Industry of the Future: The Ramp-up in Technological Competencies of SMEs. The Case of Industrial Companies

Report Summary

The report of the National Academy of Technologies of France on the *industry of the future*[1], as well as a number of economic studies, show that large French industrial companies (LEs[2]) are progressing well, and that on the whole the major industrial customers and their first-level suppliers have had positive operating results. ISEs, of which there are still not enough, and most SMEs, which have been able to adapt their strategic positioning and upgrade their industrial facilities, are performing well. However, a considerable number of SMEs and VSEs (or MICs)[3] are not in this enviable position and this subject is at the centre of this report.

France has a big problem in the area of individual skills at the level of the workforce and competencies at the level of the smaller companies.
Patrick Artus, Director of Studies at Natixis[4]

The ability to reinforce the competitiveness of industrial SMEs does obviously depend on the continuous improvement of their competencies.

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[1] *The industry of the future: from the technical system 4.0 to the social system (2017).*

[2] LE: large enterprises. ISE: intermediate-sized enterprises. SMEs: small and medium-sized enterprises. VSE: very small enterprises. MIC: micro enterprises.

[3] Thus, 20 to 40% of industrial SMEs, depending on the sector, according to the studies, are threatened with marginalisation in the industrial sectors.

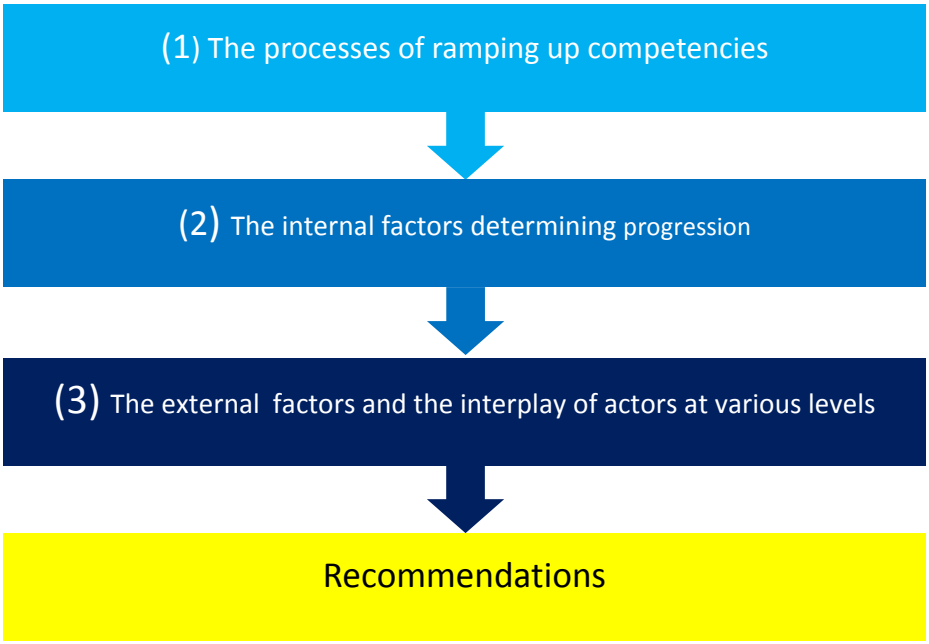
[4] *L'usine Nouvelle*, N° 3535 of 26 October 2017.

How can we increase the competitiveness of the many industrial SMEs that are on the brink of shutting down business? Is it perhaps already too late for many of them? Are we at the edge of a massive extinction of the "species" of small industrial companies? Some people doubt that there is any point in supporting just the existing competencies with digital tools without going any further by adding the new ones that are needed in the digital age.

In order to structure the discussion as clearly as possible and provide possible answers to these questions, we think it would be useful to organise our discussion in three interrelated parts:

- the processes of upgrading competencies in industrial SMEs; their rationales, their underpinnings, their practicalities;
- the internal factors that determine the capacity of enterprises to upgrade their competencies;
- the external factors at the national, regional, and local levels that facilitate the ramp-up of industrial SMEs and the interplay of actors at these three levels; the essence of our recommendations follows from this 3rd part of our report.

Note: In our analysis, we have excluded financial issues (e.g. level of fixed capital, level of margins, investment capacity, etc. of SMEs) and the risk-taking propensity of financial institutions, all of which are certainly important. We focus on the issue of competencies, a decisive factor of competitiveness. This subject is already vast and complex. As an example: when we mention Bpifrance, we refer to the service company rather than to the public bank.



1st part: the processes of ramping up competencies in industrial SMEs

These processes form an integral part of the transformations that we are witnessing today. They are often triggered by malfunctions or even crisis situations. The causes may be external (e.g. a sharp downturn in the markets) or internal (e.g. a significant deterioration in management quality indicators), sometimes both.

The new technological competencies and skills to be mastered are different from one branch to another and from one industry sector to another, but digital competencies, including those related to 4.0 technologies, concern all of them (see box below).

Un bouquet de technologies

After going through the industrial phase 3.0 (computer-aided design and manufacturing, digitisation and automation, robotics...) and after adopting some Internet tools, industry enters the phase 4.0. However, many SMEs are not yet making adequate use of the tools the Internet is offering. This current phase of industrial history is characterised by the progressive diffusion and utilisation of new technologies such as: collaborative robotics (*cobots*), massive data or *Big Data*, artificial intelligence (AI), *Industrial Internet of Things* (IIoT), virtual reality (VR), augmented reality (AR), mixed reality (MR), additive manufacturing or 3D manufacturing, modelling and simulation (including virtual twin), and digital platforms. Not all of these technologies are at the same level of maturity and diffusion. They call for new collective and individual skills in companies, whether they are SME concept developers or co-developers or sub-contractors.

On top of this, there are tools that contribute to the operational efficiency of industrial companies*: Product Lifecycle Management* (PLM), *Supply Chain Management* (SCM), *Lean Manufacturing*, *Manufacturing Execution System* (MES), etc. They call for new ways of doing and thinking in the industry, and therefore new competencies. By far not all industrial SMEs have integrated these tools.

However, it has become clear that, in order to make the most of these technologies, companies must achieve total digital permeation. This has become a cornerstone for their competitiveness and is at the heart of the 4.0 strategies implemented by large enterprises and many ISEs. Some SMEs, at their own scale, have committed themselves to this approach, while a large number of others also still need to do so.

Box I

These technologies, and the associated competencies, can be viewed from two different perspectives: that of a competitive advantage to be reinforced or that of a backlog to be cleared. The stakeholders and "interveners"[5] with business leaders will need different profiles and strategies with respect to these two perspectives.

[5] We call "interveners" the natural persons, representatives of various organisations, national, regional, local, public, consular or private, who are in direct contact with the managers of SMEs.

These competencies and skills are technological as well as non-technological[6]; both are closely inter-related.

The general competencies are in the areas of business strategy, marketing and design, team organisation and management, and human capital development. They are applied in a personalised manner from the top manager to the operator, including middle management, in most functions of the company[7(7)].

We stress that all SMEs must develop multi-skilled employees in order to integrate and support the changes taking place.

These changes require new or enhanced capabilities. The prevailing culture in many of our companies does not encourage their dissemination. This is for example the case with autonomy, one of the first qualities now required: studies show that it is increasingly discouraged in all socio-professional categories.

General, i.e., universal, skills now include digital literacy for everyone. Individual and collective skills are inter-related, the latter being derived from an adequate mix of the former.

2nd part: the internal factors determining how SMEs are ramping-up their competencies

As already mentioned, industrial SMEs must integrate new technologies. This raises the issue of their adoption by managers and their employees.

In order to think and act with due insight when implementing new technologies, top management - and managers in general - need to understand the process of adoption and assimilation of new technologies and/or new technical objects by the enterprise.

Any 4.0 technology integration process must be consistent with the company's strategic

[6] They are also referred to as general or cross-cutting.

[7] It should be noted here that SMEs that have evolved their offer and their processes, and that are in a good position on value chains - positions that will remain unstable - still need to progress in technological and especially non-technological competencies.

plan. The strengthening of competitiveness, which is part of a strategy, and the ramp-up of competencies are, in fact, the two sides of the same coin. However, each company must be considered as a particular case: the level of digital maturity to be reached and the agenda to be respected are specific to each case.

It is clear that, in the process of reaching higher levels of competitiveness and competencies, the role of the SME director is crucial.

The insertion of the entrepreneur into an "industrial social life"[8], determines whether or not s/he is open to the ecosystems in which the company is integrated (territory, branch, sector, academic world, etc.). There is nothing worse, in this respect, than the isolation of an SME top manager. To prevent this isolation, her/his confidence must be gained. Feedback gained in the territories indicates that technology is not the right entry point for exchanges with an SME director to be successful in convincing her/him. While waiting for trust to be gained and buy-in to be obtained, a problem-solving approach is more likely to attract attention than a technology-push approach.

Even convinced SME executives see that resistance to change and the lack of skills in the face of the complexity of the subject pose the main obstacles to the digital transformation of their company.

Notwithstanding, resistance to change within the company can be reduced by management practices that are based on a climate of trust.

The lack of skills inside the company arises from the failure to adapt the human capital through training and appropriate recruitment.

The practice of forward-looking management of jobs and skills (FLMJS) or, in a more contemporary context, the development of shared forward-looking visions of jobs and skills (SFLVJS), in a territory, in a branch or in a sector, is an essential preliminary exercise for a company or an association of companies seeking to position itself. The use of job observatories - provided they are of high quality - is essential.

[8] *Industrial social life: all the non-commercial relations which are woven between company managers and with leaders of social, political, economic, scientific and technological organisations (including training establishments) in their environment (branch, territory).*

Middle management in SMEs must be properly prepared for the challenges they face. They must be trained in project- and digital transition management.

The training of the existing workforce is one of the two main levers of transformation. Its efficiency depends on various parameters. For example, the operating constraints in which SMEs find themselves must be taken into account in the design of training programmes. Efforts have been made. There is still significant potential for improvement.

Recruitment is the other lever for improving skills and SMEs must upgrade their methods.

In order to attract and retain new employees, particularly for jobs where candidates are in short supply, the attractiveness of a company depends on the quality of its employer brand. An industrial SME generally attaches little importance to this point.

Quality of life and health at work - another component of the employer brand - are important in driving organisational change. Technologies such as cobotics, mixed reality and artificial intelligence can contribute to this, but precautions must be taken as there can be ethical concerns.

Faced with the human and social stakes of the transformations underway or announced, the existence of a true HR function, dedicated or shared, is more important than ever.

3rd part: the external factors driving the ramp-up of competencies in SMEs

SMEs are generally located in multi-layered national, regional and local ecosystems[9], some of which are related to the company's activity (e.g. branch, sector, industry), others are not (e.g. the territory). In each layer, public, chamber of commerce and private players take initiatives with the shared aim of helping the SMEs to improve their competitiveness, i.e. to innovate and grow, adapt their industrial tools and facilities and develop their competencies, often with a view to increasing their international presence.

[9] We could have added "European and international". But we have chosen to confine ourselves to national territory in this report.

There is no shortage of players in the various ecosystems to take an interest in industrial SMEs and to support them. However, the relatively large number of players is a source of complexity[10]; the absence of coordination between them can be counterproductive.

Moreover, some SMEs have joined clusters, such as competitiveness clusters, company clusters and local groupings. All three of them form networks where SMEs benefit from cooperating with other members and where managers benefit from associating with their peers.

I. *At the State level*

The CNI[11], under the auspices of the Prime Minister and structured according to the large, integrated, vertical industrial sectors, is beginning to address the issue of competencies in industrial SMEs. The very recent creation of the *digital CNI*[12] paves the way for a transversal, *cross-sectoral* vision of the ramp-up of SMEs' digital competencies for which the time has come.

Among the ministries that are directly concerned by this issue are the ministries in charge of general and of higher education. However, these do not have a policy specifically dedicated to industrial SMEs. The situation is quite different for Research and Innovation where SMEs are a permanent target of public policies. In order to assess the support provided to industrial SMEs, we must look at vocational, secondary and higher education establishments. We will come back to this later.

The DGE[13] is the instrument through which the Ministry of the Economy deals with the competitiveness of SMEs in general. Its means of intervention are, however, diminishing, while the Ministry of Labour, assumes primary responsibility: the DGEFP[14],

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[10] We hear the message from those who believe that the more voices in the industry of the future, the better. But they still have to obey rules of harmony...

[11] Conseil national de l'industrie (National Industry Council).

[12] The *digital CNI* is misnamed because its name might suggest, as with the other components of the Council, that it would deal with a "digital sector", whereas its purpose is cross-cutting: the digitisation of the industrial fabric.

[13] Direction générale des entreprises (Enterprise Directorate General).

[14] Délégation générale à l'emploi et à la formation professionnelle (General Delegation for Employment and Vocational Training).

with the support of the Direccte[15], supports competency development actions. But the Ministry does this from the perspective of reducing unemployment and social exclusion, which is its top priority. Lack of skills must not be the reason that even more "batallions" of the workforce are weakened or even excluded from the productive system. At this level, the EDEC (Employment and Competencies Development Commitment) approach seems to be the best answer to the problem in question, but it is little known to SME managers and little practiced in industrial ecosystems. The system has just been introduced into the action programmes of the CNI's industrial sector strategy committees and its effects are therefore still uncertain and long-term.

The law labelled "Professional Future" and the ramp-up of competencies of industrial SMEs

In brief:

the still recent law introduces important innovations on various social and economic aspects (apprenticeship, vocational training, roles of the actors involved, operating and financing rules).

Some of them should facilitate the ramp-up of skills within SMEs. However, it is not certain that they will actually contribute to this in a way that is commensurate with the stakes involved.

It is indeed too early to assess the important issue of appropriation of the new measures and provisions by the concerned actors, i.e. entrepreneurs, the workforce and young people. Some of these provisions, pending the implementing decrees, remain somewhat imprecise.

At the level of grassroots organisations, OPCAs(1), which the law now reorganises into OPCOs, have the potential to support SMEs in the development of their human capital. Uncertainties still weigh on the reliability of their economic model and it is not certain that at this time the "interveners" from these organisations have the skills required to accompany the SMEs' 4.0 revolution.

1 - OPCA : organismes paritaires collecteurs agréés (approved joint collecting bodies). OPCO : opérateurs de compétence (competency operators)

Box 2

15 Directions régionales des entreprises, de la concurrence et de la consommation, du travail et de l'emploi (Regional Directorates for Enterprise, Competition and Consumer Affairs, Labour and Employment). They report to the Ministry of Labour (DGEFP) and the Ministry in charge of the Economy (DGE).

Another major state-owned player is Bpifrance. The institution directs most of its interventions towards start-ups and innovative and growing SMEs and does not, or only marginally, address, the issue of skills. Moreover, seen from the terrain, the macro ecosystem with all its actors appears to be overcrowded: Conseil national de l'industrie, France Industrie, Alliance industrie du futur, French Fab, etc. The SME directors we met stressed the lack of legibility of this system and feared a waste of energy and resources. We share their bewilderment, particularly with regard to the link between the Alliance and the French Fab.

We believe that the *Alliance Industry of the Future*, an initiative of the Ministry of Economy taken in 2015, opens interesting perspectives. However, its membership needs to be broadened (for example: neither the food and textile industries nor the universities are members, only a few engineering schools represent the system of professional training; the regions, key players in the transformation process, are not represented, etc.) and its operating mode, in relation to the territories, must be improved. We suggest that, once remodelled, it should become the sole national prime driver for the transformation of the French industrial fabric.

Ⅱ. *At the level of intermediate or regional and local ecosystems*

Since we cannot deal with all situations at the level of the meso-ecosystems, we have focused our attention on:

- an industrial sector: the aeronautics and space industry (Gifas - Groupement des Industries Françaises Aéronautiques et Spatiales = Grouping of French Aerospace Industries),
- an industrial branch: the mechanical industries, with their industrial technical centre (CETIM - Centre technique des industries mécaniques = Technical Centre for Mechanical Industries),
- and finally, a region (Nouvelle Aquitaine).

In all three cases, the related institutions are among the most advanced in the area under discussion.

We also looked at employment pools, clusters, research organisations, and vocational training institutions at various levels, all of which play a role in increasing the skills of

industrial

SMEs. They are stakeholders in meso- but also in micro-ecosystems.

The examination of meso-ecosystems (sector, branch, region) and micro-ecosystems (employment areas) has allowed us to highlight common points:

- In spite of the significant efforts made, the penetration rate of the new technological system that is required to enable SMEs to participate in the new economy remains low (see graph[16] below): the order of magnitude in 2020, the date of projection by various institutions, is 30% to 35% of the companies concerned. This is up from about 5% in 2015, the period of the launch of the "industry of the future" programme[17]. As there is no single and shared tool for measuring progress, this figure is imprecise; it is not only applying to "transformed" enterprises, but includes, for example, those companies that have so far only made a preliminary diagnosis.

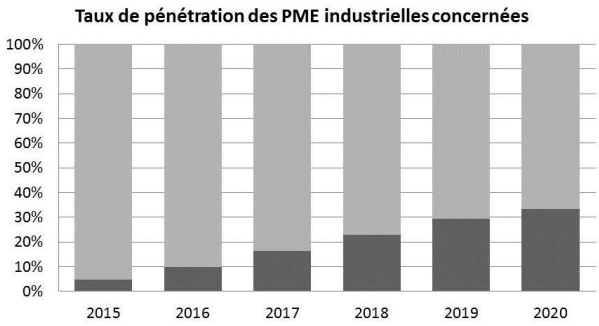

Chart I

Penetration rate of the industrial SMEs concerned

It's the most accessible and receptive SMEs, often the largest, that have initiated the transformation process. For various reasons, all other things being equal,

[16] This chart is indicative.

[17] Following the "factory of the future" industrial plan launched in 2013, which formed the basis for this plan.

progress might slow down in the years to come.

Since it is not possible to reach 100% of SMEs through action programmes run from Paris, or even from a regional capital, it is necessary to create the conditions in the industrial fabric for a viral propagation of the technologies and practices of the industry of the future.

- In the support systems that is already in place, more attention is paid to technological skills than to non-technological skills. While *strategy and marketing* and *industrial organisation* issues are fairly often addressed, the aspects relating to *general organisation, design, team management, human capital management, etc.* are neglected or overlooked in most cases. However, as we have seen, these points are important for strengthening the competitiveness of companies.
- Many of the mechanisms implemented understandably involve the highly dynamic Bpifrance, which focuses on the growth of innovative SMEs. This focus contributes to strengthening competitiveness of our economy and industry; however, it leaves behind a considerable number of industrial SMEs. Moreover, Bpifrance's strategic online paper "*Intervention Doctrine"* does not mention competencies at all. Bpifrance does, however, support actions undertaken by the private sector; these do sometimes deal with competencies.
- A gradual alignment of all public policies[18] is currently taking place in the sectors defined and supported by the CNI. This vertical orientation, which has its own logic and interest, disregards the large number of sub-contracting SMEs at the second level and beyond. The latter are in several sectors and therefore, in fact, in none in particular. This alignment also excludes SMEs offering their own

[18] Ministry of Economy, Ministry of Labour (in particular with the transformation of OPCA of branches into OPCO of sectors), and henceforth certain regions, etc.

products. It is in these two categories that we find the most companies that have been fragilised by the current changes.

- Among the Industrial Technical Centres (CTI), only the CETIM has a global understanding of the problem of how to transform the industrial fabric, specifically in its mechanical sector. Is the CTI network equipped to deal with this issue? Convinced of its usefulness, we suggest that it be restructured and merged with the network of Regional Centres for Innovation and Technology Transfer (CRITT). We recommend that the economic model of the centres be established in a viable and sustainable manner. Finally, coupling the CTI and future OPCOs (Operators of Competencies) would allow the provision of complete technological and non-technological solutions to industrial SMEs.
- At the level of micro-ecosystems, i.e. the local/regional employment areas, where all the targets of the actions undertaken are located and where all the initiatives implemented by various institutions converge, we can see a certain degree of disorder. This is not compatible with what should be a ***general mobilisation*** in favour of SMEs which are faced with the need to catch up **immediately**. Therefore we recommend that a coordination of the intervening organisations in each employment area be instituted. The Region would choose and support the local representative of one of these organisations to ensure the coordination.

In our opinion, it is essential that the regions be entrusted with a unique system for steering the programme within their territories, embracing all branches and sectors combined. A single local animation for each employment area, while not creating any additional structure, is just as necessary.

III. *At the cluster level*

In the territories, the effects of business- and competitiveness-clusters can be seen in the convergence of national and/or regional public policies and initiatives

by professional organisations. It is a virtuous effect and should be pushed as far as possible.

The competitiveness clusters must be reinforced in their role as a federative and driving force for industrial SMEs. Their added value (apart from R&D) is fully realised in the targeted areas (competency ramp-up can be one of them), but in rather member-centric advantage-oriented collective approaches. Some clusters have shown that, under certain conditions, they can also have an **individual** knock-on effect on their member-SMEs and even on SMEs beyond the clusters. On the other hand, they can drive catching up strategies, which are achieved through network approaches. The State has just announced the launch of a new phase - the fourth - in the life of the clusters (moving up-market and increasing their size, opening up to Europe). It is important that new objectives do not distract them from the role they can play as "vectors of competitiveness" in the territories, for all industrial SMEs.

Business clusters, which were once supported by the State, need to be revived and supported. At their level, they are learning communities. The regions are responsible for reinforcing the potential of clusters and the positive influence the "social life" within these clusters can have on SMEs' ability to improve their competitiveness and skills. The creation of a system, or network, combining business clusters, competitiveness clusters, and trades and vocational training campuses (see below) is to be promoted. Within the framework of a national policy, this system must free itself from regional borders, which are artificial in this respect.

Local groups of companies, neighbourhood associations of business leaders, clubs, and all types of initiatives that are developing an "industrial social life" in a territory, are to be encouraged. This contributes to the viral propagation mentioned above.

It is important that isolated companies are aggregated to or associated with these various clusters and initiatives in one way or another, with the constant objective of involving as many as possible.

Employers' groups, which make it possible to pool resources and develop new ones, are to be multiplied in the employment areas, in particular by relying on the progress, as yet under-exploited, of the 2016 labour law.

Ⅳ. *The vocational training system*

The vocational training system must be at the service of all industrial SMEs and support them in their development of competencies. Not all its components are involved at the same level[19].

Its responsibility begins with providing information on industrial trades and helping high school and university students, as well as the workforce, to orient themselves towards industry and its SMEs.

Vocational training institutions, at all levels, dedicated to the industry, are often its first showcase for young people. They must make it attractive.

The vocational training system must adapt continuously to the changes taking place. Anticipation is, however, becoming increasingly difficult for companies and their associations[20]. The solution hinges therefore on the responsiveness and agility of the system. It must take better account of the operating constraints of SMEs.

The IUT (university institute of technology) and technological and vocational high schools have a major card to play.

Engineering schools must innovate to support those SMEs that for reasons of geographical location cannot rely on higher education when developing their competencies. Under certain conditions, work-linked training courses, which go beyond the usual framework of the transmission from master to apprentice, can become a means of introducing new skills into SMEs. New forms and purposes of work-linked dual training are suggested here.

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[19] This topic was extensively covered in the Academy's report on the industry of the future. We reiterate and clarify some of its elements.

[20] This does not mean, however, that there should be a renunciation of the FLMJS or SPVJS programmes, the contributions of which we would like to highlight.

Training at intermediary levels is a possible response to the identified SME needs for management staff that is trained over a fairly broad spectrum (4.0 technologies, project management, digital transition management, etc.). Engineering schools are opening bachelor's degree courses. It is important that they are not diverted from this purpose[21].

The Campuses of Trades and Qualifications (CMQ) offer a real potential for skills development for young people and the workforce, but also for businesses, especially SMEs. They will be reoriented. This is an opportunity to network them with competitiveness clusters and business clusters across the country.

In order to ensure the success of training campaigns, the operating constraints of SMEs must be taken into account. The pedagogical tools and methods used, as well as the practical arrangements put in place in the training courses for SMEs, have a great influence on their accessibility and efficiency. On-the-job training tools need to be developed.

Workshop-schools, factory schools and, more broadly, training platforms for the technologies of the industry of the future are instruments that contribute to the dissemination of new production technologies, to their implementation in systems, but also to the optimisation of industrial processes for SMEs. Their presence in industrial employment areas is valuable[22].

However, they generally deal with only one aspect of skills development, namely technology, including digital tools for industrial management. In the territories, cooperation between technological and non-technological training bodies should be encouraged to better prepare for all the necessary competencies in an integrated manner.

Offering online training may be an appropriate response, but a MOOC[23], or any other online tool, without support (mentoring, coaching) is of little use to industrial SMEs.

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[21] And that they do not become mainly new preparations for engineering or master's degree courses.

[22] As is also the case for the "showcases" or showrooms of the industry of the future, which must be articulated, networked, with the platforms mentioned here.

[23] *Massive Open Online Course*.

V. *Personalised support for the parties involved*

Supporting SME managers, through advice and mentoring, is a sine qua non condition for the success of a competence ramp-up process. Peer intervention is essential. Support for employees, through mentoring and the creation of learning communities, is necessary. This support has a cost, and must be integrated into all SME support systems that promote skills development.

In conclusion, it should be remembered that all the players concerned (individuals), company directors, managers, engineers, technicians, operators, people looking for work, young people in training, have an inside or outside perception of the industry. They have a mental image of the company in which they work and convey this image to the outside world, or they have a perception of the company in which they aspire to work, its professions, the technologies it uses and the territory in which it is located. This dimension of the imaginary, which is not taken into account in any of the measures mentioned, is a determining factor in the transformation of the industry. The National Academy of Technologies of France will include this dimension in a forthcoming report on the attractiveness of industrial companies, professions and territories.

Key recommendations

The recommendations formulated in the report of the Academy on the *industry of the future* remain valid[24]. In the following tables, we present what we believe to be the most important recommendations, including those that are highlighted in the present document and which are noted [R] in the following text. Reading this report, each player in an ecosystem can find those that concern him directly.

The main targets adressed are to be found at any of the three levels of the ecosystem: national, regional, subregional or local. They have four objectives, the first leading to the other three:

- accelerate the ongoing transformation of the industrial fabric;
- ensure consistency and simplify the systems, with a single body in charge at each level of the ecosystem;
- create synergy for all the actors of the transformation of the industrial fabric, associate the technological and the non-technological aspects;
- network the business leaders.

[24] Pages 13 to 15.

Key recommendations for the national ecosystem

Entrust a single organisation with the overall supervision of the digital transformation of the industry. The *Industry of the Future Alliance,* which must be remodelled, can play this role.

Entrust each region with the delegated supervision (all branches and industrial sectors combined) of the transformation programmes on its territory. Involve the regions in steering the *Industry of the Future Alliance*.

Create synergies between the French Fab and French Tech at the national, regional and local levels.

Relaunch a policy of support for "industrial clusters".
Within homogenous areas on the national territory, ensure that competitiveness clusters, business clusters, trade and competency campuses are networked, with the competitiveness clusters, heading the network, whenever possible.

Restructure the network of industrial technical centres (CTI), foster closer ties and mergers between them and with the regional centres for innovation and technology transfer (CRITT).
Couple the CTIs with the new competence operators (OPCOs).

Create a robust, unique and shared tool to measure the progress of industrial SMEs in their digital transformation.

Key recommendations for regional ecosystems

A policy of support for (vertical) industrial sectors is implemented at national level. At the same time, support actions focused on (horizontal) sectors or trades, should be implemented at regional level, so that all industrial SMEs are involved in the transformation movement.

Structure each regional territory into "extended employment areas", including the surrounding dispersed local industries. Designate a single coordinator of industrial transformation among the actors present or represented in each extended area.

Key recommendations

Within homogenous areas in the regional territories, network the competitiveness clusters, enterprise clusters, trade and skills campuses; the competitiveness clusters acting, whenever possible, as network leaders.
Connect in each region, according to level, technological training institutions and institutions exercising in other fields of importance to the future of the industry: design, management, administration, etc., around the issues of the *Industry of the future*. Encourage them to make joint offers, particularly in continuing education.
Encourage vocational training establishments with an industrial vocation, of all statuses, at all levels, in all specialities, to develop innovative ways of work-linked dual training allowing a better integration, in SMEs, of the practices and technologies of the *Industry of the future*.
Network the training platforms for the technologies of the *Industry of the future* (factory schools, workshop schools, FabLabs, etc.) in each regional territory. Link these training platforms to the "showcases of the *Industry of the future*", and to the existing showrooms on the territory, so as to build in each region, in an articulated form, a catalyst of transformation.

Key recommendations for sub-regional or local ecosystems

Provide access to information adapted to the concerns of the company director, based in particular on the findings of trades observatories (branches and/or industry sectors).
Turn technology training platforms and showcases of the *Industry of the future* into places of industrial social life.
Earn the trust of every business leader involved. Mobilise the actors who have their confidence: other business leaders, chartered accountants (to be trained for this)... Apply discernment when choosing the "interveners" in the field, they must be prepared for their mission.
Ensure that professional training establishments with an industrial vocation, at all levels and in all specialities, which are often the first showcases of industry for young people, convey a positive industrial image to them. Mobilise local and regional authorities regarding the "housing and means" aspects for the benefit of these establishments.