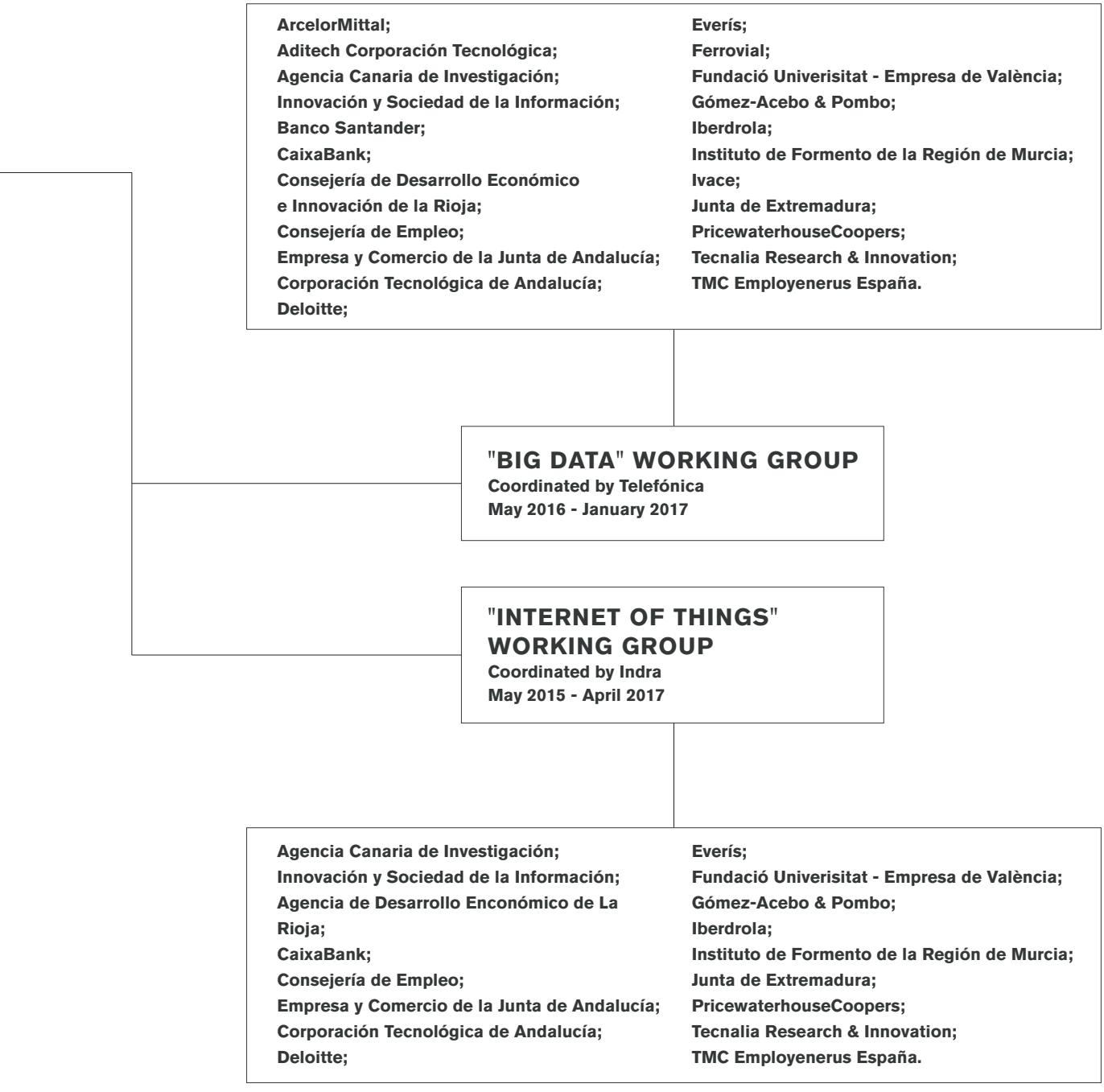


FIG. 3 - COTEC Spain methodology scheme

ETHNOGRAPHIC OBSERVATIONS

While it is true that we cannot predict the future, it is also true that observing situations where technology is used profusely in different stages of the production chain can provide clues as to the future interaction between humans and machines. In an experimental manner, on-site visits were conducted to organisations in different sectors of activity whose outcome was a set of conclusions about the role of people in the interaction with machines and technology.

Considering the following five dimensions, each visit was characterized. Some aspects were considered as barriers to a smoother transition to a Work 4.0 environment and others as drivers.

SENSE OF SECURITY

The employee's feeling with regard to the risk of losing his job;

AFFIRMATION OF PERSONAL IDENTITY

The extent to which the surroundings allow the active construction of personal identity through interaction with one's peers;

KEEPING CONTROL

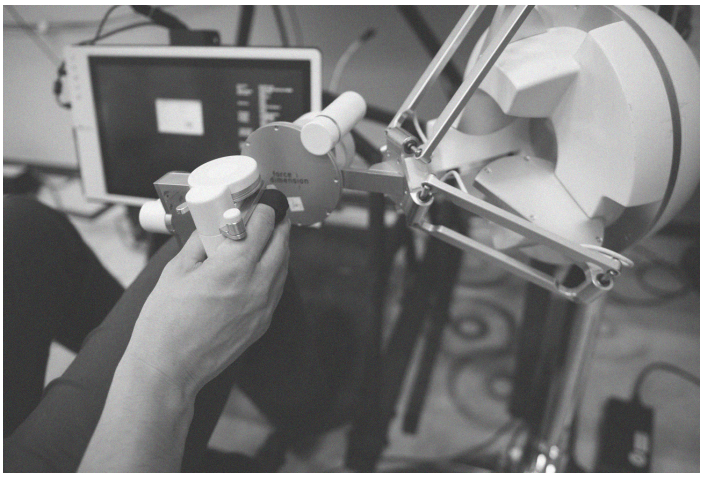
The employee's control when interacting with technology;

ABILITY TO RECOGNISE THE VALUE OF MACHINES

Degree of exposure and visibility of technology in the context of the employee's tasks;

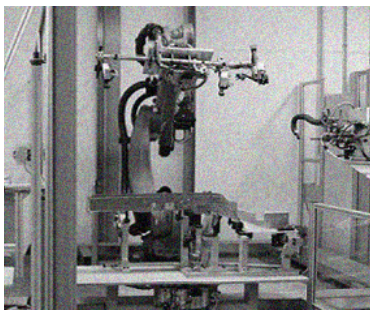
POSSIBILITY OF SIGNIFICANT LEARNING

Degree of training enabled by the introduction of technology into the production chain.



Within the sample of ethnographic visits carried out, four were selected as examples. Some observations regarding the five dimensions are identified below.

	MCDONALD'S	ISQ
SENSE OF SECURITY	Jobs are reduced and replaced by machines.	Creates innovation and improvements at the training level.
AFFIRMATION OF PERSONAL IDENTITY	Duties are recreated and people reallocated to different tasks, increasing the possibilities of transformation.	Example of training in welding: stimulates the development of new sensory and emotional functions, namely concentration, precision and motor skills.
KEEPING CONTROL OVER THE MACHINE	Machines are only used in certain stages and have no control over people.	The machine is a training aid with no autonomy or freedom to act independently.
ABILITY TO RECOGNISE THE VALUE OF MACHINES	Machines are used to process more tasks, facilitating people's routine activities.	The machine as a tool enabling the value of the training component.
POSSIBILITY OF SIGNIFICANT LEARNING	To carry out new duties.	The use of technology as a training aid enables better results.



INTROSYS

Importance of the human element in defining and building the characteristics and functions of machines.

After implementing solutions, machines function autonomously, projecting the illusion of having power over themselves.

The machine is "taught to think" and replaces humans as a productive resource solution.

Possible greater learning as humans are the ones who create the machine and its programming.

NAVIGATOR

Production processes with human intervention limited to control areas and/or default moments.

Despite the production process requiring no (or little) human input, human control over machines is remembered at times of breakdown/maintenance.

Barrier

Driver

TABLE 1 - Characterization of ethnographic observations according to five considered dimensions

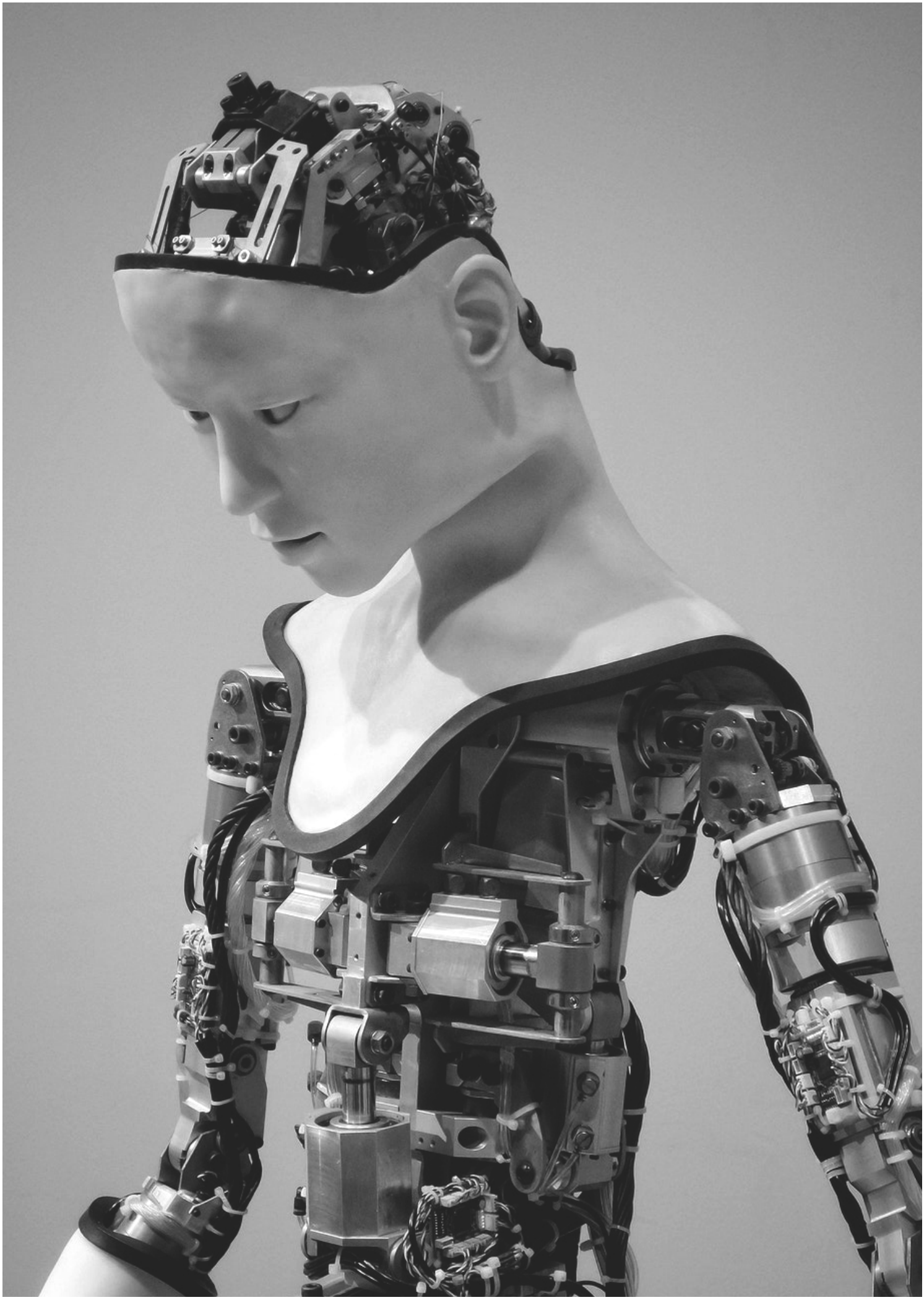
TRANSVERSAL INSIGHTS GARNERED FROM THE VISITS

Human intervention, whether physical or supervisory, is still a constant factor observed at all the companies visited, but it differs in degree and number. However, in the examples observed, no company has yet been found where the physical human presence was deemed dispensable.

The personification of machines raises several ethical problems to the extent that constant innovations introduce key technological moments in all the cases observed in which machines can perform parts or all of the tasks, leading to a new work ethic. This is a recurring theme, verified when mass production was first introduced. The difference is that, today, innovations are far more numerous and on a far larger scale and are being processed at astonishing speed.

In all the cases observed, the layouts were adjusted so that humans and machines could coexist in a harmonious working environment.

Even though human emotions are a constant factor, when interacting with machines, the latter can optimise human performance by raising the perception of the surrounding environment to higher levels.



VARIABLES OF THE TRANSITION PATH

When machines exist that are able to perform complex tasks by simulating certain human capabilities partly or fully, the course of the history of work is necessarily altered. This section attempts to identify the active variables in this process of transition. During the various weeks of interviews with the aforementioned working groups, 14 variables related to Work 4.0 were identified and tested.

DEMOGRAPHIC BALANCE

Geographical (urban and rural) and generational (young and old)

EXPECTATION TOWARDS RECOGNITION / RETURN

Social and professional recognition with a possibility of reward (income or other benefits);

FEELING OF BELONGING (COMMUNITY)

Community at a personal or an organizational level;

SENSE OF SECURITY

Personal and professional security;

GOVERNMENTAL REGULATORY ACTION

Responsibility to enforce standards, oversee and regulate;

MARKET

Demand and supply;

MATCHING DIGITAL SKILLS

Adequacy of digital skills (qualification and re-qualification);

MOBILITY AND ADEQUACY OF URBAN PLANNING

Route between home and workplace and new places to work;

NEED FOR NEW WORKING MODELS

New space and time working configurations (personal and professional);

PERCEPTION OF BENEFITS OF DIGITALISATION

Knowledge of short and long-term benefits;

PRIORITY IN DIGITAL INVESTMENT

Investment with regard to transition;

SOFT SKILLS DEVELOPMENT

Interpersonal-communication skills;

SUSTAINABILITY

Social, cultural, economic and resource sustainability;

WILLINGNESS TO LEARN AND THINK

Readiness and conditions to make the effort.

TABLE 2 - Variables considered in Part 2 of the interviews conducted by COTEC Portugal

Ultimately, fourteen variables were identified in a system approach that enabled the mapping of potential relations and alliances between them.

All the variables form uncertain alliances. The task of understanding how the interlinked socio-economic system works, what its main archetypes are and how one can nudge the system into a faster and leaner adaptation of emerging technologies falls into the category of a volatile, uncertain, complex and ambiguous (VUCA) problem.

A map was built after the interviews using the web-based systems mapping tool “KUMU”[1].

[1] https://kumu.io

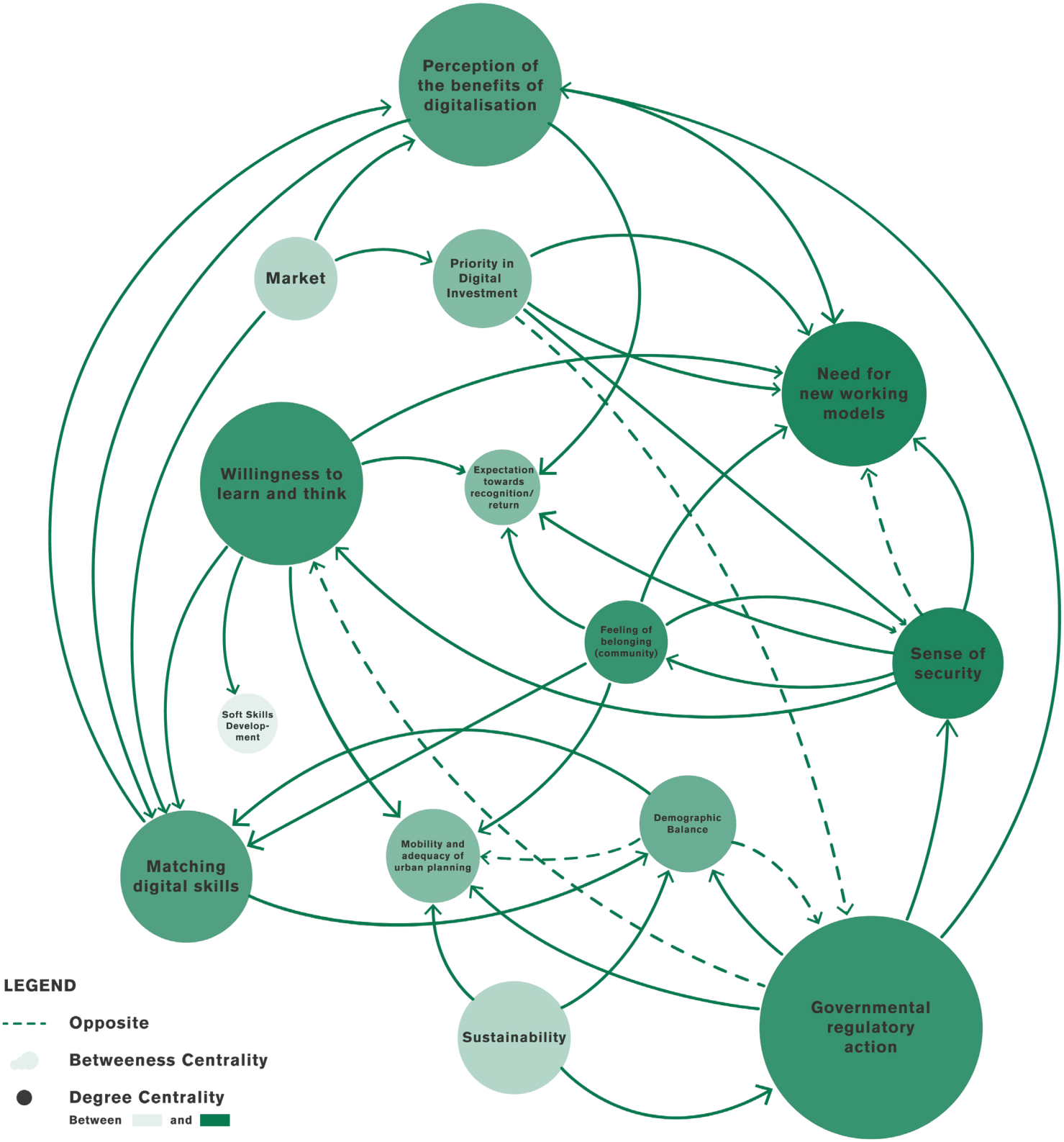


FIG. 4 - System map for the transition to a Work 4.0 environment

SYSTEMS NETWORK ANALYSIS (SNA)

Through the connections observed in Figure 4, it is also possible to characterize the importance of an individual variable on global systems by using systems network analysis (SNA) metrics such as:

DEGREE CENTRALITY: this counts the number of connections a variable has, allowing us to understand how many other variables it can affect. However, the high degree centrality of a variable does not mean that it strongly influences the system. In other words, quantity is not quality.

BETWEENNESS CENTRALITY: this measures the number of times a variable lies on the shortest path between two other variables, allowing us to understand which variables can be modelled as catalysts or buffers of the system.

EIGENVECTOR CENTRALITY: this expresses how well connected a variable is to other well-connected variables. Variables with high eigenvector centrality are most probably changers (leaders) of the system.

Centrality metrics allow us to disclose the variables that are leverage points of the system, i.e. the variables which when fine-tuned can contribute most significantly to the system's transformation. Table 3 shows the eight most influential variables of the system according to the different centrality metrics. This analysis is of particular importance to feed and expedite the modelling exercise and scenario-building to find new solutions and support the decision-making process.

	DEGREE	BETWEENNESS	EIGENVECTOR
1	Need for new working models	Governmental regulatory action	Need for new working models
2	Sense of security	Willingness to learn and think	Feeling of belonging (community)
3	Feeling of belonging (community)	Perception of the benefits of digitalization	Sense of security
4	Willingness to learn and think	Need for new working models	Expectation of recognition/reward
5	Governmental regulatory action	Matching digital skills	Willingness to learn and think

TABLE 3 - Top 5 system variables according to centrality metrics (Degree, Betweenness and Eigenvector)

The variables “Ability to adapt to emerging working environments“ and “Willingness to learn and think” appear in the top 5 of all centrality metrics, drawing attention to their importance as convergence points. This means they will be focal points in the future of work to which system agents will be drawn to and search for.

The negative impact that “Governmental regulatory action” and the “Priority of digital investment” have in the system needs to be considered.
This first exercise in adopting a systems thinking lens to understand the social, economic and political dynamics that shape the emerging future of work revealed several insights:

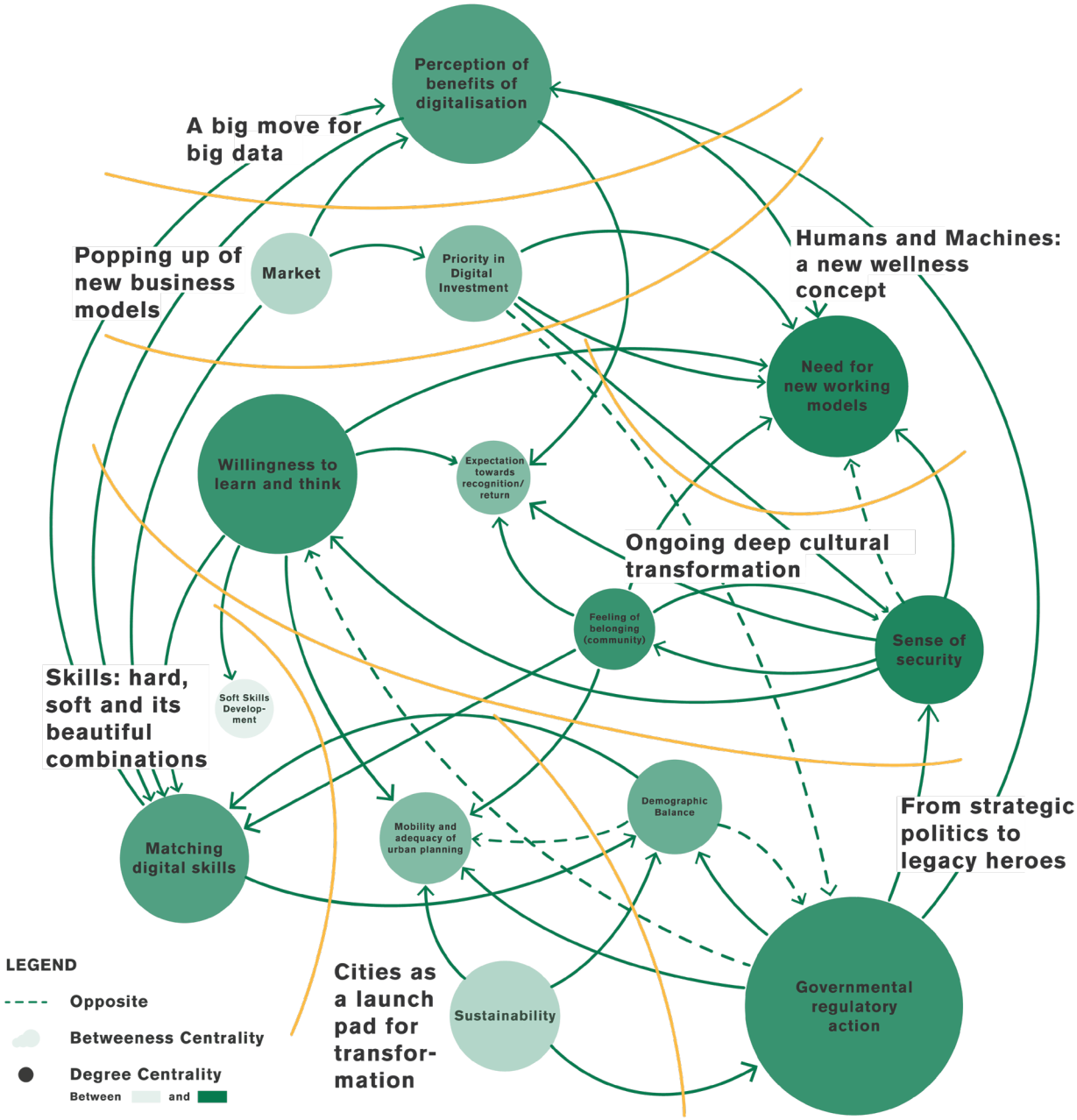
A generative dialogue with the stakeholders, where they are invited to share not only their views, but also to construct a model, revealed a number of unexpected unknowns.

A systems perspective provided a glimpse into the complexity of what preparing for the future of work actually means in terms of interconnected variables.

The analysis of the resulting map revealed a collective intelligence about what the variables are that are most likely to define how the systems will evolve.

SEVEN KEY DIMENSIONS OF PATH 4.0

Considering the relations and influences identified beetween the fourteen variables, the following seven logical dimensions were established.



DIMENSIONS	VARIABLES
FROM STRATEGIC POLITICS TO LEGACY HEROES	Governmental regulatory action
	Demographic balance
HUMANS AND MACHINES: A NEW WELLNESS CONCEPT	Need for new working models
ONGOING DEEP CULTURAL TRANSFORMATION	Expectation towards recognition/return
	Feeling of belonging (community)
	Sense of security
	Willingness to learn and think
A BIG MOVE FOR BIG DATA	Perception of the benefits of digitalisation
POPPING UP OF NEW BUSINESS MODELS	Market
	Priority in digital investment
SKILLS: HARD, SOFT AND ITS BEAUTIFUL COMBINATIONS	Matching digital skills
	Soft skills development
CITIES AS A LAUNCH PAD FOR TRANSFORMATION	Mobility and adequacy of urban planning
	Sustainability

TABLE 4 - Correspondence between fourteen variables and seven dimensions

DIMENSIONS CHARACTERIZATION

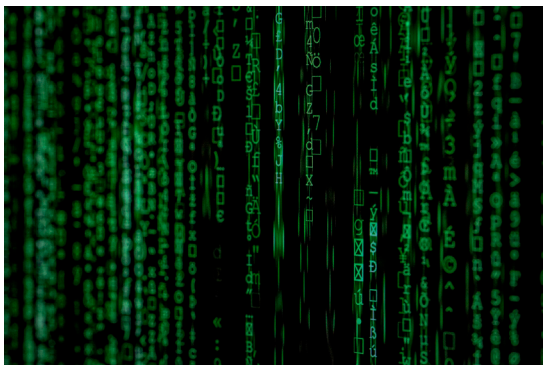
1 FROM STRATEGIC POLITICS TO LEGACY HEROES

The complexity of contemporary society is raising awareness of the need for more policies and more structured government intervention to create a shared vision for essential social cohesion. The demographic (age, gender, migrations) and environmental challenges require effective and wide-ranging solutions. These can only come from central government as it is the only entity endowed with the power to execute them.
Focused on conceiving and executing an Agenda for the Common Good, in the journey towards Work 4.0, governments (both national and supranational) are forced to implement a two-fold approach: to draft strategies and earmark resources which not only stimulate digital transformation, but also ensure citizens' safety by anticipating and controlling personal risks which ultimately result in adjustments to social and business models.
In the world of Work 4.0, the same social issues will be called into question, forcing strong interventions in sectors such as health, justice and defense, and redefining the relationship between the state and the citizen, through the successive incorporation of digital technology, and its growing automation.

2 A BIG MOVE FOR BIG DATA

Digital technology is visible in all spheres of human life: at the individual level, propelled by mobile technologies, at the community level, and at the social and economic level, as a whole, on the global scale. This omnipresent aspect has been seen and experienced as a story of success that has bred overall contentment and involvement by those who intervene, fostering a promising environment for its qualitative and quantitative expansion.
The understanding that this information runs "in line with willpower" in systems of biological intelligence, as well as artificial intelligence, goes without saying. Data acquires the status of essential prime matter and performs on a platform of overall collaborative logic. Massification (still quite incomplete) carries

the exponentiation of inputs and contents that open pathways to even better and more fertile research. The "algorithmization" of everything becomes appealing and truly irresistible, creating successive layers of theory and applied knowledge. To be aware of the sheer size of this revolution, to encounter its corresponding impacts as soon as possible, to formulate scenario planning and to look for public debate around the current main topics are all unmistakably wise options and sought after (and irreversible) pathways to Work 4.0.



3 SKILLS: HARD SOFT AND THEIR BEAUTIFUL COMBINATIONS

The growing significance attributed to the concept of "skill" in leadership practice reflects the awareness of its profound complexity – summarized by the ratio of very large-scale to very high speed. Space comes in for new multiple social phenomena and its manifestation towards a central idea that highlights the paradigm shift framework where processes are as important as results. Organizations will unconditionally need talent, defined, to a great extent, by the ability to adapt to change.

From each individual's point of view, it is about finding solutions to problems which result in a contracting welfare state, particularly in Europe, and the disintermediation of essential functions including work, which will match the current definition of employment less and less. Organizations and individuals commonly foresee that the development of new skills will be vital for humans to continue to dominate an ecosystem inhabited by (very) intelligent machines.

Working simultaneously and equally on both hard and soft skills is wise. Similarly, the need to invest in soft skills can only be achieved through hard effort, through programming and monitoring, instead of a casual letter of intent. Developing the best hard skills assumes a person is equipped with certain soft skills, which captures a unique qualitative dimension.

4 HUMANS AND MACHINES: A NEW WELLNESS CONCEPT

We live in a time of large-scale change in the field of work due to the spread of digitalization. We are well aware of these shifts – jobs which will disappear and jobs which will be created – yet they are also aligned with new levels of specialization, implying the constant need to upgrade skills.

Another aspect is the plethora of possible work configurations: in time (full-time/part- time; long-term/ occasional) and in space (physically present/remote; in the professional workplace, or somewhere else).

All these aspects have impacts on entities representing workers' interests, forcing labour unions to rethink how they are set up and what they do, while new associative formats gain relevance, in line with project-based and multi-client service provision models. Workers' lack of attachment to place and new employer and client profiles suggest that concepts such as class awareness are undergoing reassessment.

The cohabitation of humans and intelligent machines will lead to successive role adjustments and it will be up to the former to take the most out of the experience and the expertise of their "new" working colleagues. New levels of knowledge can be achieved and deep innovations can take place – as long as virtuous cycles between both parties can be created.

5 ONGOING DEEP CULTURAL CHANGES

The system of beliefs, behaviours and artistic expressions within a society constitute the concept of culture. The changes brought by the generalization of digital technologies and the web, and the vision of what the future might be, has caused significant cultural shifts in European societies, where global and local (creative) tensions constitute a relevant topic in itself.

We consider two types of culture, both of which are undergoing deep metamorphoses. The first, more anthropological in nature, includes the key dimensions of human life: the sense of belonging and the need for security. The second type of culture appears to be more functional and points to a renewed demand for constant learning as a constitutive trait of contemporary human identity.

6 CITIES AS A LAUNCH PAD FOR TRANSFORMATION

Cities have an uncanny ability to create favourable ecosystems that nurture modernization. This dominant type of habitat reinforces its strengths through clear predictability and the assumption of its position as a trendsetter. At a time that requires multiple skills, only cities are endowed with suitable critical mass, speed (and quality) to overhaul talent. It is where all types of people converge and learn to cultivate diversity as a means to create added value.

The journey towards Work 4.0 implies urban qualification and its effective sustainability.

In addition, it requires intelligently digitalized public services and effective allocation of public funds, which are well known to be scarce. For all COTEC countries, one matter is of particular relevance: tourism. The activation of macro- and micro-self-regulation mechanisms is key to ensuring the balance of the urban ecosystem. All biological and artificial intelligence must be called upon to think, organize and monitor collective life, in a context a growing population flows. The quality, quantity and actuality of data is crucial for the mission of managing and enhancing public space.

7 POPPING UP OF NEW BUSINESS MODELS

The shredding of digital transformation is characterized by its impact on systemic social, economic and cultural interaction. Businesses are experimenting with new mediation models, which represent a crucial element that raises clients' perceived value, and subsequently demand, to unprecedented levels. Clients' new digital nature requires supply which does not yet totally fulfil this dimension, and in addition it is not yet able to recurrently exceed expectations and, consequently, demonstrate innovation.

The value chain is subject to analysis, deconstructing and reconstructing products and services which can satisfy the market's emerging needs. Up until now, these same features that enable the innovation factor have been hidden in a single and satisfactorily cohesive one. New partnerships will arise as new businesses arise from this process.

Along with this greater agility and openness to the flows and rhythms of a plural and geometry-changing world, another trend is starting to bloom: more concern about production targets that are less dependent on the purely technological possibilities and more grounded on a company's specific reality. The true nature (qualification and skills) of human resources and the type of relationship established with intelligent machines become vital aspects in this new changing world. The complexity created by the overall digital movement forces one to look for the highest existing predictability, and, consequently to treasure new ways to surpass the ever relevant context costs.


PARACHUTE
CLOSEOUT
CONE (PCC)

DEBATE ON THE WAY FORWARD

In addressing the Work 4.0 topic, the goal of the COTEC EUROPE SUMMIT 2018 was to launch a dialogue on how we want to shape work in the future, in all its breadth and diversity, in a way which benefits people and companies, moving economies and societies forward, at the European Union level.

The following images represent the main ideas discussed during the panels and interventions of the COTEC EUROPE SUMMIT 2018 event called Rethinking the Human-Technology Alliance.


COTEC EUROPE SUMMIT 2018
WORK 4.0

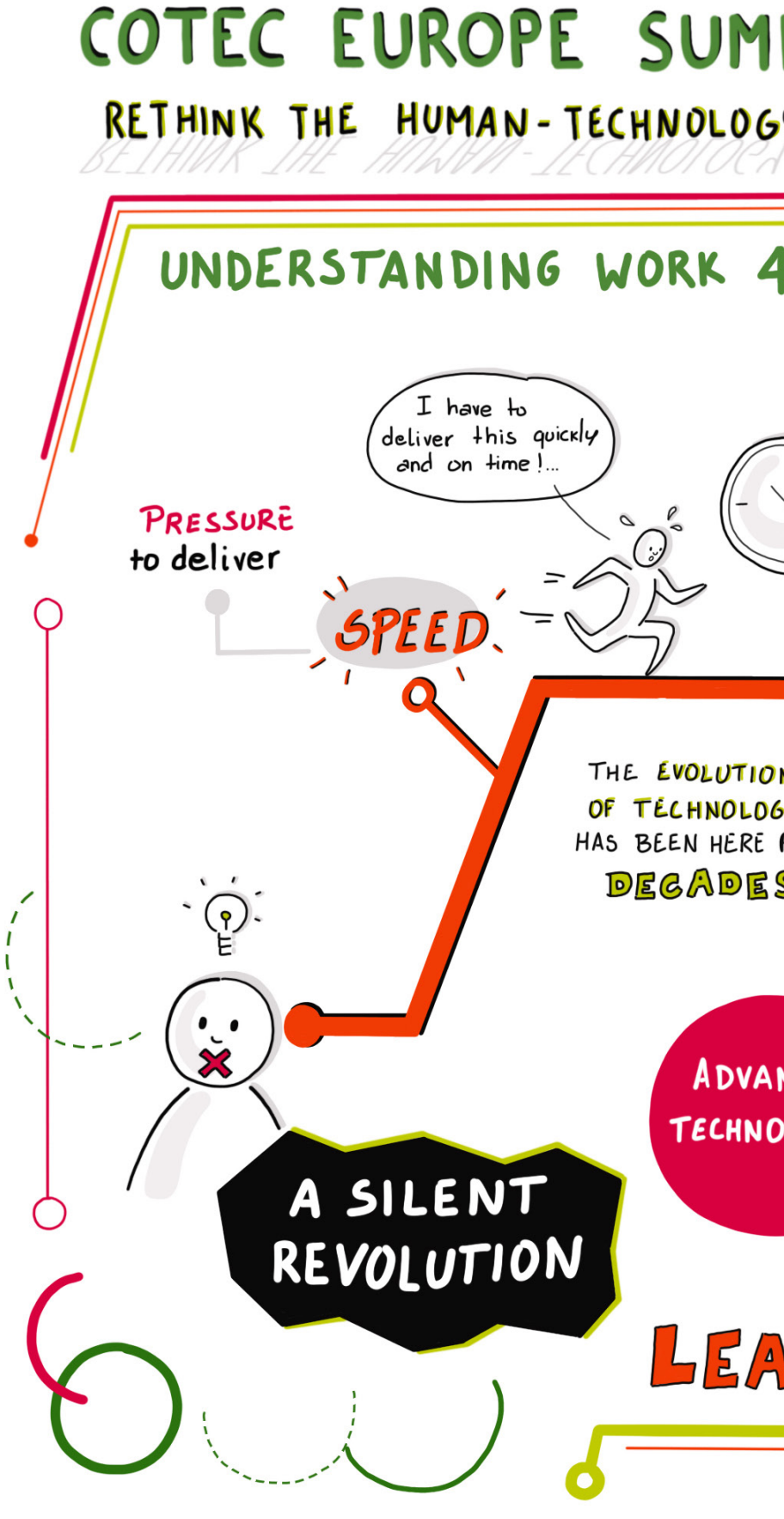
A SILENT REVOLUTION HAS BEGUN WITH INCREASING CONNECTIVITY, AUTOMATION AND BIG DATA ANALYSIS TOOLS.

COMPANIES ARE NOW CLOSER TO CUSTOMERS AND SUPPLIERS AND REACT FASTER.

THERE IS A LOT OF PRESSURE FROM CUSTOMERS TO GET INSTANT FULFILMENT AND SPEED IS THE KEY ELEMENT.

HOW CAN WE COPE WITH THIS CHANGE?

COMPANIES THAT WORK IN REAL TIME, WITH ADVANCED TECHNOLOGY, THOUGHTFUL LEADERSHIP AND EMPOWERED TEAMS.

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WORK 4.0
4.0
HOW TO DEAL WITH THIS ?
People
CAN'T WAIT
TIME
Hurry up !!
SMART WORKING
AGILE WORKING
New methods
Authonomy
Responsibility
Creativity
Team work
Empathy
capacity to solve complex problems
ASPIRE TO BE
a
STAR TREK
TEAM
EMPOWERED TEAMS
THOUGHTFULL LEADERSHIP
we need
HUMAN POLICIES
Health
Knowledge
Wellness
RNING ORGANIZATIONS
February 7th, 2018

WILL WE CONTINUE TO WITNESS THE CONTINUOUS SPEEDING UP OF TECHNOLOGICAL CHANGE?

CAN HUMANS BE COMPLETELY REPLACED? HOW DO WE MODIFY PRODUCTION PROCESSES?

HOW DO WE CHANGE WORKING RELATIONSHIPS IN ORGANIZATIONS?

HOW DO WE TRANSFORM RELATIONSHIPS WITH SUPPLIERS, PARTNERS AND CUSTOMERS?

CHANGES TO JOBS BRING GREATER OPERATIONAL EFFECTIVENESS BUT MUST ALTER THEM RATHER THAN DESTROY THEM.

GREATER FOCUS MUST BE GIVEN TO RETRAINING PEOPLE AND DEVELOPING NEW SKILLS, NEW PROFILES AND NEW PROFESSIONS.

THE CONCENTRATION OF WEALTH DUE TO TECHNOLOGY WILL BE ONE OF THE BIGGEST CHALLENGES WE HAVE TO FACE IN THE FUTURE. THE AIM MUST BE TO ENSURE THAT THE WEALTH CREATED BY NEW TECHNOLOGIES IS DISTRIBUTED AS WELL AS POSSIBLE TO IMPROVE THE LIVING CONDITIONS OF ALL HUMAN BEINGS.


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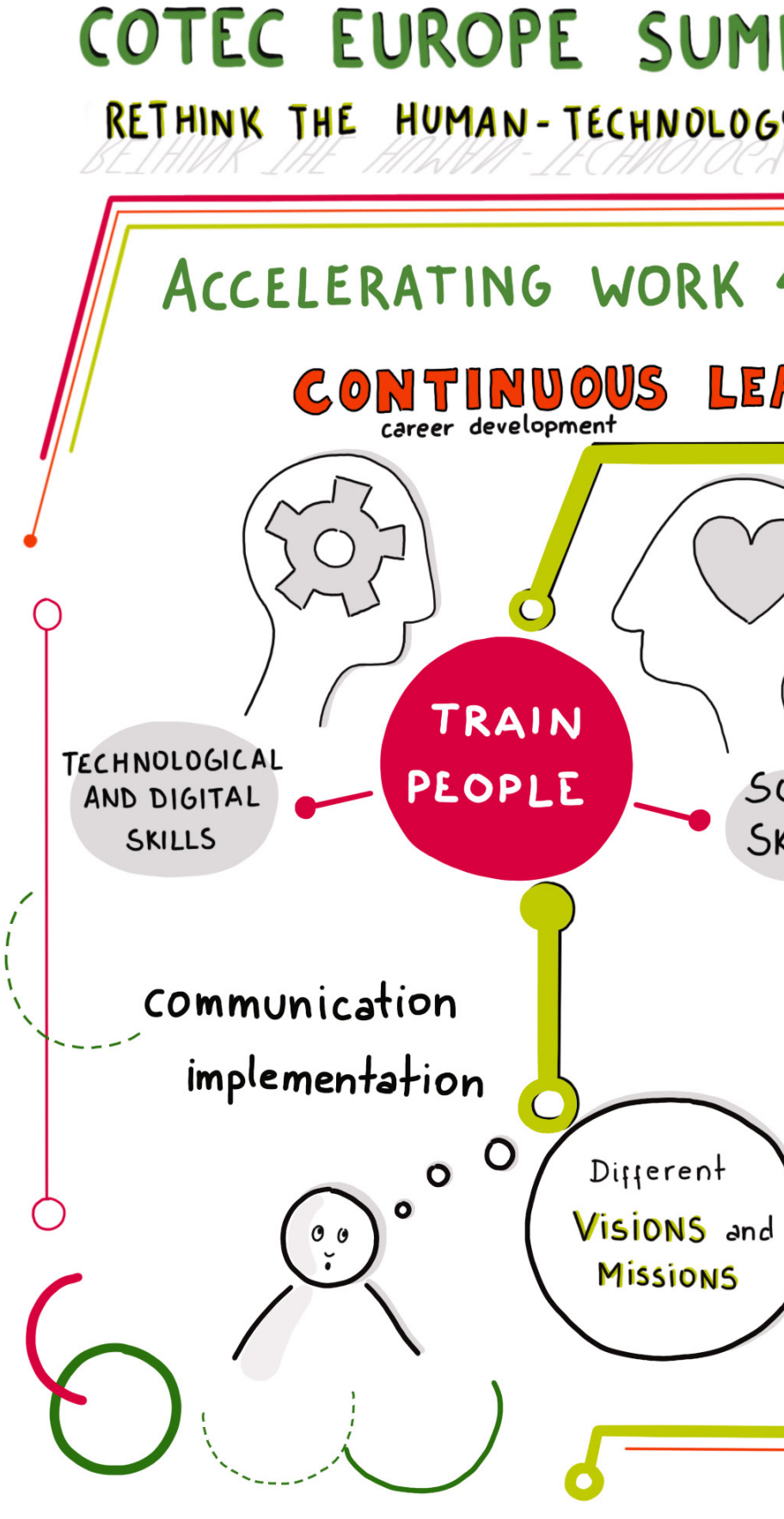
ST
WORK vrs NON-WORK
?
WEALTH DISTRIBUTION
ARTIFICIAL INTELIGENCE
BIG DATA
BETTER LIVING CONDITIONS ?
ACHINE EARNING
SKILLS ADJUSTMENT
Regulation is NOT HINDERING
DON'T PROVOKE FEAR IN SOCIETY!
Where can I have I nice conversation?
Remember when we used to gossip?
How can we make stupid jokes?
I don't envy the machines at all...
time faster and faster...
health
February 7th, 2018

NEW TECHNOLOGIES DEMAND NEW HARD AND SOFT SKILLS, AND COMPLIANCE LEADERSHIP, MISSION AND VISION.

THIS VISION MUST BE UNDERSTOOD, COMMUNICATED AND REPLICATED, BASED ON EFFICIENT AND TRANSPARENT INTERNAL COMMUNICATION.

THE IMPLEMENTATION OF A STRATEGY CAN BE A MORE CHALLENGING TASK THAN ITS DEFINITION.

ALLOWING A WORK-LIFE BALANCE CAN CONTRIBUTE TO TALENT ATTRACTION AND RETENTION.

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4.0 IN ORGANIZATIONS
ARNING
SOLUTIONS
TRANSFORM LEADERSHIP
OFT
KILLS
MULTIDISCIPLINARITY
Professional training
Re-invented University
How to work Agile
New regulations
Reduce burocracy
Create partnerships
February 7th, 2018

THE IDEA THAT 65% OF CHILDREN STARTING TODAY IN PRIMARY SCHOOL WILL WORK IN PROFESSIONS THAT DO NOT EXIST YET, REPRESENTS A SKILLS GAP.

THIS SKILLS GAP CAN BE CONSIDERED AT TWO DIFFERENT LEVELS:

1. INTERSECTION OF THE PHYSICAL AND THE DIGITAL. HOW TO CONNECT THE DIGITAL SKILLS TO THE WORLD OF TODAY?
2. KNOWLEDGE THAT CANNOT BE DIGITIZED AND MUST BE LEARNED BY EXPERIENCE, BY CONNECTING WITH OTHER PEOPLE AND NOT ONLY BY BOOK LEARNING.

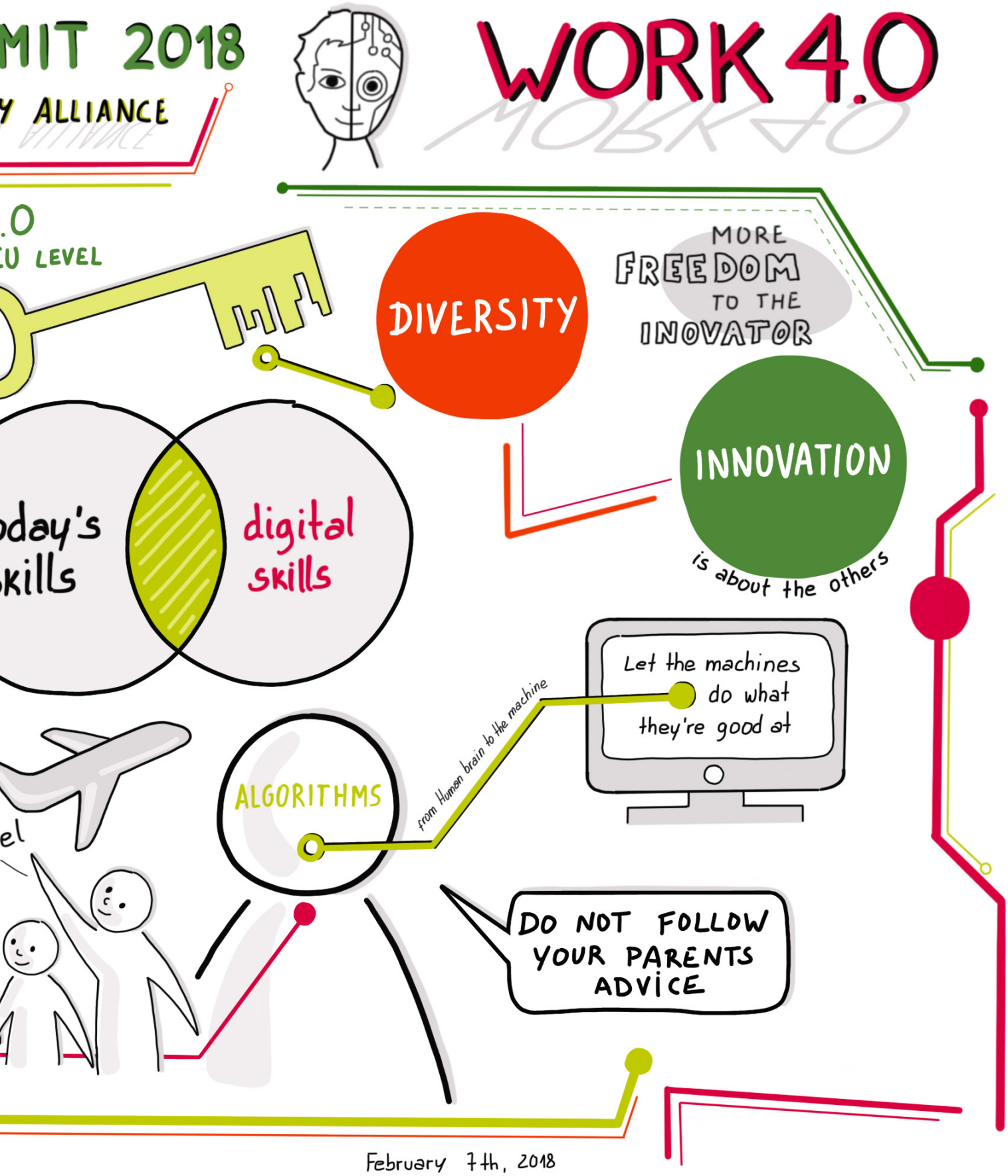
AND HOW DO WE PREPARE FOR THAT?

COUNTRIES SHOULD BE WILLING TO CHANGE THEIR EDUCATION SYSTEMS IN ORDER TO ADDRESS THESE GAPS.

PEOPLE SHOULD BE TAUGHT NOT TO FEAR TECHNOLOGICAL ADVANCEMENTS.

DO WE WANT ARTIFICIAL INTELLIGENCE TO REPLACE US OR DO WE WANT IT TO MAKE US SMARTER OR TO COMPLEMENT US?

GIVEN THAT PARENTS ARE USUALLY RISK ADVERSE, CHILDREN SHOULD NOT FOLLOW THEIR ADVICE. THEY SHOULD CONNECT THEMSELVES WITH THE FUTURE, TRAVEL AND BE ABLE TO CONNECT THE DOTS IN THEIR SURROUNDINGS.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DIVERSITY
MORE FREEDOM TO THE INOVATOR
INNOVATION
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kills
digital skills
Let the machines do what they're good at
from Human brain to the machine
ALGORITHMS
el
DO NOT FOLLOW YOUR PARENTS ADVICE
February 7th, 2018

RECOMMENDATIONS

The seven dimensions identified, grouped together as they fully characterize the transition period, also originate a set of work recommendations intended to accelerate the new era of work.

This set of recommendations, organized by key dimensions, results from all the contributions obtained during the development of the defined methodologies, involving the interviews and ethnographic visits organized as well as the interventions of the participants in COTEC EUROPE SUMMIT 2018.

1 FROM STRATEGIC POLITICS TO LEGACY HEROES

1 Governments must find solutions that combine the drive to speed up and universalize Work 4.0 while transmitting a sense of security to citizens and economic agents.

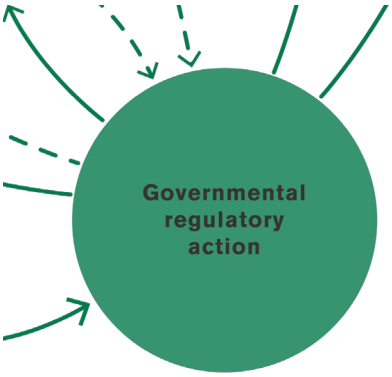
2 The role of companies as reputable social actors able to conceive of new ways of working in the Work 4.0 environment must be borne in mind when redefining labour laws.

3 The public administration in every country must intensify its administrative modernisation, operating as a fertile means of changing processes and mentalities throughout society and the economy.

4 The inevitable inequalities stemming from the specialization and high qualifications required in Work 4.0, as well as those which stem from unemployment in areas which can be automated require urgent policies to engender inclusivity.

5 Also at the level of the expected productivity resulting from Work 4.0, it is important to value the gains in value creation, with fair remuneration that can create a new culture to mobilise workers.

6 The governments of COTEC countries must develop closer ties with the European Union as a whole, strengthening the capacity for innovation and the installation of a powerful and highly connected industry in continental Portugal.



VARIABLE CENTRALITY METRICS
(see Table 3)

GOVERNMENTAL REGULATORY ACTION
#1 Betweenness Centrality
#5 Degree Centrality

The complexity of contemporary societies is awakening the need for an increasing number of policies and more structured government intervention so that a shared vision of essential social cohesion can be achieved.

2 HUMANS AND MACHINES: A NEW WELLNESS CONCEPT

1 The decision-makers and thinkers, at the economic and social level, must be aware of the importance and irreversibility of the Work 4.0 revolution, urgently putting the theme at the heart of the agenda and generating public debate around it.

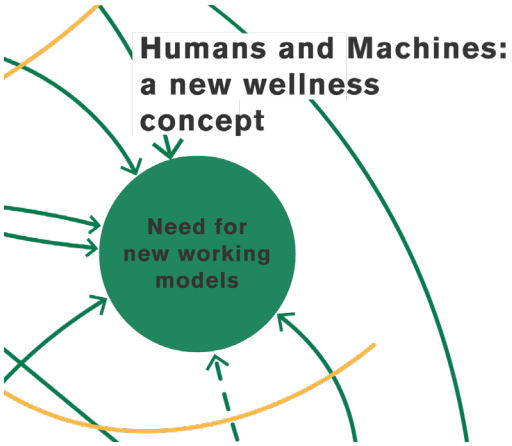
2 The drafting of a Charter of Principles establishing the predominance of humans and their intelligence over machines and their ability to work autonomously is of major importance in the interplay of control in the workplace.

3 The diversity of human resources – in terms of demographics, literacy and mentality – obliges strategies for inclusion and empowerment of expertise, interlinked in the transition phase to Work 4.0 for better technological assimilation.

4 The new physical and digital environments in which humans and machines cohabit recommend the creation of their own codes of conduct and mechanisms that can be swiftly reconfigured depending on the lived experience.

5 The investment in forms of remote working, as well as flexibility in allocating time, require careful planning that considers new talent profiles, such as millennials.

6 It will be a good idea to develop psychological studies – challenges to construct identity through the new system of "mirrors" in which humans and machines coexist – and linguistic studies – new emerging languages.



VARIABLE CENTRALITY METRICS
(see Table 3)

NEED FOR NEW WORKING MODELS
#1 Degree Centrality
#1 Eigenvector Centrality
#4 Betweenness Centrality

The cohabitation of man and intelligent machine will lead to successive role adjustments and it is up to humans to take the most out of the experience and the expertise of their "new" working colleagues.

3 ONGOING DEEP CULTURAL TRANSFORMATION

1 The concept of the creative economy – the product of collective intelligence and broad citizen participation – requires that the humanities and the arts be regarded on a par with science as centres of value creation.

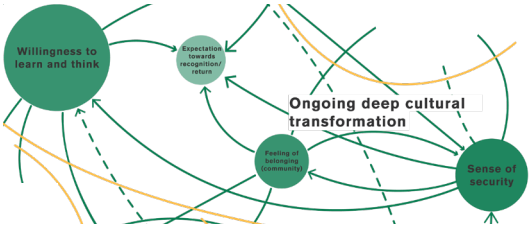
2 The fact we live in a "risk society", with its unpredictability and volatility, invites the active search for subjective forms of security that contribute to new structures of positive belonging.

3 Digital literacy is an urgent theme, integrating every level of formal and informal education. While it equips people for digital work, it also helps them to overcome a fear of this unknown.

4 The educational system needs to change, with a revised curriculum and teaching methods, in line with the new model of economic and social value creation – networked, on a global scale, centred on demand and ultra digitalized.

5 Focus on "informal" training models outside the traditional academic educational system, including the enhancement of internal company initiatives that can inspire the formal system.

6 Recognition of the younger generations as natural leaders of the digital transformation processes. Giving them a relevant role in the social hierarchy has high cultural value for society as a whole.



VARIABLES CENTRALITY METRICS
(see Table 3)

WILLINGNESS TO LEARN AND THINK
#4 Degree Centrality
#2 Betweenness Centrality
#5 Eigenvector Centrality

EXPECTATION TOWARDS RECOGNITION / RETURN
#4 Eigenvector Centrality

FEELING OF BELONGING (COMMUNITY)
#3 Degree Centrality
#2 Eigenvector Centrality

SENSE OF SECURITY
#2 Degree Centrality
#3 Eigenvector Centrality

The changes brought by the spread of digital technology and the web, and the vision of what the future might be, has caused significant cultural changes in European societies, where global and local (creative) tensions constitute a relevant topic in itself.

4 A BIG MOVE FOR BIG DATA

1 Clarification of the Work 4.0 concept would be very useful. The difference relative to the "mere" mass use of the internet and the gradual spread of robots must be explained: the level of AI, interconnectivity and speed are where it differs.

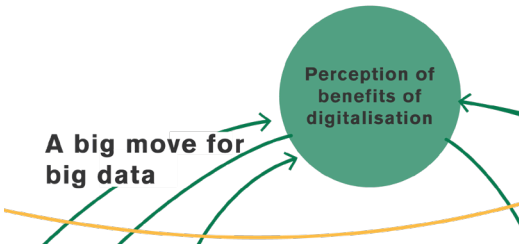
2 The perception of machines as "man's best friend", the awareness of the structural difference of intelligence between some and others and the radical definition of robots' lack of empathy and emotion must be explained.e in the interplay of control in the workplace.

3 Artificial intelligence has objective advantages over humans in terms of rapid processing of large amounts of data and must be fully used in planning complex social realities.

4 On the other hand, it requires critical vigilance of the limits of modelling, establishment of standards afforded by AI – leading potentially to simplification and the reduction in sought after diversity.

5 The constant introduction of new digital products and environments into daily life brings ergonomic and practical management challenges for users that would gain from being monitored for better adhesion to Work 4.0 culture.

6 Data, as a very important raw material, must be experienced and seen beyond the administrative and legal dimension. To the indispensable defensive and protective logic must be added its enhancement for the positive for everyone.



VARIABLE CENTRALITY METRICS
(see Table 3)

PERCEPTION OF THE BENEFITS OF DIGITALISATION
#3 Betweenness Centrality

The presence of digital technology is visible in all spheres of human life: at the individual level, propelled by mobile technologies, at the community level, and at the social and economic level, as a whole, on the global scale. This omnipresent aspect has been seen and experienced as a story of success, of overall contentment and involvement by those who intervene, fostering a promising environment for its qualitative and quantitative.

5 A POPPING UP OF NEW BUSINESS MODELS

1 It's necessary to have an in-depth knowledge of the value chain afforded by the Work 4.0 philosophy, which covers the whole product lifecycle and leads to new areas of intervention by companies far beyond the initial sale.

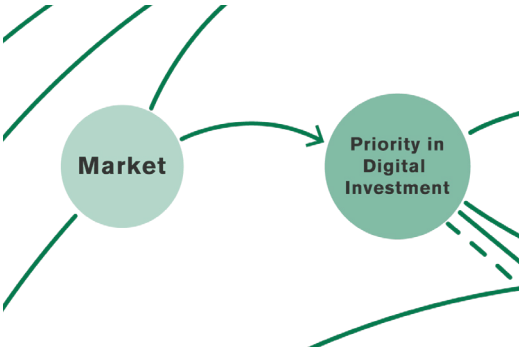
2 It's important to develop a more careful vision in terms of timelines, overcoming the tendency to manage (only) for the short term. The creation of medium- and long-term scenarios is more compatible with Work 4.0 requirements.

3 Learning from the movement underway of the concept of the more inward-looking company towards an ecosystem in which there is a broad and constant openness to the outside allows a good strategy for choosing and managing business platforms.

4 The elevation of talent, as a valuable asset via knowledge, to the level of importance of financial capital is a key issue. The economic enhancement of intangible HR must be taken into consideration by banks and investors.

5 The rate of customers' technology assimilation will affect the speed at which they absorb available innovation. A value proposal centred on demand, on emotions, is key to successfully promoting sales.

6 Exploring all possible combinations of actors (B2C, B2B, B2T and, increasingly, C2B) is a mandatory task in order to explore the potential opened up by Work 4.0 and its new business models.



The shredded digital transformation is characterized by its impact on systemic social, economic and cultural interaction. Businesses are experimenting with new mediation models, which represent a crucial element taking clients' perceived value to unprecedented levels and subsequently demand.

6 SKILLS: HARD, SOFT AND ITS BEAUTIFUL COMBINATIONS

1 Understanding the profound interdependence between hard and soft skills in the Work 4.0 environment, resulting in the valuing of the individual factor in the value creation process, which must be borne in mind in assessing performance.

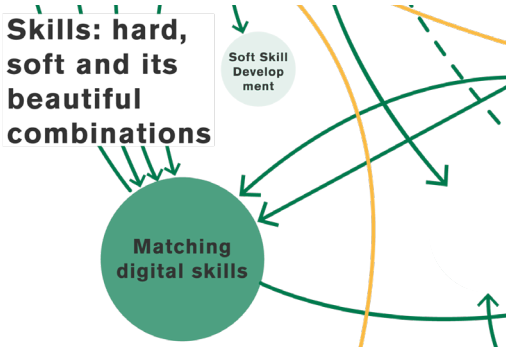
2 Investing in skills aimed at understanding and managing complexity, alongside stimulating critical thought, familiarity with personal creativity and the desire to share with others.

3 Fostering the development of teamwork skills, including physically close and remote teams, variable in composition and in flexible time periods – a "looser" idea of the team.

4 Incentivising the practice of constant exercises to see the full picture and to deepen parts of it, developing a computational approach that includes classes of abstraction, breakdown and recognition of patterns and algorithms.

5 Establishing constant proximity between skills developed during the process of transition to Work 4.0 and the new professions that will emerge, benefitting from the time we have to prepare them.

6 Critical transfer of learning from the Work 4.0 environment to social practices, in the sense of harmonising languages and developing a work-life balance.

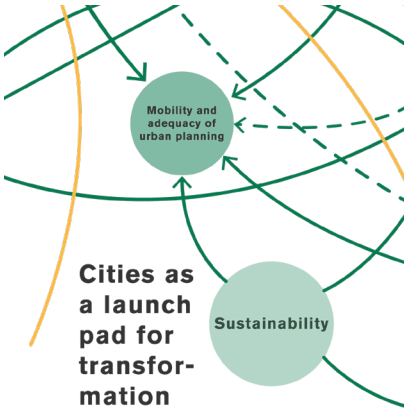


VARIABLE CENTRALITY METRICS
(see Table 3)

MATCHING DIGITAL SKILLS
#5 Betweenness Centrality

The growing significance attributed to the concept of "skill" in leadership practice reflects the awareness of its profound complexity – summarized by the ratio of very large-scale to very high speed. Space comes in for new multiple social phenomena and its manifestation towards a central idea that highlights the paradigm shift framework where processes are as important as results are.

7 CITIES AS A LAUNCH PAD FOR TRANSFORMATION



1 Defining the city as the right social format to realise the full implementation of the Work 4.0 revolution, investing in its symbolic and functional design to empower collective intelligence and the physical wellbeing of citizens.

2 Demographic pressure – low birth rate and long lives – obliges governments to consider new approaches to active populations, attracting people from outside and upgrading the skills of national human resources.

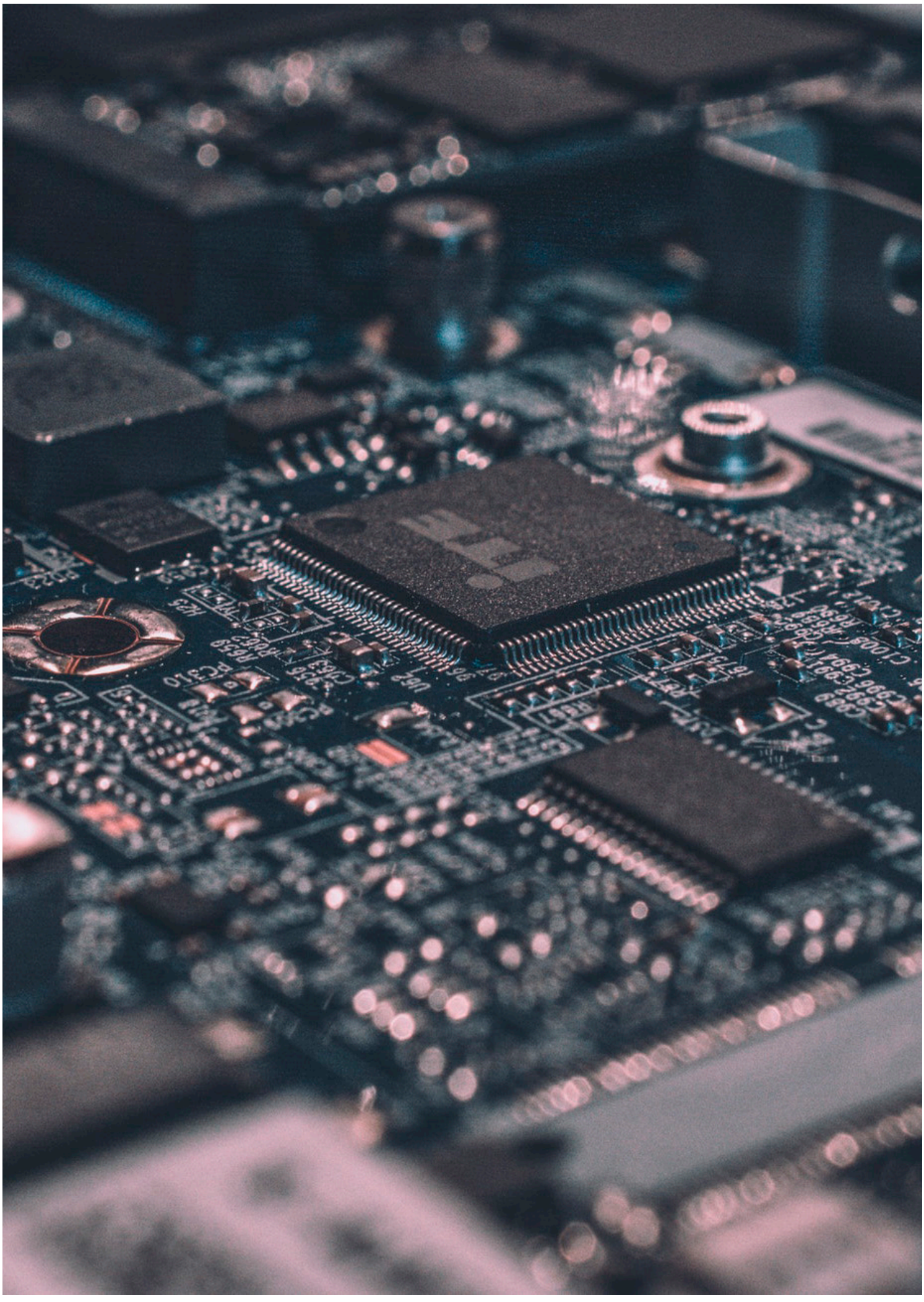
3 Defence of artificial intelligence and the major systems of automation as a decisive resource for the efficient management of cities in all aspects of land planning and the respective "mobility policy".

4 Fostering an alliance of purpose between technology and the environment, giving body to the values of sustainability through operational accountability of each citizen in the digitalised and mobile everyday.

5 Deconstructing what has been a working environment/workplace until now, opening up to the possibilities of Work 4.0 and the reconfigurations of associated space and time, working in autonomous vehicles and travelling in well-equipped rooms.

6 Contributing, for sociological reflection, to new forms of local power with greater involvement of citizens based on their networked, real-time "digital nature".

Cities have the uncanny ability to create favourable ecosystems that nurture modernization. This dominant type of habitat reinforces its strengths creating a clear predictability and assumption of its place as a trendsetter. At a time that calls for multiple skills, only the city is endowed with suitable critical mass, speed (and quality) for talent.



ANNEX

ABOUT SYSTEMS APPROACH

Addressing complex social systems in a comprehensive way calls for a new holistic approach, as opposed to a linear problem-solving methodology, which falls short of shedding light on emerging and unpredicted patterns and ability to promote an integrated vision of all the parts involved (singular elements or sub-systems) highlighting their interconnectedness.

The case for a systems approach has been growing together with the perception of the need to cope with crucial changes and the adaptation of the most diverse sectors such as health, education and the environment, to name just a few. The public sector, in its role as the steward of shared social systems, is one of the agents that will benefit the most from a systems perspective and the breakthrough innovations that it potentially unleashes. Moreover, a systems approach is more relevant as it strives for more participatory and understanding decision-making processes, and helps achieve higher levels of engagement by inviting all stakeholders to participate in the systems mapping process.

A warning regarding the two main components of a systems approach and the road ahead:

On the one hand, there is the systems thinking component, understood as a way of collectively thinking and understanding complex interrelated problems implying or suggesting a shift in mental models by broadening the limits of one's own reality and ways of seeing the world.

On the other hand, the systems practice component calling for specific intervention towards a systems change, which implies new ways of doing things and the courage to take innovative actions on elements of the system different from the traditional ones, carrying with it the uncertainty of the long-term results.

The analysis of the map focused on the connections established between variables. Those connections are characterized by:

1. DIRECTION
a connection from variable A to variable B or vice-versa has a different meaning;

2. SIGNAL
the connection of variable A can positively (+) or negatively (-) affect variable B.

For the fifteen variables in the interviews, where each variable can be connected to 14 other variables, the maximum number of connections possible is 210. However, during each exercise, the highest number of connections established between the variables in individual interviews was 15, with an average of 7 connections by individual exercise.

When all the layers (interviews) are overlapped on a single system map, what looked simple starts to transform into a more complete and complex map, with a total of 42 connections established between the 15 variables. It is also interesting to notice that, from the 39 connections established, the vast majority (33) connect positively to the variables, pointing out that the system is potentially unbalanced.

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