# The state of DIgIalIzatIon In SME’s In East WestfalIa, Northwest Germany

**Summary of results obtained by Bielefeld University of Applied Sciences**

All interviews conducted in German. Transcripts of all interviews available under separate cover.

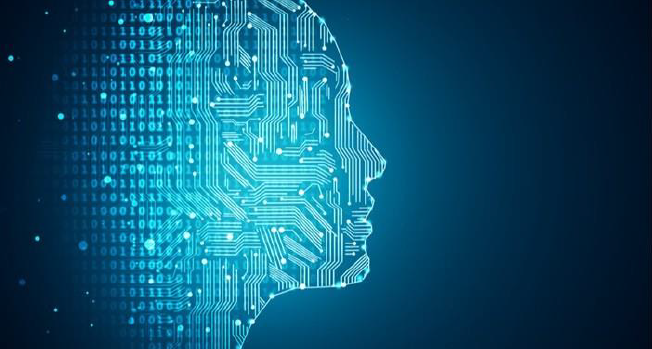
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# Building Virtual Learning Platform for Environmentally-Friendly Digital Transformation Management (Digivıp)

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| **Methodology**   * Guided interview along prepared and pre-shared core questions * Mild standardization for the benefit of identifying specifics   **Conditions and context**   * Single online interviews * Previous warm-up contact * Informers identified by rank, profile and readiness   **Non-disclosure clause**  For publication, all company data, names and specific references are to be anonymized. |

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# UnderstandIng DIgItal TransformatIon

## RelatIng to the concept of dIgItalIzatIon

All interviewees’ understanding of digital transformation follows a business pattern: ‘inside’ vs ‘outside’ a company. As regards digitalization, this distinction is made between 1. internal corporate processes and functions esp manufacturing, and 2. external market operations and interaction with clients and suppliers.

The former perspective suggests that digitalization promises higher efficiency and smoother operation. The latter one is said to create new opportunities, activities, services and business models. It is generally emphasized that both perspectives correlate in as far as external ‘digital’ activities require adequate internal conditions and in return, a digitalized organization can embrace new external opportunities.

Digitalization is thus not seen as a mere efficiency drive but also as a wave of opportunities not to be missed. Examples are emerging digital services in agriculture and the building industry and new business models in household management services (was ‘appliances’).

General agreement and also enthusiasm regarding the benefits and opportunities in those two fields is universally expressed but with a more shaded reservation: digitalization can easily be handled as a fashion and image-building trend but should actually be approached with diligence and preparation. This seems to coincide with statements in which all interviewees see their companies neither as trendsetters nor as mere followers. The dominant picture is that of an analytical and critical approach in which real internal conditions are weighed critically against abstract visions of opportunities.

The range of topics that digitalization, in the eyes of those companies, involves spans a broad spectrum of corporate activities:

* Administration and data handling
* General introduction of digital technologies and data-driven processes
* Additional and high-quality business intelligence to be obtained through data analytics and emergence of AI solutions
* Re-organization of supply chain and distribution
* Machine-to-machine communication mainly in robotics for manufacturing
* New products and services, new approaches to R&D
* IT literacy and new learning environments
* Mindset and attitudes towards change
* Organizational hierarchies, team building and cross-disciplinary communication and others

The similarities in interpreting the concept of digitalization are striking but not surprising, all the more as the three businesses interviewed are either large and mature family businesses or tech-savvy SMEs.

## Self-ımage

In universal agreement, all interviewees claim to have designed their own approach to digitalization.

Remarks made by interviewees suggest that what determinates these respective approaches seems to be

* the corporate culture and the company’s readiness for digital change
* the support from senior management
* the specific and seizable benefit(s) seen in digitizing a certain activity
* the search for a ‘tempered’ way of dealing with change, let alone disruption
* the demand for digital products and services in the market

Where the companies interviewed do differ is their approach to implementation and the impact of market specifics and diverse corporate cultures. The following variations of this diversity topic have been detected:

* Idiosyncratic approaches to Digitalization with strong insistence on the respective corporate culture and specific needs
* Adversity to disruption of specific corporate functions and endeavors to protect core processes
* Diversity in ‘evolutionary’ approaches to implementation of digital processes
* Diverging attitudes to benefits of hiring external consultiung services
* Specific models of rolling out digital innovation, ranging from satellite to internal task force to cross-departmental labs or talent pools to ‘ricochet’ approaches in which one function after another is digitalized
* Digitalization seen as a long-term process to be approached selectively and with a view of short-term vs lon-term benefits
* Company-specific priorities defined for functions to be dgitalized, e.g. parts of manufacturing vs entire supply chain, distribution vs customer bonding, machine-to-machine interaction vs administratuve processes
* Involvement of universities a suppliers of HR vs providers of R&D

The traditional distinction companies tend to make in growth and profitability strategies between...

Introducing new (here: digital) business models, expanding business

Making interaction with market, client service and communication or manufacturing faster, better, more efficient / effective

And

... can be found in all responses. The common ground is that the former tends to meet with early and unreserved acceptance from senior management whereas the latter *(more disruptive und seemingly uncertain)* option is taken up with more risk aversion and reservation. It is thus not surprising that all interviewees have based their tech advocacy inside their companies mainly on efficiency arguments, with disruptive innovation (option 2) so-to-speak sailing in the shadow of efficiency drives.

This finding seems to coincide with the more ‘evelutionary’, cautious strategies digital change is implemented with. Universal emphasis is on careful selection of corporate specific functions to be digitalized and on a general rejection of blanket approaches.

The following variations of implementation strategies have been found:

* Implementation by function and corporate activity, not globally from head to toe.
* Setting clear priorities based on (a priori intelligible) clear benefits
* Increasing manufacturing efficiency by switching production chains to wireless machine-to-machine, function-to-function and department-to-department interaction.
* Installing a satellite company developing, apart from efficiency-enhaced solutions, new products, markets and organisations
* Installing a Digital Tranformation Office that oversees and supports digital change across departments
* Building digitalization clusters and ad-hoc networks inside a company that are organized both horizontally and vertically.
* Involving universities at senior management level. All innovation processes installed not only top-down but also bottom-up. Allowing for permeability and diffusion of digital innovation processes.

In their long-term strategies, the companies interviewed do give, though with caution, room to experimentation and development of digital business models, e.g. designing a comprehensive, cross-brand farm management system going far beyond agricultural machinery management.

As regards the wider perspective of societal challenges like decarbonization and climate protection, the potental of digitalization is acknowledged but the extent and quality of implementation is, to varying degrees, said to be trailing behind potential impact.

Other critical areas where comapnies struggle are changes in supply and value chains and possible breakups of corporate process and structures.

It is universally stated that a common understanding of Digitalization and its opportunities is not easy to achieve and requires considerable effort and expenditure across the entire organization, especially with regard to bringing together disciplinary cultures (engineering vs commercial operations/management) and corporate hierarchy levels. This is a hint at the fact that behind the challenges of mere digitalization, organizational change and loss of control are (and are acknowledged to be) the ghosts ‘*that are haunting the planet*’.

Despite the differences and acknowledged shortcomings, the overall outlook on Digitalization is reasonably optimistic with deficiencies of innovation systems or existing corporate organizations generally being recognized. Two out of three companies interviewed are satisfied and partly proud regarding their track record. In one case the challenges are more emphasized than the achievements reached in digitalization.

# Understandıng the use of new technologIes

A widespread understanding of Digitalization is that it is about technologies. This is a limited but somehow understandable view. All respondents consistently refer to the wider context that will affect organization, corporate culture etc. They do insist, however, on the urgent need for specific technological skills that companies need to upgrade and acquire.

## SpecIfIc dIgItal technologIes and theIr absorptIon

A look at the specific technologies selected for adoption and implementation will reveal parallels with companies’ overall outlook on Digitalization as all technologies are considered in their immediate to mid-term payback and specific benefit and less in their contribution to an overall desirable state of the organization.

All interviewees agree there is no real Big Bang of technological development, but something like a long-term stairway to (digital) ‘heaven’. The drivers of Digitalization are seen in the benefits and added value for businesses and consumers, and of course not in technology for technology’s sake.

These benefits are thought to be

* more efficient manufacturing,
* higher performance in distribution,
* better and partly realtime control of all corporate functions
* more effective client service
* market opportunities i.e. new products and services, larger reach and larger audience (quoted with slight hesitation but conviction)

The following benefits seen in specific technologies vary in appreciation depending on the respective company’s ambition and level of achievement in Digitalization.

## WIreless connectIvIty

All intervieewees see connectivity as a prerequisite of digitalization and a relatively low-threshold challenge. Although digital connectivity is perceived as a basic stage of the Digitalization journey, they do nevertheless emphasize their company’s achievements, which may be a slight indication that mere connectivity is a relatively recently accomplished status quo.

More advanced applications using connectivity in machine-to-machine communication and similar are less emphasized and do not seem to have been implemented by all companies.

Usage made is mostly in realtime stock control, warehousing, logistics, distribution and, at higher level but in rarer cases, machine-to-machine communication and Robotics

Specific difficulties with connectivity are experienced in agrculture and construction i.e. physically mobile oerpations, and less in stationary value creation such as manufacturing or administration.

Some references are made to co-creation facilitated by connectivity.

## Sensorıng

Sensoring applications are by far not new to business and manufacturing but have taken on new meaning by connections made to Data Analytics and Robotocs. Mere (e.g. optical or chip-induced, e.g. RFID) recognition is standard on the data input and and automated execution side e.g. in manufacturing (less in administration) or logistics but less often found as a trigger of digital decision-making let alone smart contracts. The benefit of sensoring itself is fully acknowledged but its exploitation in the wider value chains more of a novelty. Pioneering applications are, e.g. in agriculture, the collection, processing, sharing of weather (forecast) data cum automated fleet deployment or automated machine maintenance planning in manufacturing.

The potential of realtime tracking and tracing for control and, as a more advanced step, for business development is, on average, acknowledged but not fully used. Certain use cases have demonstrated low reliability for technical reasons but also due to problems or little experience with Data Analytics and data cleaning.

## MachIne-to-machIne communIcatIon

Wireless data exhange is above all (cf 1) connected to sensoring and machine-to-machine interaction, e.g. in robotization.

This competence and technology with its wide-ranging repercussions and potential is obviously easier to deploy in stationary line processes like manufacturing than in mobile or shifting usages. It is therefore more developed in factory-based manufacturing processes than in agriculture or construction. As it requires highly structured data the challenges to operating or supervising staff’s qualifications are thought to be considerable but manageable if the benefit is deemed worth the investment.

## Data AnalytIcs

Data obtained from sensoring, IOT or Machine-to-Machine interaction, i.e. from mostly linear or structured processes, are found to be easily manageable by most companies. When it comes to unstructured data to be analyzed for understanding e.g. customer behaviour, fuzzy e.g. geophysical conditions or complex supply chain processes though, interviewees voiced much lower confidence and mainstreaming levels. Big Data seems to be a largely untapped mine and is seen as a field of specialists, which is why companies occasionally call on external partners including startups that can offer breakthroughs in areas of specific interest.

## IoT

All manufacturing industries have installed IoT technologies to varying degrees, be it for product handling, machine feeding, conveying, product processing or finishing. The main reasoning behind it is an increase of efficiency and control. This has, however, rarely reached a level where more disruptive technolgies like Blockchain or Smart Contracts are implemented.

## RobotIcs

IoT logically connects with Robotics, which is widely used even in lower-scale manufacturing or mass customization. Interviewees emphasize the routine their companies have acquired in re-organizing production units, even in difficult environments like construction. If there is a gap it seems to be less in the absorption of a technology than in hiring the necessary engineering skills, which are in very short supply in Germany.

## AI

AI’s potential is largely seen as a cloud in the sky with some silver lining shining on opportunities of the present.

One opportunity seems to be seen in realtime visualization in the sense of Augmented Reality. This mostly relates to customer service and planning including crowd sourcing, especially in the building industry. Beyond this, most equipment manufacturers have, e.g. in agriculture, developed expert systems for monitoring progress and flow of harvesting or field management processes that go beyond machine-to-machine interaction. They do question, however, the benefit of full-scale implementation of AI as the cost burden is high. This is why manufacturers may recur to heuristic representations that produce reliable forecasts of schedules, risks of disruption and return, including external partners’ contribution aligned with the principal value process.

AI also plays an important role in customer environments. Beyond stationary manufacturing, it is suitable for geo-based services like agriculture and also construction as typically, technical systems are deployed inside eco-systems. In these, image processing inside and outside machines is important. Customers value e.g. being able to recognize situations where drivers of machinery are supported by risk forecasts. Other applications are the use of AI in realtime sensoring for collecting and categorizing harvest data. This could offer options for executing changes in machine operation with expert systems.

Generally speaking, the more complex and multi-faceted conditions and other variables are, the more AI becomes viable.

There are a number of issues at regulatory level though, e.g. the EU’s AI directive, in which e.g. AI’s impact and product liability are regulated. Operators need to understand what a system learns and has learned. This poses the question whether newly learned skills can be deployed directly or whether a process of validation or clearance is required. After all, AI may drive processes that are high-risk for humans involved.

Some of the relevant issues are not addressed in the directive that, for the time being, is limited to high-risk vs low-risk classification of AI.

One of the worries expressed seems to be political: legal directives impose how issues e.g. with AI are solved. A high burden and slowdown factor is seen in overdetailed regulation of technology implementation. Instead of just setting (ambitious) objectives for which industry could find its own ways of achieving them, procedures are often narrowly defined and standardized, which is perceived to reduce margins for creativity and inventiveness.

## ‘Paperless’ admInIstratIon

In administrative or commercial functions, the combination of connectivity, optical recognition, IoT, ERP systems and sometimes AI has, according to all interviewees, made dramatic progress towards smooth digital workflows and automation, with obvious differences between majors and SMEs (especially craft operations) of course. On a scale of 1 to 5, Digitalization in administration is often assessed at 3 and as more advanced than in manufacturing – with reservations applying as to the interpretation of the comcept of Digitalization (cf chapter 1 above)

What seems to be a worry though is the interface of administrations with production / service delivery functions.

## BlockchaIn, Smart Contracts and DLT

Compared to the progress achieved by the three companies interviewed, their industrial environments and sectors, in deplyoing IoT and even AI applications, Blockchain, Smart Contracts and process-disruptive technologies are understandably being approached with more skepticism and hesitation.

All other technologies listed here are generally implemented, at early to mature and highly complex levels, but with a high dependence on the area of application. This is where the often-mentioned selective approach to Digitalization comes in.

# Understandıng human resource ıssues In DIgItalIzatIon

## General experIence

All participants agree that Digitalization requires new skills profiles and skills mixes. These concern

* Specific (digital) technologies and data awareness
* Management and organizational skills (depending on hierarchy levels), digital leadership
* Soft skills (communication, teamwork, initiative, cross-culture…)
* Personal dispositions, qualities and attitudes (change resilience, creativity, uncertainty resistance,

Another common theme is the age pyramid within the workforce and the diversity found in learning mode, speed and motivation. New recruits will usually bring learning habits different from staff in jobs. Older staff take longer to adapt their tech skills by training, self-study or in other ways. Younger staff tend to move more quickly. This diversity leads companies to choose specific training and learning approaches for specific target groups. Companies tend to focus specifically on specific groups, addressing target groups in line with specific conditions and evident benefits. Talent and experience retention is a common worry so approaches depend on audiences and are carefully scaled and calibrated.

The problems encountered in competence development are more in convincing and winning over staff than in the content of the learning objects. The respective task is thus less of a cognitive but more of an affective and psychological nature in which empathy and experience brought in by management are key. This needs to be complemented by incentives, time, and freedom granted so that opportunities are seizable. Opportunities are to be understood, explored, tested and investigated with curiosity. In this effort, gamification of learning items and processes can help immensely.

The freedom that ideally characterizes learning processes is to be matched by a culture of error and a rejection of an often dominant culture of perfection. Step-by-step learning and a gradual adoption of skills following a motto like #ever better is found to be key.

For details cf Organizing learning and sourcing the skills required below.

## TechnIcal competences

Considering the pace of technological change, all respondents opted for flexible learning and training agendas that are to reflect actual and specific corporate and individual skills needs rather than broad profiles acquired in storage learning settings.

It was unanimously clear that general data affinity, and more specifically skills like creating, collecting, processing, securing, analyzing, and sharing data should be at the heart of learning agendas.

At a more specific level, 3D printing in development and technical design environments and also in manufacturing was also considered an asset.

Competence in managing cloud storage and service solutions is to complement data skills.

At a more basic level, which applies in particular to the building sector, smart collaboration and wireless connectivity are seen as the more immediate challenges.

Most technical skills requirements are, however, addressed in a selective and targeted manner through online study services. Despite the fuzziness of technical qualifications future specialists will require and a perceived shortage of technology awareness among senior commercial management, HR departments seem less concerned with matching technical skills needs than with hiring staff with adequate soft and personal skills profiles.

## Soft skills sought from new hires

The soft skills most sought after seem to have changed from communication and teamwork to more personal attitudes like curiosity, readiness for change, error and uncertainty tolerance, and innovation drive. Ideally, these qualities are combined with critical thinking and digital self-organization, digital collaboration, quality awareness, delivery skills and competence in self-access-learning – most of them going far beyond the digital sphere.

It is these personal abilities and qualities that recruiters tend to primarily look out for in staffing procedures. This suggests the conclusion that technical skills shortages are seen as manageable deficits whereas personal dispositions will take longer to grow or change if not in line with requirements.

## SkIlls profIles

As regards skills mixes, all interviewees emphasize the shortage of science, IT and technology skills they find in the labour market. This seems to apply to all levels of the skills pyramid and affects planned digitalization efforts. It is particularly noteworthy in corporate commercial and HR functions where wider technical knowledge would make technical and recuiting operations more dynamic. As a secondary effect, this trend slows down technological innovation a general mental readiness for digital change.

Even in Engineering, expanding staff’s data and IT skills is often not an easy game. In one example, the distribution ratio of those skills among engineers was found to be

* one third that had the skills
* one third that managed to acquire them
* one third that did not.

Though this case is quoted as an isolated phenomenon it hints at the fact that technical upskilling efforts in companies require, apart from adequate materials and incentives, a readiness to learn and to embrace change. The close interplay of attitute, mindset and skills upgrades is found to be a key factor in successful HR development that is to move digitalization forward.

Technical skills relevant for digitalization are, however, not seen as an isolated area of HR development. They are viewed as closely related to cost and quality awareness, project management and ‘people’ / soft skills. Frequent reference is also made, looking at the side of individual staff members, to mindset and attitude that determine readiness for and outcomes of learning.

From a collective angle, learning motivation and personal development are also seen as closely connected to corporate culture, processes and organizational development. To put it bluntly: an organization whose units remain locked up in silos and that offers little empowerment to staff will not acquire the skills necessary for quick progress in digitalization.

Against the background of aging workfoces, it is thus obvious that success in corporate HR development and upgrading skills portfolios appears as largely dependent on variable context factors such as organizational behaviour, inclusive processes, participatory corporate culture, trust culture, tangible and intangible incentives and empowerment.

All interviewees share the view that skill building programmes for digitalization need to look far beyond HR and training and should and will sooner or later be coupled with major corporate re-organisation.

## OrganIzatIon and management

The changes imminent in organizations will concern hierarchies, management and leadership styles, value chains and corporate processes, customer relationships, team organisation, stakeholder relationships and project management. It is interesting to note that those businesses that see themselves as advanced in this respect also seem to have embraced digitalization most actively.

Despite obvious successes there are also bottlenecks and slowdown factors though. These concern technical skills shortages as mentioned above, the sometimes slow change in management culture (‘from directing to coaching’) and lengthy mainstreaming processes in which innovations are implemented.

A variety of models are used to promote digital change. Popular approaches seem to be

* Creating digital ‘satellite’ labs as separate units – sometimes as separate legal entities - developing innovative products, services and processes
* Building digital talent pools that make digital skills available across divisions and departments of companies
* Combining these talent pools with traineeships offered to young graduates that are immersed with teams and assigned specific digitalization tasks
* Using student internships for analyzing digitalization options
* Identifying pioneer units for digitizing processes with the chance of upscaling change processes later
* Calling on universities for supporting skill bulding programmes
* Restricting engagement of external consultants to a necessary minimum.

All efforts seem to point at more flexibility, cross-disciplinary processes, higher uncertainty tolerance, disappearance or breaking up of formal hierarchies and more co-operative and collaborative structures in companies. It is self-understood that these trends play out to degrees varying considerably from one company or department to another.

## Mındset

The biggest slowdown factor to digital change that is unanimously stated is mindset issues. Leaving routines and acquired wisdom behind for an uncertain industrial future requires a dramatic change in corporate culture and individual disposition. This change will, especially in an aging workforce and society, not come overnight and can be seen as the reason why HR departments consistently insist on the ‘evolutionary’ character of the transformation their companies are undergoing. An individual can-do and a collective ‘Yes we can’ spirit can easily be undermined by initial failures, errors and dead ends.

To harness a workforce against a loss of trust and confidence, HR and management need to combine incentives, appropriate and positive communication and wording, an error culture, visibility and inclusiveness in their leadership style. The digitalization journey will thus become a much deeper change movement going far beyond a transformation of specific processes.

## LearnIng and change

All learning is a change effort that staff are asked to make. This effort needs incentives that are to target human needs and tastes. Interestingly enough, the trend about incentives is moving away from pay and tangibles towards values like ‘appreciation’, ‘meaning’ and ‘sense of belonging’. Today’s workforces do expect fair pay and benefits but also claim personal respect and recognition of their contributions. This respect can be experienced in workplace communciation but also in inclusive planning and implementation processes where staff are seen as more than executioners of management decisions. All interviewees emphasize the crucial factor of a stimulating and supportive work and learning environment that combines challenges with appreciation.

In this type of setting, curiosity can become a key factor of productivity. Curiosity can be stimulated by horizontal and vertical empathy and openness and is enhanced by error tolerance, listening habits and enthusiasm, often paired with cross-disciplinary thinking. The learning chain thus goes from abilities to readiness to ultimate delivery.

To make learning efforts fruitful, companies have started reshaping their training programmes in several ways:

* Offering job-based training related to upcoming challenges a company is facing; high matching degree and little redundance (so that staff see the benefit of their effort)
* Drawing away from ‘storage learning’ and advocating a ‘just in time’ logic that integrates with team tasks and places responsibility on a learner
* Individualizing learning so it can flexibly integrate with workload (so that staff experience a sense of purpose)
* Digitizing learning materials (so that they are easy to access) or recurring to offers from Udemy, Khan Academy or MOOC providers

Respondents do not ignore the sacrifices this requires on the part of staff, i.e. higher workload density if learning is integrated or fewer opportunities to get away from daily routines when travelling to external training, fewer chances of socializing with peers during workshops etc

Formal training courses have actually not disappeared but often focus on soft skills.

In a changing environment that has started to empower staff more, it has, so it seems, become less of an urgency for staff to define the limits of their personal engagement, which is why even the compacting of workloads when using idle times for learning has become acceptable. This convergence is only viable, all interviewees acknowledge, if the benefits are obvious and seizable for staff.

İt has also been noted that learning habits differ between staff categories and ‘trades’. As opposed to administrative and commercial staff, technical staff tend to learn in their spare time.

To make learning more attractive, some (though a minority of) companies are allocating more working time to self-learning, e.g. by freeing up one day per month for studying relevant or interesting subjects. This might motivate staff members further down a corporate hierarchy where more efforts need to be made in the future.

Another source of workforce learning is shaping in the centers of (digital) competence and digital labs certain companies are building. Not only do these centers or pools deliver solutions to digital problems but they also inject and evangelize new fields and items of learning into corporate departments. These lab activists are often highly motivated and ready to share their knowledge provided hierarchies are flat and audiences receptive. This openess also helps companies from sectors often perceived as unattractive like construction or agriculture in hiring professionals and young high potentials.

Against this background, training input from universities seems to play a minor role at least for companies that have achieved a certain degree of agility in workforce learning. Universities’ role in transfer of R&D and technologies continues to be acknowledged though.

A similar trend appears when the role of external consulting is considered. The ‘home breeding’ tendency that cherishes close matching and in-house profiling of skills makes companies limit their reliance on external advisers, be it about actual implementation of digital solutions or training of workforces. Projects led by consultants tend to be large-scale whereas specific digitalization efforts targeting at specific functions are mostly run in company-specific ways.

The success factors of staff development for digitalization thus seem to be

* Organizational reform
* Thorough agenda setting
* Workforce motivation, encouragement and incentives
* Inclusiveness across all hierarchies and easy and ample access
* Workplace integration

## Understandıng green skılls needs

As highlighted in chapter 3, today’s workforces tend to expect, apart from fair compensation and benefits, a sense of purpose and even belonging from their jobs.

It appears therefore reasonable for companies to shape their climate policies in the same spirit as digitalization, i.e. with openness, inclusiveness and intrinsic motivation.

It is therefore encouraging to find out that most companies interviewed and beyond seem to base their sustainability efforts on broad workforce consultation and engagement.

It also turns out that digitalization and data management skills can actually efficiently support a number of sustainability conversion efforts.

* The skills required in this are thought to be
* Life cycle awareness regarding corporate output and products
* Carbon footprint measuring and reporting
* Awareness of relevant standards, norms and legislation
* Design thinking and stakeholder involvement
* Awareness of sustainability as a brand quality
* Circular and resource efficiency thinking
* Supply chain management
* Mobility management
* Enhanced science (chemistry, physics, biology) knowledge

It is acknowledged that not all skills are yet up to challenges but motivation to comply with standards and mitigate adverse effects is found to be high, all the more as support from workforces is seizable.

Data management is expected to play a crucial role in monitoring corporate sustainability performance, which is why companies are optimistic they can quickly achieve breakthroughs.

In this context, they point to the long-term continuity they have already built in resource efficiency and their active commitment to a cleaner environment.

What is sometimes seen as a slowdown is certain European or national legislation that overdefines how solutions are to solve issues rather than setting targets and leaving it up to companies to define strategies.

Companies tend to see sustainability efforts as a brand quality which helps them in readily embracing the challenges and in relying on the motivation of their workforces.

One limitation of their impact seems to be, at least for the present, their reach with customers and supply chains. They are less worried about internal processes but feel less certain about being able to influence customer behaviour and compliance of supply chain actors. The proposed EU regulations on supply chain diligence is met with a fair portion of skepticism, not because of the impact they seek to make but because of limited leverage and influence they feel they have over complex processes far beyond their control.

## Currıculum desıgn

Any curriculum designed for addressing digitalization needs to address the following topics as a minimum requirement, all respondents state:

* Data management and data analytics
* Change, innovation and organizational reform
* Digital collaboration
* Quality of products and processes

When designing skills programmes, the following changes in learners’ attitudes and corporate requirements need to be taken into account:

* All knowledge and skills are fluid and fast-changing
* Formal (course-based) learning is losing in importance.
* On-the-job learning is a priority and should be integrated and compatible with everyday workload.
* Learning should be portioned as ‘nuggets’ that can be acquired in short iterations.
* Learning items are to target specific company needs, ‘broadband learning’ is found to be redundant.
* ‘Storage’ learning is making way for application-focused learning taken up ‘just-in-time’.
* Technical learning should be mostly digital, incentivized and ‘sweetened’ by symbolic ‘rewards’. Gamification is a boost factor.
* Testing options should be an integral part of learning.
* Conventional classroom training offers still have a place but should do what contact learning can do best, i.e. promoting people and soft skills.

Any digital skills curriculum will thus need to leave room for tailoring it to specific requirements and environments. It will therefore take a new look and appear more as a system of options and directions with little concern about universal learning outcomes for all learners.

What companies seem to need and what also staff seem to appreciate is flexbile pathways to acquiring skills urgently required in management and shop floor that allow for direct application, learner satisfaction and also fun.