New innovation models in Switzerland

Report on behalf of the Swiss State Secretariat for Education, Research and Innovation (SERI)

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Sectoral reports

In addition to the main report, four of the included sectors are analysed in additional sectoral reports:

Barjak, F., Heimsch, F., Cornet, B., Foray, D., Wörter, M. & Schenckery, A. (2026). *Project "New innovation models in Switzerland". Sector brief: Medical technologies.* Link

Barjak, F., Heimsch, F., Wörter, M. & Schenckery, A., Cornet, B., Foray, D. (2026). *Project "New innovation models in Switzerland". Sector brief: Information & Communication Technologies (ICT).* Link

Cornet, B., Foray, D., Barjak, F., Heimsch, F., Wörter, M. & Schenckery, A. (2026). *Project "New innovation models in Switzerland". Sector brief: Finance.* Link

Wörter, M. & Schenckery, A., Barjak, F., Heimsch, F., Cornet, B., Foray, D. (2026). *Project "New innovation models in Switzerland". Sector brief: Chemicals, pharmaceuticals and biotechnology sector.* Link

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Executive summary

Aim and data basis of the analyses

This study explores new innovation models in the Swiss economy. It was commissioned by the Swiss State Secretariat for Innovation, Research and Innovation (SERI) to generate data for answering the postulate 24.3009 'Declining innovation activities of Swiss companies. Identify the causes and remove the obstacles', which was accepted by the Swiss National Council on 30.05.2024. The analyses are co-funded by Innosuisse, Swiss Medtech, Interpharma, swico, the Swiss Bankers Association, Swiss Fintech Innovations, and the Swiss Insurance Association.

An online survey of 6,578 companies in six sectors (chemicals, pharmaceuticals & biotechnology, ICT, medical technologies, metals, electronics, machines (MEM), food & beverages, and finance) generated a dataset with more than 1,100 responses on corporate innovation activities in general, and specifically on innovations related to digitalisation and sustainability, the influence of regulation, and the commonness of innovation collaboration. The analyses differentiate sectoral and size-specific aspects of innovation models, differentiate R&D-based and non-R&D innovation and relate this to the use of public innovation support. Moreover, it compares the practices of the different sectors, size classes and innovator types in the areas of data and digitalisation, sustainability innovations, complying with regulation, and collaboration in innovation projects.

Moreover, we conducted two Delphi rounds of interviews with companies in the six sectors to validate the findings of the survey and derive innovation policy implications. In a first round of bilateral online interviews with 70 companies, sector-specific and cross-sectoral problems were identified and policy solutions recorded. In a second round of face-to-face group discussions with 35 companies, these problems and further solutions or detailed aspects of the solutions were explored in greater depth.

Note that the data collected within this study does not cover the entire Swiss economy, but only selected manufacturing and service sectors with above-average innovation activities. Secondly, larger and mid-sized companies, which are more likely to innovate, are over-represented in the dataset. And thirdly, non-innovative companies might have been less motivated to reply to a survey on new innovation models. Hence, the results cannot be generalised to the entire Swiss economy, and the share of innovators is overestimated. However, the analysis contains a lot of insights on changing innovation models, and companies' needs to overcome innovation obstacles.

Main findings of the survey

Strong sectoral differences with regard to innovation inputs, outputs and public innovation support

We see differences of the innovation activities and use of innovation funding of the surveyed companies across the six sectors included in this analysis:

- Chemicals, pharmaceuticals and biotechnology, the MEM sector, and the ICT sector have above average ratios of innovative companies and companies introducing radical innovations. R&D innovation is by far the most common model. The innovation models in these sectors align well with the current Swiss innovation policy paradigm of supporting science-industry collaboration and entrepreneurship. The companies use funding in line with their needs, enabling them to tackle more technologically risky projects or even ensure the success of their R&D activities.
- The medical technologies sector shows a strong performance with regard to incremental product innovations, but it also characterized by few radical product innovations, few process innovations, and few companies engaging in R&D. It has a high proportion of small companies that are less likely to engage in R&D-based innovation

and more likely to do non-R&D innovation. Nevertheless, this sector still makes high use of innovation funding.

- In the finance and food sectors, relatively few companies carry out R&D and one third of companies are non-R&D innovators. Incremental product innovation is dominating over radical product innovation. While in finance a large share of two thirds of the companies introduced process innovations, in food process innovations are also less common than in the other sectors. The needs of finance and food companies do not seem to map well on the available innovation support instruments, as their innovation models and partner networks (see section on cooperation) are not particularly geared towards collaboration with academia in R&D.

Perceptions of external technological, competition and customer-related dynamics and innovation behaviour

In the survey the companies were asked to evaluate three types of contextual dynamics with regard to technology, competition and customers. These factors reflect perceptions and not any factual dynamics and merely tell us, how important their influence on behaviour is from the company's perspective. The sectors differ in their assessments of all three types of dynamics, but predominantly of the technological dynamics. The influence of competition is the most important common factor among companies of similar size, with medium-sized and larger companies attaching greater importance to it and small companies attaching less importance to it.

Lower relevance of technological dynamics and – to lesser degree – of customer-related dynamics characterises non-innovative companies. While innovators agreed to the statement that technological change offers opportunities for the industry, non-innovators gave a neutral reply. And, on average, they perceived less often that technologies in their industry are changing rapidly. Moreover, the non-innovators see less often customer-related dynamics, i.e. more non-innovators than innovators perceive that their customers are not open for innovations.

This perception of a more stable technological and market environment among non-innovators could signal a shift of expectations regarding the costs and benefits of innovation away from the benefits, thereby reducing the willingness to invest in innovation projects.

Digitalisation and data: firm size determines the level of development

Not surprisingly, the conjunction of being a very small firm, non-innovator and operating in low or medium tech sectors make such firms disconnected from the dynamics of digital innovations. They don't rank any technologies as important, and barriers are about understanding and awareness of the importance of digitalisation as well as resource constraints (costs and people). By contrast, large companies which are also R&D innovators and operate in sectors like ICT, finance or chemicals/pharma & biotech are proactive, have multiple digital technology objectives but struggle with data and skills issues. Finally, medium-size companies in most sectors can be more or less proactive with multiple or little technological targets – depending on whether they are R&D innovators or non-R&D innovators. While digital transformation includes the introduction of multiple, often incremental, innovations, e.g. of digital products and the digitalization of processes (Hanelt et al., 2021), we see that companies conducting R&D have a stronger focus on more advanced data applications, e.g. for pattern recognition, predictive modelling, digital twins/virtual modelling than companies without R&D. R&D creates the absorptive capacity for more fundamental digital transformation and innovation.

Sustainability: strong sectoral differences and a predominantly incremental focus with little indication of a sustainability transition

The analysis of sustainability innovation across sectors reveals some heterogeneity in both the intensity and nature of innovation activities. The chemicals, pharmaceuticals & biotech sector exhibits the highest average sustainability score, driven by broad integration of environmental, social, and governance (ESG) considerations. The other sectors each have an area of sustainability that receives less attention in innovation: in ICT, medtech and finance, this is environmental sustainability, while in food, MEM and medtech, it is ethical governance.

A key feature emerging across all sectors is the dominance of incremental innovation. Most companies report sustainability improvements through minor adjustments to existing products, processes, or organizational structures rather than through fundamental redesigns or the creation of new solutions. This trend is particularly pronounced in metals, electronics & machines, where incremental change exceeds 50%. While sectors like chemicals, pharmaceuticals & biotech show more frequent occurrences of the introduction of substitutes, these remain exceptions. The strong reliance on incremental mechanisms indicates a prevailing "path dependency", where existing innovation models are adapted to incorporate sustainability concerns without disrupting established technological or organizational routines.

In addition to sectoral differences, firm size and type of innovator play a critical role in shaping sustainability innovation. Large firms report higher average sustainability scores and demonstrate a broader use of innovation mechanisms, likely reflecting greater resources, regulatory exposure, and internal capacity. Small and medium-sized enterprises (SMEs), while less engaged overall, engage in product life cycle extensions on a comparable level to medium-sized companies. Moreover, R&D innovators consistently report higher levels of sustainability integration and a greater capacity for transformative change compared to non-R&D innovators and non-innovators. This confirms that both scale and innovation capability are central enablers of sustainability-oriented transformation.

Despite widespread commitment to sustainability, significant barriers persist. Across all groups, high costs remain the most frequently cited obstacle, especially in capital- and technology-intensive sectors. Regulatory burdens and other innovation priorities are particularly pronounced among large and innovative firms, while SMEs relatively often report issues such as lack of data, conflict with customer demand, or supply chain implementation issues. Interestingly, non-R&D innovators and smaller firms are also more likely to cite a perceived lack of need, suggesting that limited strategic engagement with sustainability remains a barrier in important parts of the business population.

Regulation: High degree of heterogeneity in terms of the relevance and impact across sectors and company sizes

Regulations have become an increasingly important factor shaping firms' innovation strategies, particularly in the context of the twin-transformation (sustainability and digitalization). While initially perceived as a source of uncertainty, regulatory frameworks can also stabilize expectations and provide direction for innovation. Their relevance varies significantly across sectors, firm sizes, and innovation profiles, influencing both the extent and nature of innovation activities.

At the sectoral level, the regulatory burden is most pronounced in chemicals, pharmaceuticals & biotech, medtech, and finance, where compliance with product safety, environmental, and quality standards is deeply embedded in innovation processes. In contrast, sectors such as food, ICT, and metals, electronics & machines report lower average regulatory scores and a higher share of firms with minimal regulatory exposure. However, even within sectors, the perception of regulatory impact is highly heterogeneous, reflecting diverse product types, market environments, and compliance demands. Data protection, environmental, and process-related regulations are particularly important for firms in nearly all industries, underlining a broader trend towards regulation as a systemic driver of the adaptation of innovation models.

In terms of firm size, large companies consistently report higher average regulation scores and greater exposure to diverse regulatory frameworks, which quite often requires more qualified staff, causes more uncertainty, requires an adaptation of business processes, and increases costs. While small and medium-sized enterprises (SMEs) are also affected, they experience regulation less uniformly, with an accumulation of firms that are only marginally impacted. R&D innovators face the highest regulatory relevance and intensity, especially in domains like digital compliance (data protection), environmental standards, and organizational processes.

The impact of regulatory changes is multifaceted. While many firms report increased uncertainty, higher costs, and a growing need for qualified staff, others experience positive shifts such as greater cooperation and closer engagement with regulators. However, a significant share of companies – especially in sectors like medtech, finance, and chemicals – report that regulation has led them to pursue fewer radical innovations. This suggests a possible trade-off, where compliance pressures reinforce incremental adaptation and risk aversion. Yet, among R&D-active firms, the majority still sustain or adapt their innovation strategies, demonstrating a relatively high degree of resilience and flexibility.

Collaboration: academia and other companies as the key partners across all sectors except for finance

There is a general trend of increasing collaboration in 2021-23 compared to before and there is little inter-sectoral variation. Three times as many R&D innovators collaborate on innovations as innovators without R&D. This suggests that collaborations are often related in some way to research and development. The standard pattern of collaboration involves academia and other companies as the most important and effectively used partners, financial constraints as the main obstacle against collaboration and a low importance of IP/legal issues as collaboration obstacle. The collaboration pattern of finance companies is slightly different, as they do not partner that often with academic entities and service companies and consultancies are by far their most common type of collaboration partner.

Key aspects with policy implications

The analyses of the survey data point to a few aspects which are relevant for innovation policies:

1) Transformative innovations in products, processes or business models are relatively rare. However, as they contribute to productivity growth, structural change and the transformation of the economic system, they are highly desirable and should receive special consideration in innovation policy.
2) Innovation drivers, innovation barriers and partnerships in innovation projects vary according to sector, company size and type of innovator. This is why a certain degree of flexibility is needed in innovation policy instruments. For example, not all sectors have the same collaboration requirements and in collaborative innovation projects in the financial sector technology service providers could be well suited to fill the role of research partners. Furthermore, foreign companies that generate added value in Switzerland and are anchored in local innovation systems could also be admitted as business partners in funded innovation projects. Last but not least, changing requirements of the different stages of the innovation process might be reflected in flexible terms which lower entry barriers particularly for SMEs.
3) We find that selected industries and small businesses (with the exception of start-ups) are lagging behind in digitalisation. Comprehensive countermeasures might be needed to make up for this lag, including, for example, information, training and support for adoption.
4) Regulations are perceived in virtually all sectors as barriers to innovation, increasing innovation costs and reducing innovation activities. Initiatives are needed to overcome this negative aspect and make regulations a positive force for innovation.
5) Innovation partnerships are not as widespread as they could be in an economy based on the division of labour with increasing specialisation of skills. The conditions for partnerships with academia and between companies should be addressed.

The results of the survey were used in Delphi interviews with companies to deepen understanding of the needs that innovation policy should address and to gather suggestions as to which measures might be appropriate for this.

Results of the Delphi interviews

The first round of Delphi interviews with 70 companies from six sectors provided further details on opportunities and challenges encountered by companies with regard to digital innovations, sustainable innovations, making innovations compliant with regulation, and innovation collaboration. The interviews also contribute several critical points on the current federal innovation policy instruments, above all with regard to their general design and operational management.

Design issues include:

a) the partnering requirement which may slow down innovation processes,
b) the "one size fits all" approach which fails to reflect sectoral or size-related needs and restrictions,
c) the strong influence of academia/research partners on project content and progress,
d) the lack of financing for start-ups, and
e) barriers to international collaboration and knowledge transfer in Swiss innovation projects.

Criticism of the operational implementation of project funding – by Innosuisse – focuses on:

a) Not sufficiently elaborate feedback (on rejected proposals) and little project monitoring,
b) too time-consuming paperwork/reporting for funding, and
c) rigidity of approved projects and limited flexibility in cooperation contracts and funding.

In summary, the interview partners pointed to five overarching needs that innovation policy should address:

1) Strengthen start-up and innovation financing across all stages. It is essential to support start-ups and provide financing including public funds, tax incentives, venture capital and private investments, as well as targeted subsidies and startup-friendly frameworks that help bridge critical early funding gaps and reduce risks. It is also important that financing is designed with flexibility and continuity in mind. It should be adapted to the different stages of projects, offering long-term commitments and flexible terms (i.e. adaptation to the changing requirements of the different stages of the innovation process), supported by dedicated programs and campaigns that lower entry barriers particularly for SMEs.

2) Make regulation more innovation friendly. Establish sector-specific (e.g. crypto, medtech, recycled materials) experimental spaces such as regulatory "sandboxes", or experimental regulatory spaces for e.g. testing innovations under reduced regulatory burdens , or replacing sandboxes with real-world pilot projects. It is important to improve regulatory clarity, speed, and flexibility with solution-orientated rules, simplified approval processes, risk-based regulatory frameworks, and dynamic regulatory processes.

3) Strengthen collaboration and partnership ecosystems. Promote cross-sector and international partnerships (industry-academia, company networks) by adapting the support to these international collaborations. Promoting B2B collaboration especially for SMEs by supporting partner search and knowledge exchange through a dedicated forum, and ensuring lower entry barriers for partnerships for SMEs, by lowering their costs to partner with large firms, reduce application complexity and simplify access to funding for collaboration.

4) Strengthen talent development, skills and education. To secure innovation capacity, it is crucial to strengthen skill development and education. This includes attracting international STEM talent, investing in training programs, and ensuring that curricula are continuously adapted to emerging needs in AI and digital technologies. Equally important are lifelong learning opportunities and vocational training systems that enable workers to upskill and reskill throughout their careers.

5) Increase data openness and sharing. Availability and access to data is an important driver for innovation. To unlock its potential it requires building open digital ecosystems and promoting the use of open data, supported by harmonized standards. At the same time, a digital identity and signature infrastructures would be important to ensure trust and security.

In the second Delphi round of group discussions, measures that could be suitable for reducing the current barriers to innovation were identified and discussed together with the 35 participating experts from the companies. An overview of selected prioritised measures is provided below.

Learnings about the decrease of R&D and innovation

We found a number of hints in this study that may be related to a decline in innovation activity, although the available data from the survey and interviews do not allow for a statistical causal analysis:

- Non-innovators in our survey perceive less technological dynamism in their industry, including with regard to digital technologies, and see less openness to innovation among customers. The lack of innovation might therefore be due to the assessment that developments in technology and customer needs do not require innovation, and that innovation costs will not necessarily be offset by corresponding future revenues.
- We see low momentum with regard to sustainability innovations and a limited response to the megatrend of the sustainability transformation of modern economies. Companies follow the existing technological paths and sustainability innovations are merely incremental. This is not least, because high costs, regulatory hurdles and low customer willingness to pay make fundamental sustainability innovations unattractive.
- Thirdly, the negative incentive currently posed by government regulations for innovation emerged in the survey and the Delphi interviews that we conducted: even though the influence of regulations naturally depends heavily on a company's sales markets, products and processes, the considerable heterogeneity of regulations and low legal certainty due to a high degree of dynamism make innovation projects expensive or unattractive.
- Fourthly, the financing of innovation in both start-ups and SMEs in general remains a problem. Start-ups encounter financial constraints at various development stages and have an incentive to relocate their business activities abroad. Similarly, SMEs and research-based companies find attractive conditions in other countries within the EU and beyond, with comprehensive support for R&D activities, a skilled workforce and, above all, better access to the respective markets. Such locational disadvantages are clearly not always offset by the stable regulatory framework, high-quality infrastructure and comparatively low tax burden in Switzerland.
- In our study, we also find sectoral differences in terms of the use of public innovation funding and cooperation patterns. In fact, those industries with low public funding incidence and low cooperation with the scientific sector in innovation projects, finance and food, are also industries with comparatively low research and innovation activity in our survey. Providing public support for innovation projects as needed could also help to increase innovation rates or prevent it from falling further.
- In connection with this last point, we also see a lack of knowledge among companies about innovation support and funding measures, relevant expertise and services offered by scientific institutions and intermediaries. These information deficits influence decisions on whether to undertake innovation projects, their objectives and the partnerships chosen.

- Furthermore, with regard to digital innovations, many companies are not yet benefiting from the increasing diversity of data on consumers, savers, patients, etc., for example because data access is not possible, data standards and interoperability are lacking, or the digital ecosystems or necessary skills are not available. As a result, there is less digital innovation than would be desirable given the growing importance of digital transformation.

These points do not result from a statistical analysis that is able to relate decreasing inputs to, or outputs of, innovation activity to possible causes. They should be considered more like plausible hypotheses that the survey and interviews suggest. An earlier report on the determinants of R&D decisions, in which one of the coauthors of this report was involved, used a survival analysis to identify the characteristics of companies which are more likely to exit the R&D market (see König et al., 2022). Dropping out of the R&D market is more likely in case of:

- Small size,
- low productivity,
- limited human capital,
- weak export orientation, and
- low technological potential.

Additionally, the ease with which innovations can be copied, and a lack of equity capital make it less likely that companies stay in the R&D market.

Innovation policy could play an important role in keeping companies in R&D. König et al. (2022) show that national innovation policy can reduce the exit rate by around 50%. However, relatively few companies receive innovation support, according to the most recent Swiss innovation survey, only 11.6% of innovative companies (Spescha et al., 2025). In order to keep companies in the R&D market, the political framework and policy design should be improved.

Innovation policy implications

The companies surveyed and interviewed in this study paint a positive picture of Swiss innovation policy overall. However, at the same time they point to the needs to make regulations more innovation-friendly, to ensure the availability of skilled labour, to facilitate even better collaboration between the various players in innovation projects and, last but not least, to spread the high risk of innovation projects across several shoulders by means of financial support. In order to stimulate innovations and make the Swiss research and innovation system more enabling, we are prioritising nine measures from the numerous proposals made by the companies involved in this project, based on their focus, relevance, and feasibility:

1. Sector-specific regulatory sandboxes for innovation,
2. Harmonisation of regulations,
3. Mobilising start-up funding,
4. Targeted support for transformative and sustainable innovation,
5. Innosuisse: Operational improvements,
6. Matchmaking: Current Research Information Systems (CRIS) and collaboration brokers,
7. Article 15 RIPA extension,
8. National data strategy,
9. Fast-track procedure for work permits for highly qualified professionals.

This study does not have the capacity to analyse these measures in detail and examine aspects of their implementation – this task must be initiated and carried out by those responsible for innovation policy at federal and cantonal levels at a later stage.

1 Project background and field of research

Switzerland is one of the most competitive countries in the world. Commercially successful innovation activities are an essential part of this achievement. However, for some years innovation statistics have shown a significant decline in the fraction of research and development (R&D) active companies in Switzerland (König et al., 2020; Wörter & Spescha, 2020). This overall decline is mainly due to developments among small and medium enterprises (SMEs), and it raises several questions that should be addressed in this project.

In autumn 2022, the State Secretariat for Education, Research and Innovation SERI commissioned a first short study to analyse the decline in R&D-performing companies and trends in the innovation activity of Swiss companies by means of six hearings with representatives from industry sectors. This study revealed several factors that pose major challenges to companies' innovation activities.[1] These include, above all:

1. Growing centricity of consumers and generally clients in processes of innovation,
2. Widespread digitalisation of innovative products and services,
3. Marked demands for considering sustainability in innovation projects,
4. Increasing influence of regulations,
5. Transformation of the competitive environment (e.g., geographically, new entrants from technology industries, disruptive start-ups, etc.).

Most importantly the first study made clear that the conditions and contexts of innovation are to some degree sector-specific, and a “one-size-fits-all” approach is neither suitable to understanding corporate innovation activities nor from a policy perspective appropriate to support them. Following this preliminary study, the National Council’s Committee for Science, Education and Culture submitted postulate 24.3009 ‘Declining innovation activities of Swiss companies. Identify the causes and remove the obstacles’, which was accepted by the National Council on 30.05.2024. The Federal Council was instructed by this postulate to analyse in detail the causes of the decline in innovation activities by companies in Switzerland and to provide answers as to how the obstacles in the innovation process can be removed.

The project informs the Federal Council’s reply to this postulate. It is dedicated to new sectoral innovation models and their consequences for innovation policies. Against this background, four key areas of adjustment were defined to better understand the new innovation models, identify potential weaknesses in the current (regulatory) policy framework and, if necessary, propose recommendations for Swiss innovation policy: 1) Data-related practices and needs in corporate innovation activities, 2) sustainability-related innovation activities and drivers and bottlenecks of such innovations, 3) collaboration practices and needs, and 4) regulations. The project addresses these four themes and analyses the current situation and recent changes in four selected sectors and thus enables in-depth and more specific analyses that are not possible on the basis of innovation surveys of the entire Swiss economy:

1. Medical technologies (Medtech)
2. Finance (banking, insurance) & fintech
3. Pharmaceuticals
4. Information and communication technologies

The four sectors are remarkable with regard to their innovation dynamics according to the hearings and results of the first study (Barjak et al., 2023). They are subject to a high commonness of new/non-R&D innovation models and a particularly pronounced impact of current megatrends (digitalisation, sustainability transition, supply/sales market disruptions).

[1] See Barjak, Foray & Wörter (2023) on the results in more detail.

In addition to the core sectors, the study will include samples from two further sectors to ensure a good representation of the Swiss economy as a whole: the metals, electronics and machine (MEM) industries and the food industries.

1.1 Research questions

The project wants to answer research questions, involve industry experts and policy-makers in the Federation and cantons, and generate recommendations in the three areas specified above. Above all the research will address the following questions:

1. *Data-related practices and needs in corporate innovation activities:*
   What type of data do companies use/need most for innovations?
   What data is generated internally, what is obtained from external sources, and what is being missed?
   What are the barriers to using more data?
   How has data affected innovations of products, processes and business models?
   How do "big data", AI, and other digital technologies help or hinder innovations?
2. *Sustainability-related innovation activities and drivers and bottlenecks of such innovations:*
   How frequent are sustainability-related innovations?
   What activities and processes are used to create sustainability innovations?
   How important is R&D and how important are other innovation activities for sustainable innovation?
   What triggers and what blocks them, and how are business models affected by sustainability innovations?
3. *Collaboration practices and needs:*
   What benefits or added value do innovation collaborations generate?
   What collaboration/ecosystem constellations drive innovation success?
   Which channels of knowledge transfer between, e.g., universities and companies are functional?
   How do firms evaluate the existing support measures to different forms of innovation collaborations (e.g., bilateral, multilateral)?
4. *Regulation:*
   Is the timing of regulations adequate? Are areas relevant for innovation overregulated? Where are regulations missing?
   What type of regulations, e.g. related to the environment, consumers, products, work or knowledge and Intellectual Property, affect corporate innovation activities?
   Which levels of government are responsible for the most influential regulations?
   How do regulations influence corporate innovation activities? What activities and strategies do companies use to comply with the regulations?

2 Methods of data collection and analysis

2.1 Company survey

2.1.1 Questionnaire development

The questionnaire was developed by the research team over a period of several months. Relevant specialist and industry literature for Switzerland and internationally was evaluated and some questions were adapted from existing surveys in Switzerland and abroad, e.g.

from the KOF Innovation Survey (Spescha & Wörter, 2022), OECD work on sustainability innovations (OECD, 2009) and scientific studies on the influence of external dynamics on innovation activities (Narver et al., 2004).

The questionnaire was tested in twelve interviews with industry experts to improve the wording of the questions and their answerability, and to align the answer options with aspects relevant to the companies.

A four-language online version was programmed in an online survey tool and also produced as a printable personalised text document. Divided into five modules, the questionnaire contains 43 questions, although due to the filter system, no company had to answer all 43 (see Appendix 11).

2.1.2 Population and sample

The total research population consisted of companies in six sectors:

- Chemicals, pharmaceuticals & biotechnology
- Information & communication technologies (ICT)
- Medical technologies
- Metals, electronics, machines (MEM)
- Food & beverages
- Finance (banking, insurance, other financial services)

A gross sample of 6,692 VAT numbers ("UIDs") from these sectors was obtained for the survey. The large majority of the UIDs (92.6%) were provided as a stratified random sample from the corresponding NOGA classes by the Swiss Federal Office of Statistics. 495 additional UIDs were contributed by the supporting industry associations.

Table 1. Gross sample by sector and size class (in %)

	NOGA 2008	4-9	10-49	50-249	250+	Total
Chemicals, pharmaceuticals & biotechnology	19-21, 7211	254	279	162	65	760
Information & communication technologies (ICT)	261, 262, 268, 53, 61-63	348	281	296	94	1,019
Medical technologies	325	307	178	47	11	543
Metals, electronics, machines (MEM)	24, 25, 263-267, 27, 28	329	412	629	189	1,559
Food & beverages	10, 11	335	428	265	58	1,086
Finance	64-66	435	358	320	117	1,230
NOGA class missing (additional data ind. associations)		n/a	n/a	n/a	n/a	495
Total		2,008	1,936	1,719	534	6,692

2.1.3 Survey implementation and response statistics

The survey invitation was sent between December 04 and December 16, 2025, to the 6,692 unique UID numbers. In total 114 UIDs had to be taken out of the population based on the responses, for example because they were UIDs of government offices or not-for-profit organizations, the company had ceased to exist, or simply because they were separate UIDs for one commercially not separable company. Out of the remaining 6,578 UIDs for 6.7% no functioning email address could be found.

Due to the very few responses until December 19, a printed survey invitation was sent out by mail to all companies which had not yet responded after December 23. From January 15 onwards the non-responding companies were called by telephone, and a final reminder was sent on March 4 to 4,410 companies which had not yet responded.

In total, 1,744 companies (26.5%) replied to the survey invitation by activating the link to the questionnaire or requesting a printable version of the questionnaire. Another 247 companies (3.8%) rejected the survey invitation. This implies a response rate of 30.3%. The highest response rates came from companies without NOGA classes – i.e. for the addresses from industry associations – finance, and ICT (Table 2). The lowest response rates were from the food and beverages and MEM sectors. It is important to note that the statistical data in this report only refers to the companies that responded. The results are not representative for the sectors or Switzerland as a whole.

Table 2. Responses by sector (in %)

	Response	Rejection	Non-response	Not reached (by email)	Population total	Outside of population
Chemicals, pharmaceuticals & biotechnology	24.4%	3.5%	64.2%	7.9%	692	10
Information & communication technologies (ICT)	27.5%	3.3%	61.2%	8.0%	907	21
Medical technologies	25.8%	5.8%	61.3%	7.1%	496	6
Metals, electronics, machines (MEM)	23.6%	3.1%	65.2%	8.1%	1,478	25
Food & beverages	21.4%	4.4%	68.6%	5.7%	987	16
Finance	29.7%	3.9%	59.5%	6.9%	1,055	27
NOGA class missing (data industry associations)	33.7%	3.5%	60.0%	2.7%	963	9
Total	26.5%	3.8%	63.1%	6.7%	6,578	114

Response rates by industry associations are shown in Appendix 1.

2.2 Delphi-study

The Delphi study was conducted in two rounds:

1. Round 1 gathered qualitative insights through bilateral online interviews with decision makers in companies,
2. Round 2 convened the participants of round 1 – and in selected sectors further participants – to a discussion round of sectoral policy issues.

Round 1. For this initial phase, we conducted a total of 70 bilateral online interviews with experts representing companies or organizations across several key sectors. Each interview lasted for 20-30 minutes. The questions asked are provided in Appendix 12 (p. 117). The expert pool was compiled primarily from the contact base established during the previous online survey and was complemented by additional experts recommended by some of the participating industry associations. To ensure balanced sectoral representation, between 10 and 16 experts were selected per sector. All identified contacts were invited to participate via email; participation refusals were rare, and in such cases substitutes were drawn from the available contact list. This process ensured that we reached the target of 70 participants. The final sample showed the following composition of experts (see Table 3).

Table 3. Number of experts per sector and firm-size class participating in the first round of the Delphi-Study

	Small (1-49)	Mid-sized (50-249)	Large (250+)	Total
Chemicals, pharmaceuticals & biotechnology	5	2	6	13
Information & communication technologies (ICT)	4	3	4	11
Medical technologies	6	1	3	10
Metals, electronics, machines (MEM)	5	1	4	10
Food & beverages	4	3	3	10
Finance	3	2	9	16 (14)
Total	27	12	29	70

Note: No size information for two finance companies.

All interviews were recorded and selectively transcribed. The key points were summarised in an overview file, which was then further reduced by the research team manually and with the aid of AI tools (chatGPT) and evaluated for patterns (similarities, differences).

Round 2 consisted of one 120 min. group discussion per sector with the round 1 participants and, in case of insufficient availabilities, further participants from companies in the sector, as well as observers from the participating industry associations, SERI and Innosuisse. In total the six workshops had 52 participants (35 companies/17 others): finance (7/3), ICT (5/3), MEM (4/2), pharma/chemicals (7/3), medtech (7/3), and food (5/3).

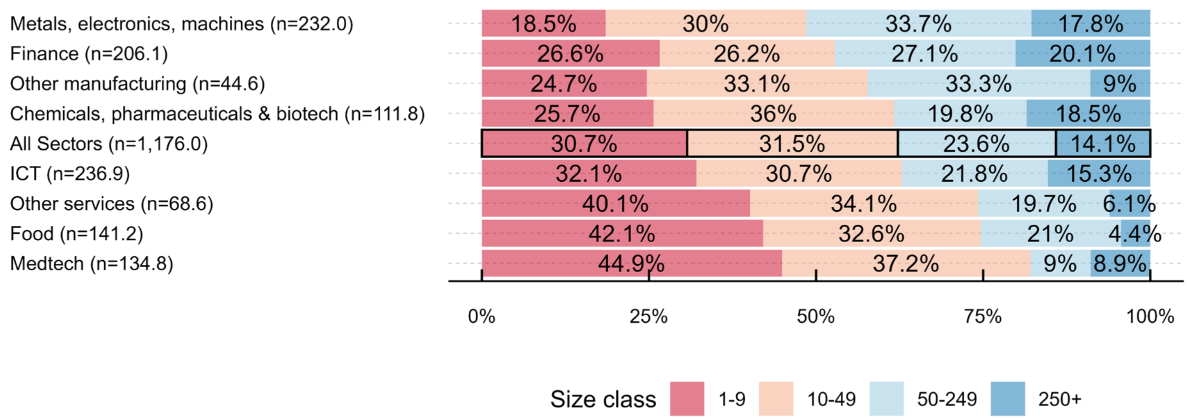
3 Results of the enterprise survey

3.1 Structural characteristics of the data set

Of the 1,188 responses to the survey, one-fifth can be assigned to the ICT sector and one-fifth to the MEM industry (see Appendix 2). 18% of the companies belong to the financial sector, while the medical technology, chemical and pharmaceutical, and food and beverage industries each account for around 10-12%. A little under 10% of the companies belong to other industrial and service sectors. The most common entries in these residual sectors were manufacturing of cosmetics, plastics, automobile components or watches and services related to retail and wholesale, education and training, real estate, and consulting.

Taking global employment, a majority of 86% of the respondents are SMEs with less than 250 employees and 14% have 250 or more employees (Appendix 3). Figure 1 (see also Appendix 4) shows the cross-tabulation of sectors and size classes. The share of larger companies with 250 or more employees is highest in finance, chemicals, pharma & biotech, MEM and ICT industries. In finance and MEM, we also find larger shares of mid-size companies among the responses, so that approximately half of the finance and MEM companies are small with below 50 FTEs, and the other half is mid-size or large. In the medtech, food & beverages, and other service industries we obtained responses from a larger number of micro firms and small companies. They add up to 82% (medtech) and 75% (food and other services) of the responses, and mid-size and larger companies are only few.

Figure 1. Distribution of responses by sectors and size



3.2 Innovation activities of the surveyed companies

3.2.1 Overview

Out of 1,131 companies providing answers on their innovation activities 83.3% were innovators 2021-23 and 16.7% did not innovate. The share of innovating companies is considerably higher in this survey than in the Swiss Innovation Survey (Spescha et al., 2025). There are several reasons for this: firstly, the survey focuses on highly innovative manufacturing and service sectors and the results cannot be generalised to the entire Swiss economy. Secondly, larger and mid-sized companies, which are more likely to innovate, are over-represented in the dataset. Thirdly, the survey was explicitly announced in the invitation to participate and in the questionnaire title as a survey on new innovation models, which may have deterred non-innovative companies from answering (self-selection bias). As a result, the share of innovators is overestimated. However, it is indeed mainly innovators who can say something about changing innovation models, and the survey invitation may also have motivated companies that have changed their innovation activities to respond.

Innovation outputs

Product innovations. The companies were asked whether they introduced product innovations in 2021-23 and before, i.e. in 2020 or earlier. While three quarters of the companies stated that they introduced product innovations in 2020 and before, the share grew to 78.1% in 2021-23 (Table 4). This increase of product innovators seems to be driven predominantly by more companies introducing new or improved services than by companies introducing new or improved goods. Moreover, incremental product innovations which are new to the firm are twice as common as radical product innovations which are new to the market.

Table 4. Product innovators

	2020 and before	**2021-23**
Product innovators (new or improved goods or services)	74.9%	78.2%
New or improved goods (incl. software, financial products)	65.0%	65.8%
New or improved services	56.5%	63.2%
Radical innovation: new to the market and not previously offered by -competitors	–	38.8%
Incremental innovation: new for the enterprise	–	77.7%
New product innovators (in 2021-23 but not in the previous period)	–	10.8%
Product innovation drop-outs (no product inn. in 2021-23 but in the previous period)	6.5%	–

Process innovations. Table 5 shows the share of respondents that introduced process innovations, defined as the first-time use of technically new or significantly improved production/process technologies to produce goods or provide services for people or objects (following the definition of OECD & Eurostat, 2018). While 54% of the companies introduced process innovations in 2020 or before, this share grew to almost 60% in 2021-23 (Table 5). While the share of companies that stopped innovating processes is almost identical to the share of those that stopped innovating products, there are slightly more companies that began innovating processes in 2021-23 than companies that began innovating products. This suggests a slight trend towards process innovations in our dataset.

Table 5. Process innovators

	2020 and before	**2021-23**
New or improved processes	54.3%	59.5%
New process innovators (in 2021-23 but not in the previous period)	–	13.2%
Process innovation drop-outs (no process inn. in 2021-23 but in the previous period)	6.8%	–

Either a product or a process innovation was introduced in 2021-23 by 83.9% of the companies, up from 80.4% in 2020 or before. Only 4.4% of the companies stopped innovating products and processes in 2021-23 compared to the previous period and out of these only a small share was willing to answer a direct question on the reasons for doing so. Financial reasons (high costs, lack of financing) and regulatory barriers were given as the main reasons by these companies.

Innovation inputs

Companies were asked as well about their R&D activities and other innovation inputs. One key input to innovation is research and development (R&D) which was defined – following the OECD (2015) – as creative and systematic work aimed at increasing knowledge, including knowledge of humanity, culture and society, and applying this knowledge to new uses. This definition excludes market research and routine software development. The share of companies that conducted R&D in 2021-23 is 63% and up by about 2 percentage points from 2020 and before (Table 6). Both, in-house R&D and external R&D contracted out to other organisations grew in a similar way. We also see that more companies started to engage in R&D than companies stopping R&D in 2021-23 compared to before.

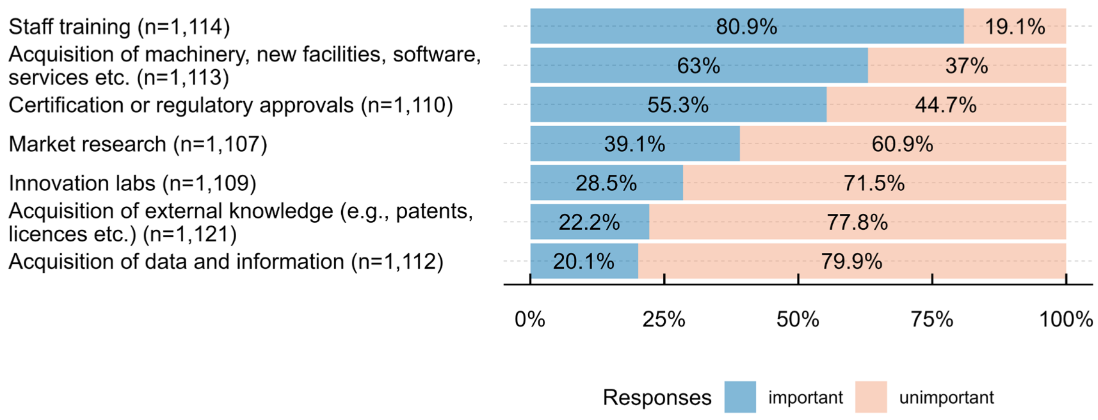
Table 6. R&D-active companies

	2020 and before	**2021-23**
R&D-active (internal R&D or contracted out R&D)	60.3%	62.9%
R&D performed in-house	53.1%	55.1%
R&D contracted out	31.6%	33.9%
R&D-active companies (in 2021-23 but not in previous period)	–	6.7%
R&D drop-outs (no R&D in 2021-23 but in previous period)	3.9%	–

The increasing importance of R&D among the companies surveyed is also supported by the fact that around 4 in 10 companies reported increasing R&D expenditure, just over half reported constant R&D expenditure and only a small proportion (7%) reported lower R&D expenditure in 2021-23 compared to 2020 and before. About half of the responding companies also provided an answer on their estimated R&D expenditure in 2023. This correlates with firm size, of course, and by dividing R&D expenditure by turnover the so-called ‘R&D intensity' of a company can be calculated: the 542 companies for which this calculation is possible, had an R&D intensity of 6.3%.[2] This number can be compared with the R&D intensities published in the European R&D investment Scoreboard (European Commission: Joint Research Centre et al., 2024) for the largest R&D investors worldwide. In 2022, the US American companies included in the scoreboard had the highest R&D intensity with 8.4% of their sales, followed by EU and Japanese companies (4.2%), Chinese companies (3.9%) and the rest of the world (3.7%). In sum, the respondents in the sample compare very well with respect to their R&D intensity.

Of the innovation expenditures not categorised as R&D, spending on staff training (81%) appears to be by far most important, followed by acquisition of machinery, new facilities, software, services, etc. (63%) and certification or regulatory approvals (55%) in second and third place (Figure 2).

Figure 2. Importance of non-R&D expenditures for innovation in 2021-23



Combining innovation inputs and outputs (innovator types)

A simple approach to combining innovation inputs and innovation outputs in one variable is shown in Table 7. As the group of non-innovators is rather small with merely 16.7%, it is not possible to differentiate them further into R&D active/not-R&D active. More than half of the companies are R&D innovators and one quarter innovates without R&D.

Table 7. Taxonomy with regard to R&D and innovation outputs

Innovation inputs		**Innovation outputs Product or process innovator in 2021-23**	
		No	**Yes**
R&D active 2021-23	**No**	Non-innovator with and without R&D: 16.7%	Non-R&D Innovator 24.8%
	Yes		R&D innovator 58.4%

Public innovation support

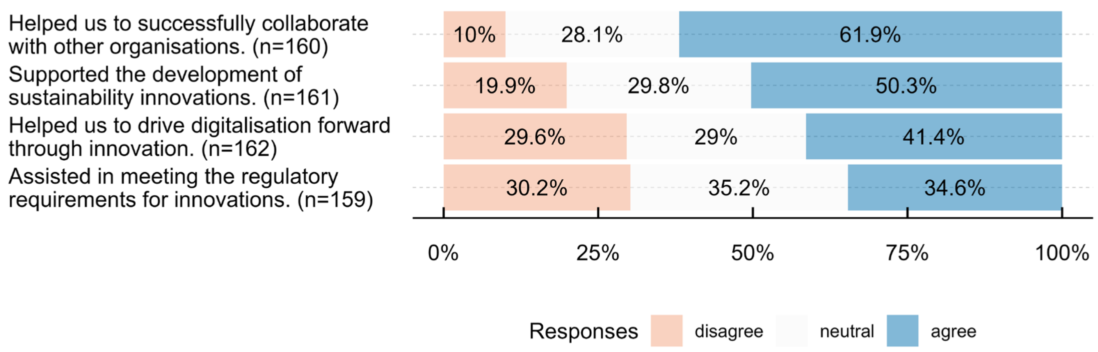
The survey also asked companies questions about the utilisation and evaluation of public innovation funding. In response, 13.5% of companies stated that they had received funding from Swiss sources. By far the most-widely used funding source is the Swiss innovation agency Innosuisse, which went to one in ten of the companies surveyed (9.5%). Cantonal or

[2] This number does not use the often used arithmetic mean, but Huber's robust M estimator which is less influenced by outliers and extreme values.

other regional innovation funding went to one in 20 companies (4.9%) and other Swiss funding to 2.2% of the responding companies. 2.8% of the companies were supported by foreign innovation funding, in particular EU programmes (to 2.7% of the companies).

Six out of ten companies saw a positive impact of public innovation support measures on collaboration with other organisations and half of the companies on the development of sustainability innovations (Figure 3). Four out of ten companies agreed that public innovation support helped to drive digitalisation forward through innovation, but three out of ten disagreed. The question whether public innovation support assisted in meeting the regulatory requirements for innovations was answered positively, negatively and in a neutral manner by about the same shares of companies.

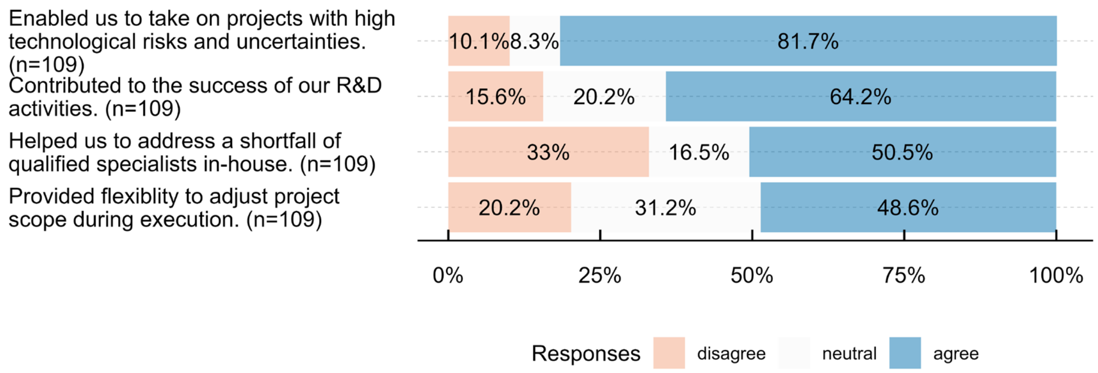
Figure 3. Agreement with the effects of public innovation funding in % of responding firms



Overall, three quarters of the responding companies currently rate public innovation funding programmes as unimportant and one quarter as important. This is in part due to not having obtained public innovation support – only a minority of 16.5% said that they received support between 2021 and 2023. In part this assessment might also be due to ineffective innovation support. With the available data, we cannot separate these two possible causes. A majority of 70% stated that the importance has not changed, while almost identical proportions of 15% stated that public innovation funding is more/less important today than in the past.

Being asked more specifically about the impact of Innosuisse innovation support, more than 80% of the companies agreed that it enabled them to take on projects with high technological risks and uncertainties (Figure 4). Almost two thirds agreed that Innosuisse support contributed to the success of their R&D activities, and half of the companies agreed that the support provided flexibility to adjust project scope during execution and helped to address a shortfall of qualified specialists in-house. On this last point, however, a third of the companies disagreed, suggesting that support in closing skills gaps is not universal.

Figure 4. Agreement with the effects of Innosuisse support in % of responding firms

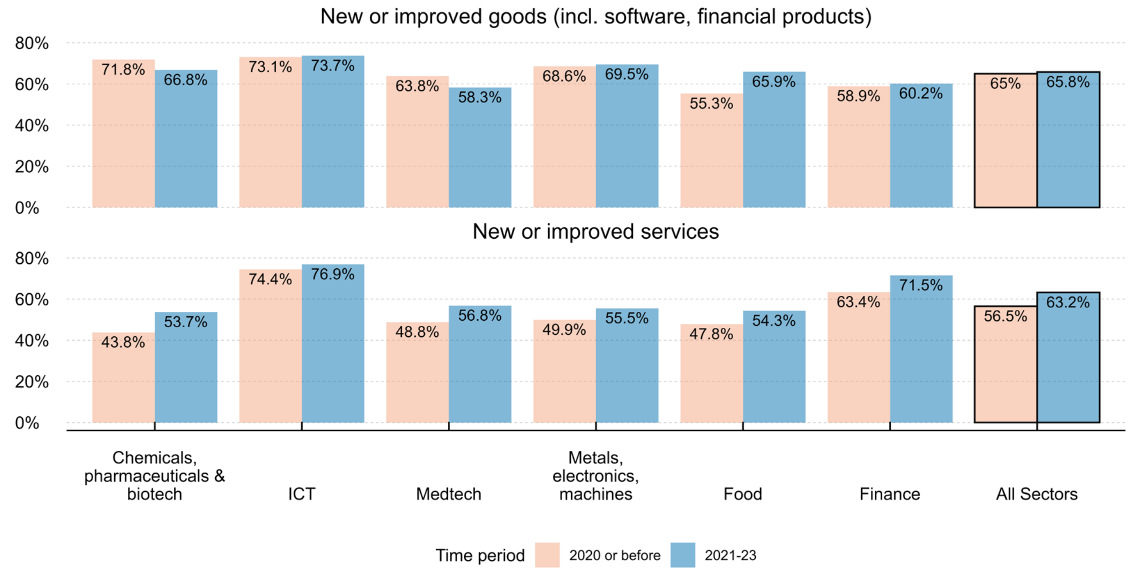


3.2.2 Innovation activities by sectors

Innovation outputs

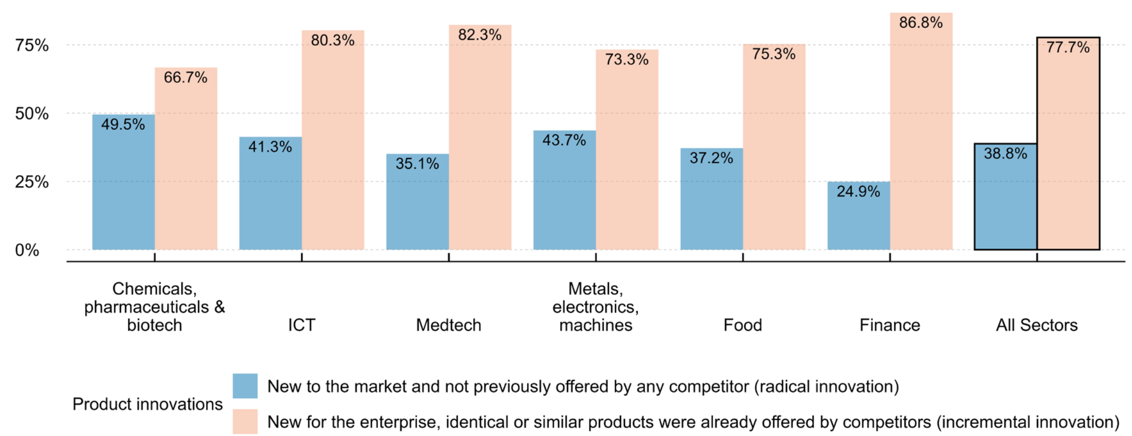
Product innovations. The trend towards service innovations is ubiquitous in all sectors included in this analysis and it is particularly pronounced in the chemicals, pharma & biotech, finance and other service sectors (Figure 5). The introduction of new or improved goods is still a common way to innovate which has, however, become less common among companies in the chemicals, pharma & biotechnology and medical technology sectors in 2021-23 compared to before. Only in the food sectors the commonness of introducing new goods has grown while it remained constant in the remaining sectors.

Figure 5. Product innovations by sector



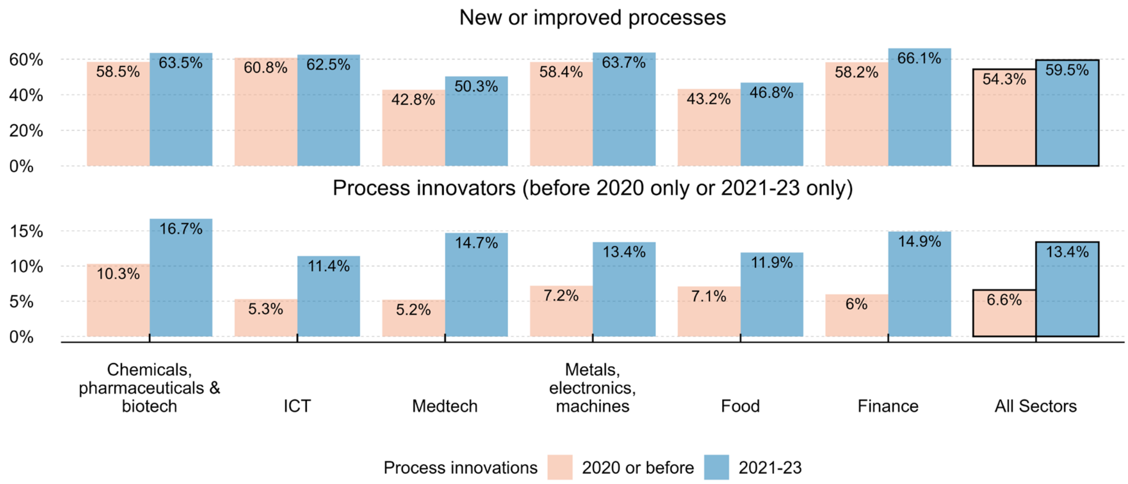
In terms of the degree of novelty, we distinguish between radical and incremental innovations. Around half of the companies in the chemical, pharmaceutical and biotech industries have undertaken radical product innovations in 2021-23, and 40-45% of companies in each of the ICT, MEM, other industry and other services sectors (Figure 6). We find low proportions of radical innovators in the financial sector in particular, where incremental innovations dominate by far. Radical innovations are also reported somewhat less frequently and incremental innovations somewhat more frequently in the medical technology and food sectors.

Figure 6. Radical and incremental product innovations by sector (in %)



Process innovations. The increased importance of process innovations (Table 5, above) indeed applies to all sectors without exception (Figure 7). Above all in medical technologies, finance, and the residual of other manufacturing industries the increase is particularly pronounced. Medical technologies companies are catching-up, but nevertheless fewer companies have innovated their processes than in most other sectors, similar to the food and other service industries.

Figure 7. Process innovations by sector and time period

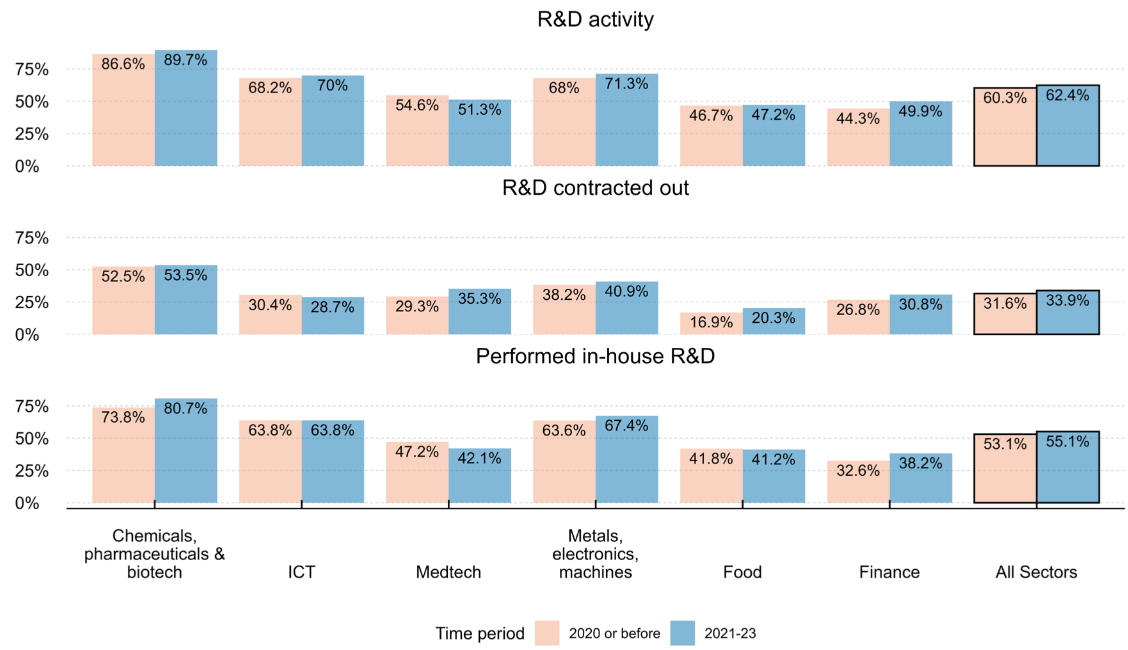


Innovation inputs

The developments with regard to R&D activities differ notably between the sectors (Figure 8).

- In medical technology, a smaller proportion of companies engages in R&D. But company-internal and external developments are different: while around 5% fewer companies are conducting internal R&D in 2021-23 than in the past, the proportion of companies purchasing R&D services from external sources has increased by even a higher share. However, the companies that contracted out R&D still performed in-house R&D and the overall proportion of R&D active firms declined. This suggests a diversification of R&D in some medtech firms while others stopped.
- In chemicals, pharmaceuticals & biotech only the proportion of companies conducting R&D inhouse has increased further, from 74% to 81% which led to a small increase of the share of R&D-active firms overall.
- In the finance and MEM sectors both, inhouse and external R&D have become more important.

Figure 8. R&D activities by sector (in %)



We see the increasing importance of R&D in the finance sector also in the result that more than half of the finance companies have increased their R&D spending and virtually no company has reduced it (Figure 9). In the food sector, however, the situation is reversed: only a small proportion (26.1%) of companies increased their R&D expenditure, while the majority of 60.4% kept it constant and 13.5% reduced it.

Figure 9. Change of R&D expenditures by sector 2021-23 compared to 2020 or before

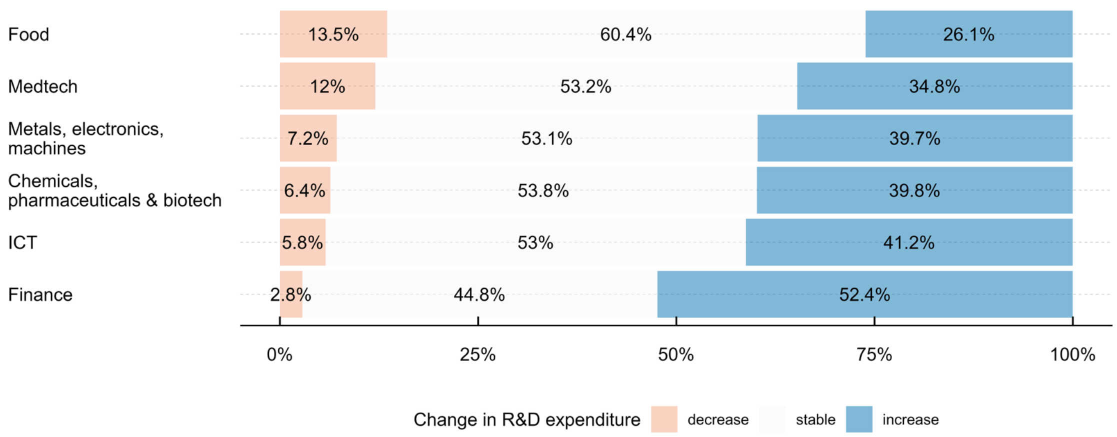


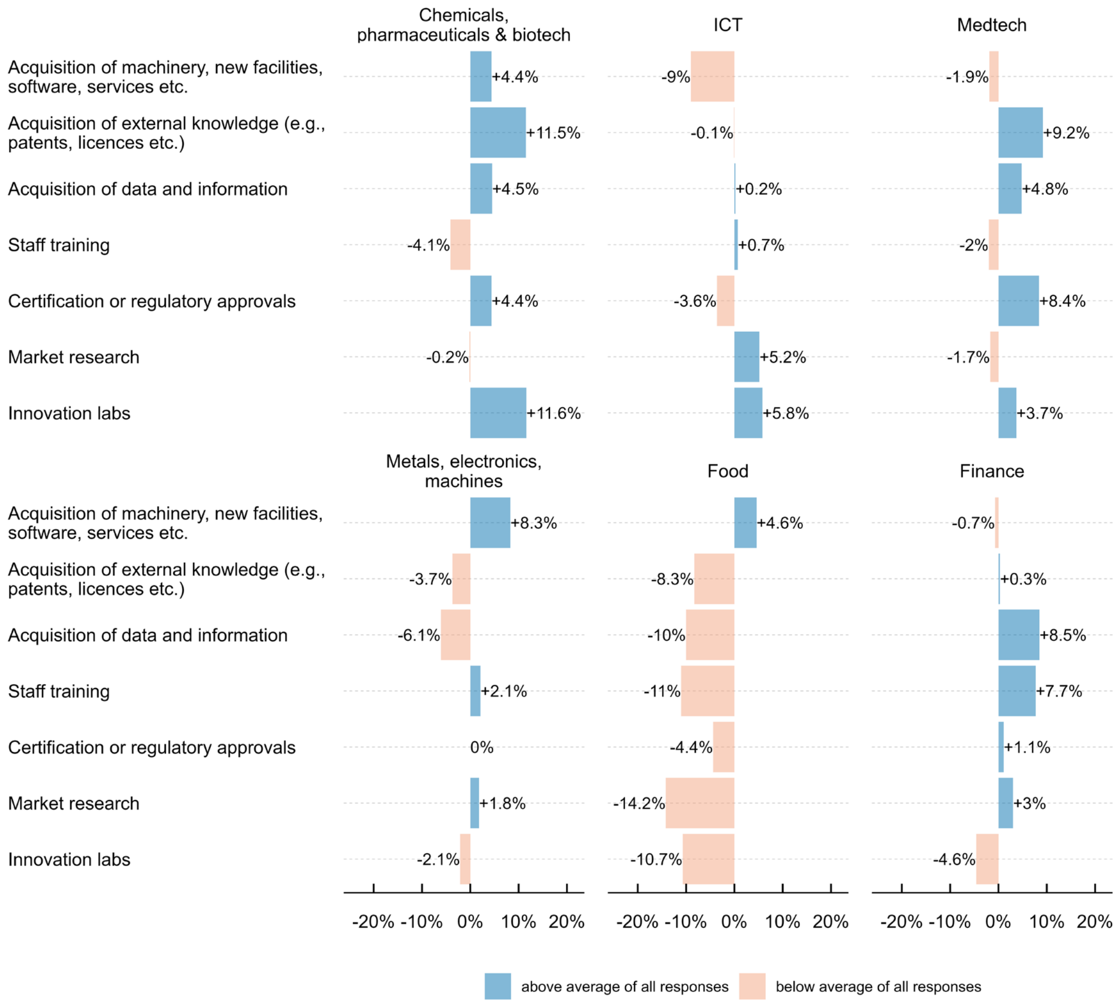
Table 8 shows the estimated average R&D expenditure and R&D intensity for each of the six sectors. The R&D expenditures reflect to large degree the company size differences between the sectors in the sample (see Figure 1, p. 18). Table 8 provides the R&D investment divided by total sales (R&D intensity) as well. For this measure, the pharmaceutical sector has a clear lead over all other sectors: the responding companies invested 2023 20% of their turnover in R&D (the estimation for the robust standard deviation cannot be shown, as it did not converge). The medtech sector has the second-highest R&D intensity at 4.6% and MEM and ICT companies also have an R&D intensity of around 4%. Finance and food companies have clearly lower R&D intensities, and the standard deviation suggests that in food a few companies invest in R&D whereas many don't.

Table 8. Estimated average R&D expenditure and R&D intensity by sector, 2023

	Estimated R&D expenditure (in CHF, 2023)			R&D intensity		
	n	Mean[b]	SD[b]	n	Mean[b]	SD[b]
Chemicals, pharmaceuticals & biotech.	72	1,186,200	837,000	63	0.200	na[c]
Information & communication tech. (ICT)	121	473,100	318,000	114	0.036	0.017
Medical technologies	42	522,100	355,000	48	0.046	na[c]
Metals, electronics, machines (MEM)	121	872,100	580,000	119	0.043	0.023
Food & beverages	35	290,700	193,400	33	0.009	0.006
Finance	59	698,300	450,000	57	0.01	na[c]
Total[a]	541	460,620	340,000	541	0.058	0.044

a The total includes further companies in other sectors which are not shown separately.
b Robust Huber M-estimators.
c SD = 0 for R&D intensity means the robust procedure deems all variability as outlier-driven.

Figure 10. Patterns of non-R&D innovation activities by sector



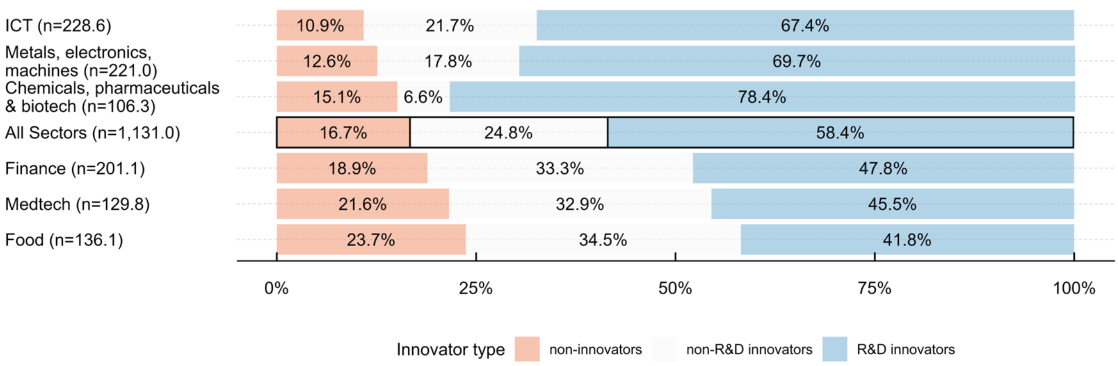
As Figure 2 (p. 20 above) has shown, staff training, the acquisition of hardware, software and services, and spending on regulatory approvals are the most important non-R&D spendings, whereas the acquisition of knowledge and of data are only relevant for small shares of firms. These patterns vary by sector (Figure 10):

- In chemicals, pharmaceuticals and biotechnology the acquisition of knowledge and data, as well as innovation labs are considerably more important than in the other sectors.
- Likewise, in medical technologies the acquisition of knowledge plays a higher role as does certification and regulatory approval.
- In the ICT sector, the acquisition of hard- and software is less important.
- In MEM, the acquisition of hardware, software and services is more important, and the acquisition of data and information is less important.
- In finance this is exactly the opposite, and, in addition, staff training is of high importance.
- Staff training, market research, innovation labs and virtually all other areas of expenditure except for hard-/software and service purchases are less important among food companies.

Innovator types

Figure 11 shows the shares of the three different innovator types, i.e. R&D innovators, non-R&D innovators and non-innovators by sector. R&D innovators are most common in the chemicals, pharmaceuticals and biotechnology sector, where they account for more than three quarters of companies. They are also very common in the MEM and ICT sectors, where they constitute more than two thirds of all companies. R&D-based innovation is less prevalent in the finance, medical technology and food sectors, where around a third of companies innovate without research and development and a fifth of companies – and in the case of food, almost a quarter – did not innovate at all during the surveyed period.

Figure 11. Innovator types by sector (in %)

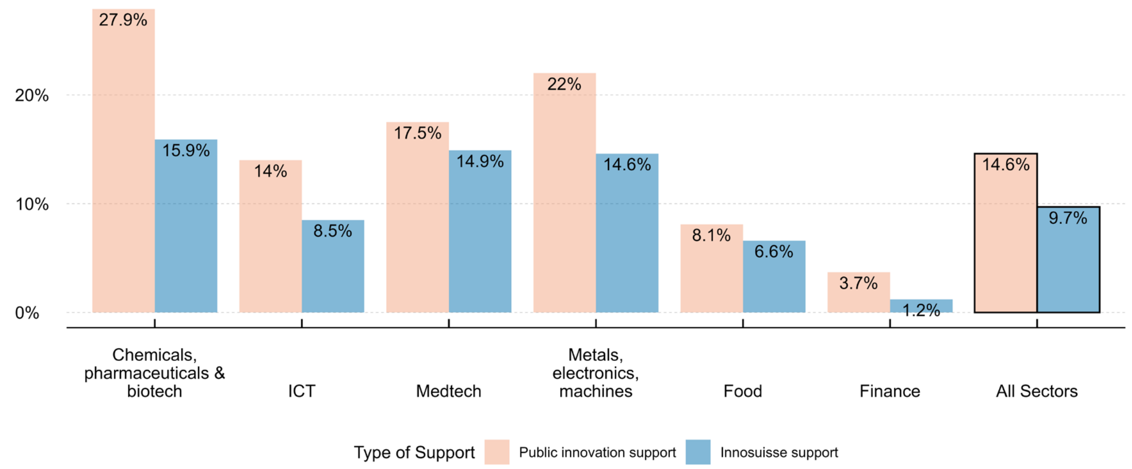


Public innovation support

Companies in the chemical, pharmaceutical and biotechnology sectors reported receiving public support for their innovation activities almost twice as often as all companies overall (Figure 12). In the MEM industry and medical technology, the proportion of companies receiving support is also slightly above the average for all companies. By contrast, companies in the financial sector received support significantly less often, and the proportion of companies receiving support in the food sector is also slightly lower than in the overall sample. The assessment of the importance of public funding by sector paints a very similar picture, with a relatively large percentage of companies in chemicals, pharmaceuticals and biotechnology and in metals, electronics and machinery classifying funding as important, and few companies in finance and food doing so (Appendix 6, p. 105).

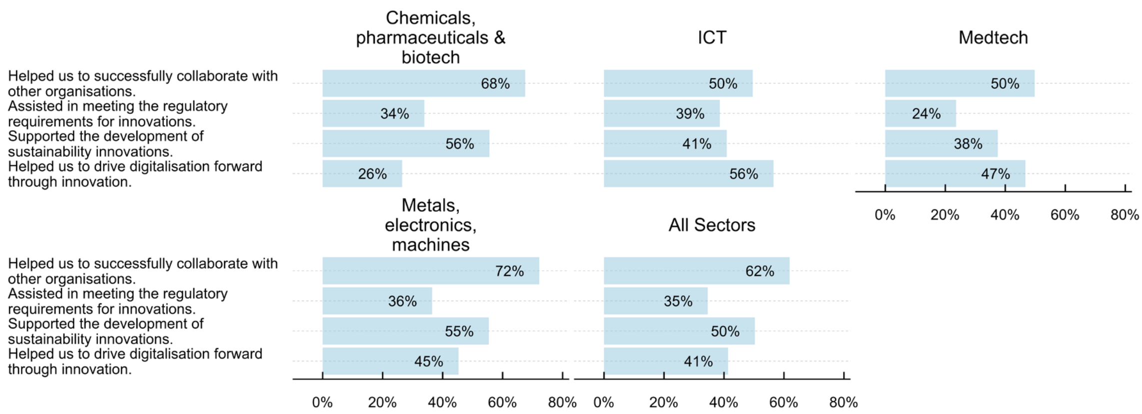
If we differentiate the share of companies that obtained Innosuisse support by sector, we get a similar picture again (Figure 12): in the three sectors of chemicals, pharmaceuticals and biotechnology, medical technology, and machines, electronics and metals the share of supported companies is higher than in the total sample and in finance and food it is smaller (the other sectors are close to the ratio for all companies). It is not easy to explain this funding bias towards three sectors. In part it might be due to the prevalence of R&D-based innovation (pharma and MEM), but in the ICT sector R&D innovators are also common and the funding ratio is only average, while in medtech the funding ratio is above the average and R&D innovators are rather fewer than in the total sample.

Figure 12. Use of public innovation support and Innosuisse support by sector (in %)



Due to the low take-up of innovation funding, no statement can be made about the impact of funding on the financial and food sectors. The same applies to the residual sectors of other industries and other services due to the low number of cases. In the chemical, pharmaceutical and biotechnology industries, the effects of funding on the development of sustainability innovations and support for cooperation with other organisations are above average (Figure 13). Similarly, in the mechanical, electrical and metalworking sectors innovation support promotes cooperation with other organisations. This effect is significantly less pronounced among medical technology and ICT companies. However, in the ICT sector, the impact of innovation support on digitalisation is reported to be greater than in other sectors.

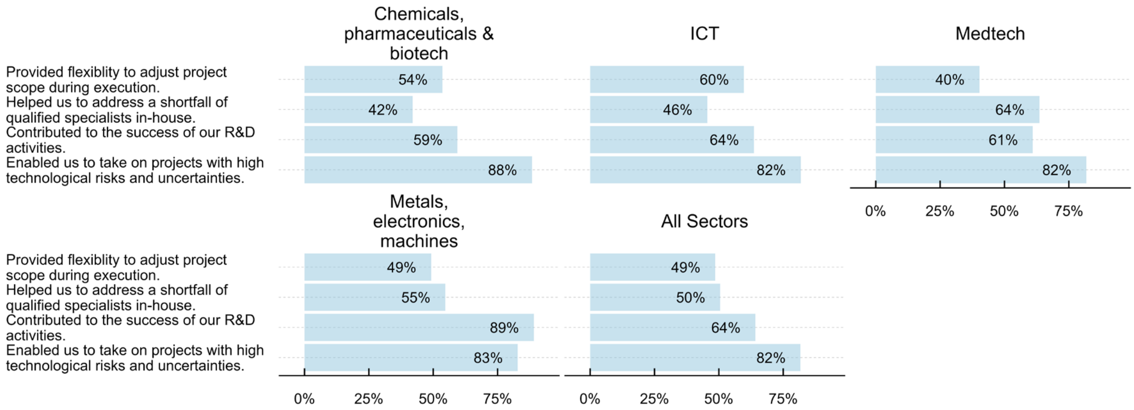
Figure 13. Evaluation of public innovation support by sector (% of firms agreeing to an effect)



Note: Sectors finance and food are omitted due to low case numbers for these variables.

With regard to Innosuisse funding, too, statements can only be made for four of the eight sectors. The chemical and pharmaceutical industry points to support for projects with high technological risks even more than other sectors (Figure 14). For the MEM sector, by far the most important effect of Innosuisse funding is its contribution to the success of R&D activities. This is the view of nine out of ten Innosuisse-funded MEM companies, which is a considerably higher proportion than in other sectors. In medical technology, on the other hand, funding has improved access to qualified specialists, and in the ICT sector, the flexibility of funding and opportunities for adjustments were emphasised more than in the overall sample.

Figure 14. Evaluation of Innosuisse support by sector (% of firms agreeing to an effect)



Note: Sectors finance and food are omitted due to low case numbers for these variables.

Summary on sectoral differences

We find increasing shares of companies that have introduced service innovations and process innovations in 2021-23 across all sectors. However, the innovation patterns nevertheless show some marked differences between the sectors:

- In *chemicals, pharmaceuticals & biotechnology* the growing proportion of companies introducing new services is particularly pronounced, but service innovations are still less important than in all the other sectors. The companies invest large amounts in R&D and a lot of innovation in this sector is R&D-based. The companies also rely more than in the other sectors on the acquisition of external knowledge (e.g. patents, licenses). The shares of both, companies conducting R&D internally and contracting out R&D, are the highest of all sectors, and even more companies have taken up in-house R&D in 2021-23. The sector has the largest proportion of companies that have benefited from public innovation support measures. Public support is viewed positively in terms of promoting cooperation, and Innosuisse funding in particular helps with the implementation of risky projects. In summary, the sector appears to follow the research- and science-based model of innovation closely and also receives significant support from public innovation funding. This funding allows additional risks to be taken, but is not necessarily guaranteeing success given the high innovation costs in later (clinical) phases.
- The *ICT sector* also has an above average share of R&D-innovators and of all sectors it has the highest shares of goods and of service innovators (three quarters of all firms). Both, incremental and radical innovations are common. Lower shares of companies from the ICT sector were supported by public innovation funding. The focus of the companies is on digital innovation, and more than half agreed that the public funding helped them to advance this.
- *Medical technologies* companies in the sample are relatively small and merely 18% of the responding companies had 50 or more FTEs. The medtech sector has fewer product innovators than the other sectors and fewer of them are radical innovators but incremental innovators are more common. In medtech, R&D is less important than in the

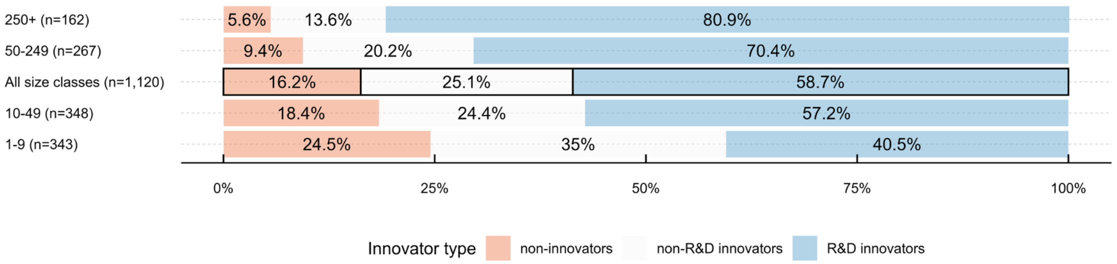
other sectors and it is the only sector where fewer companies conducted R&D in 2021-23 than in 2020 or before. There are more companies which gave up in-house R&D than companies starting to do it. However, of those continuing to invest in R&D in-house, also a higher share started to use additional external R&D contracts and R&D intensity is second highest of all sectors, although its value is less than a quarter of that of the pharmaceutical industry. Purchasing external knowledge and certification and regulatory approvals are the two more important non-R&D activities for medtech companies compared to the overall dataset. Medtech has a low share of R&D innovators, but the sector nevertheless benefited from public innovation/Innosuisse support above average. Innosuisse support permits to take on high risk projects and close gaps with regard to qualified specialists.

- In the *machine, electric, and metal (MEM)* industries, product innovation traditionally has placed a strong focus on goods, but services are also becoming more important. Above average shares of companies conduct in-house and external R&D and the acquisition of hard- and software for innovation is more important than in the other sectors. MEM companies have benefited from innovation funding also above average, and they point to frequent positive effects of innovation funding on collaboration and its vital role for the success of the R&D activities (9 out of 10 companies). This comes somewhat as a surprise, as the MEM companies are on average the biggest companies in the sample, with more than half of them having 50 or more FTEs, and the larger companies, the less they are usually affected by resource constraints.
- In the *food sector* even more than before innovations consist of new goods. However, food companies invest less often in R&D than companies in the other sectors in the dataset and the sector has by far the lowest R&D intensity. Only one out of five companies contracted out R&D. The food sector has the lowest share of R&D innovators and the highest shares of non-R&D innovators and non-innovators. Food companies were also less often supported by public innovation support measures.
- The *finance* sector is different to most of the other sectors in several regards: finance companies are above all orientated towards new services and new processes. Their product innovations are in most firms incremental and only in less than a quarter radical. Even though the share of R&D active companies has grown from 2020 or before to 2021-23, it is still below the level of most other sectors and similarly low as that of food companies. Finance firms have the second lowest R&D intensity, just slightly above food companies. The proportion of non-R&D innovators is the second highest in finance and the proportion of R&D innovators is among the lowest. However, not only the proportion of firms conducting R&D has risen, but finance is also the only sector in which a majority of the companies has pointed to higher R&D spending in 2021-23 than before. Moreover, finance companies stated more than companies in the other sectors that they acquire data and information and train their staff for succeeding in innovation. Still, the innovation model of finance companies does not seem to map well on public innovation support, as out of all sectors, by far the smallest share of firms has benefitted from such support.

3.2.3 Innovation activities by firm size

In Figure 15 we differentiate the responses by firm size and show the commonness of innovator types for micro-enterprises (1-9 FTEs), small companies (10-49 FTEs), mid-size companies (50-249 FTEs) and large companies (250 or more FTEs). The commonness of R&D innovators grows with firm size, whereas the commonness of non-R&D innovators and non-innovators gets smaller. Among the largest companies 6 out of 7 are R&D innovators whereas among micro enterprises their share is merely 40%. Non-R&D innovators are almost as common as R&D innovators among micro-enterprises and they still constitute one quarter of the firms with 10-49 FTEs. Very small enterprises also conducted less often new to the market product innovations and they have less often introduced process innovations (Appendix 5).

Figure 15. Innovator types by size class



The difference between micro-enterprises and small and medium enterprises with 10-49 and 50-249 FTEs is particularly pronounced for external R&D contracts: while 35-40% of these companies said that they had contracted out R&D, it is approximately half this share among micro-enterprises (Figure 16). The difference between small and large companies with regard to internal innovation activities is smaller. This suggests that micro-enterprises often lack the resources to engage in innovation cooperation, i.e. their limited internal resources and capacities do not allow them to expand their resources and seek external support.

Figure 16. R&D activities by size class

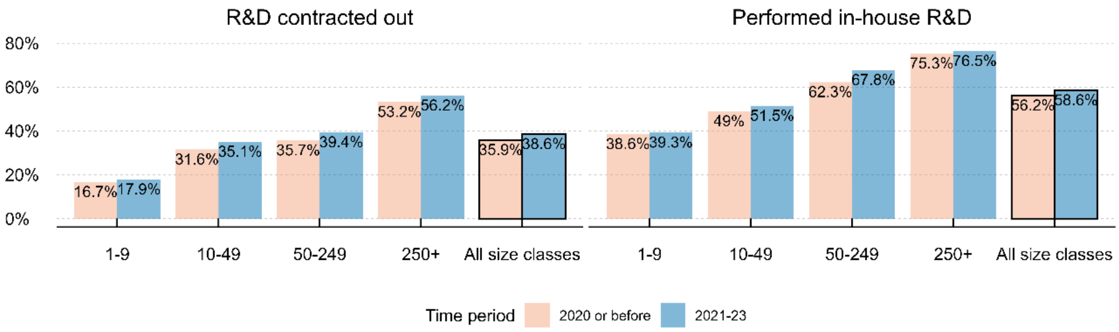
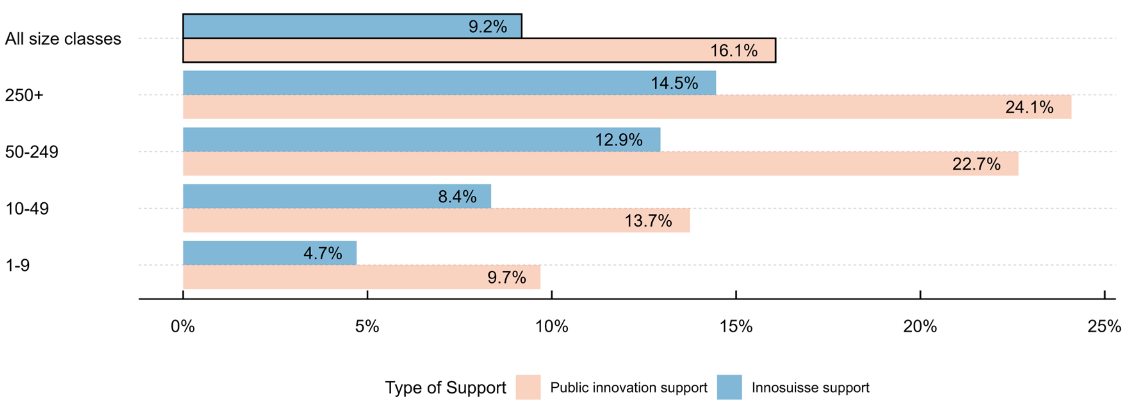


Figure 17 differentiates the use of public innovation support and Innosuisse support by firm size. Use increases with firm size, with mid-size (50-249 FTEs) and larger companies (> 250 FTEs) using the funding to about the same degree and above all micro-enterprises using it to very small extent.

Figure 17. Use of public innovation support and Innosuisse support by company size

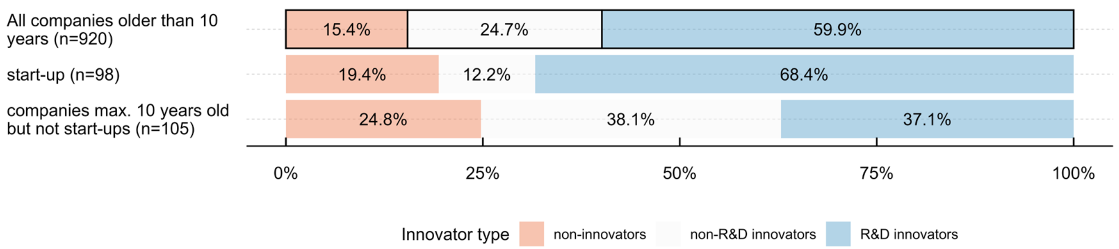


3.2.4 Innovation activities of start-ups and other young companies

All companies founded in 2015 or later (max. 10 years old) were asked whether they consider themselves as start-up companies, including spin-offs from a university or public research organisation, split-offs from another business enterprise, or independent start-up companies. In total 18.3% of the companies responding to this question (216 out of 1'179) were 10 years or younger and half of them, 9.2%, classified themselves as start-ups. 30% of all start-ups are companies in the ICT sector, 19% medical technology companies and 16% chemicals, pharmaceuticals or biotechnology companies.

If we cross-tabulate the start-up companies with the innovator types (Figure 19), we see that they are less often non-innovators than the other companies younger than ten years, but not than the rest of the sample. They are also less often non-R&D innovators than other young companies which are not start-ups – 12.5% compared to 38.6% – and more often R&D innovators 68.8% compared to 35.6%. The distribution of the three innovation types among young companies which are not start-ups is similar to the one among micro-enterprises with up to 9 employees (see Figure 15, above). In fact, a considerable share of these young companies are micro-enterprises (58%% compared to 30% among all firms) which is certainly one explanation for their low innovation rate.

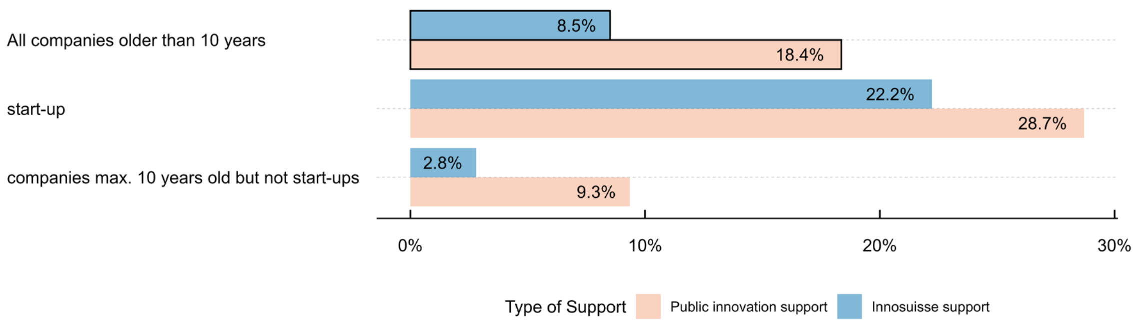
Figure 18. Innovator types by company age/start-up companies[a]



a Start-up companies are all companies that are max. 10 years old and consider themselves as university/public research organisation spin-offs, corporate split-offs, or independent start-ups.

When we distinguish between the use of public innovation funding and Innosuisse funding among start-ups, other younger companies and older companies (Figure 19), we see that public innovation funding, and Innosuisse funding in particular, is strongly focused on start-ups, with other young companies being relatively neglected: Start-ups account for 10% of R&D innovators in the data set and other young companies for 6%. Furthermore, 15% of all funded companies in the data set and 20% of companies funded by Innosuisse describe themselves as start-ups. Only around 5% of publicly funded companies and only 3% of those funded by Innosuisse are other young companies – meaning that other young companies are significantly less present in Innosuisse funding than in R&D-based innovation.

Figure 19. Use of public innovation support and Innosuisse support by company age/start-up type

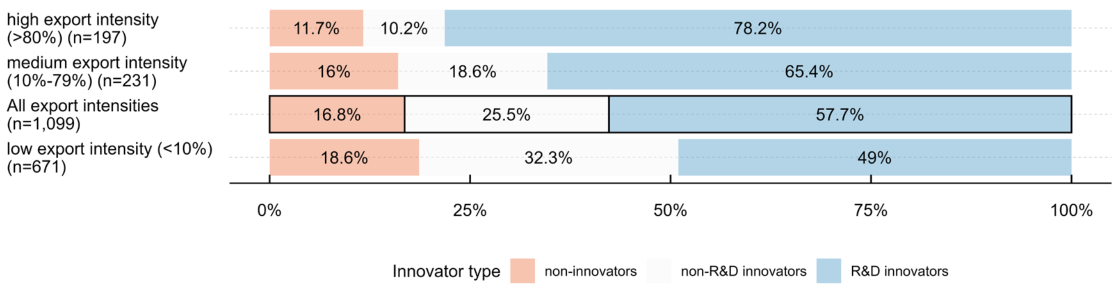


3.2.5 Innovation activities of exporting companies

We also asked the companies what proportion of their sales out of their Swiss locations were generated by sales to foreign customers (exports). Around 60% of the companies in the data set stated that they generated a maximum of 10% of their revenues through exports. Around 20% stated that they generated between 10% and 79% of their revenue from exports, and a further 20% stated that 80% or more of their revenue came from exports. Sectors in the data set with a particularly high percentage of export-intensive companies are by far the mechanical and electrical engineering industries (36%) and the chemical, pharmaceutical and biotechnology industries (one third of companies). In the medical technology industry, 18% of companies are export-intensive – although in this industry, a high proportion of 70% also has practically no export activity. Exports play hardly any role in the food industry (four out of five companies with a maximum of 10% of revenues from exports) and in the financial sector (more than three-quarters of companies with a maximum of 10% of revenues from exports).

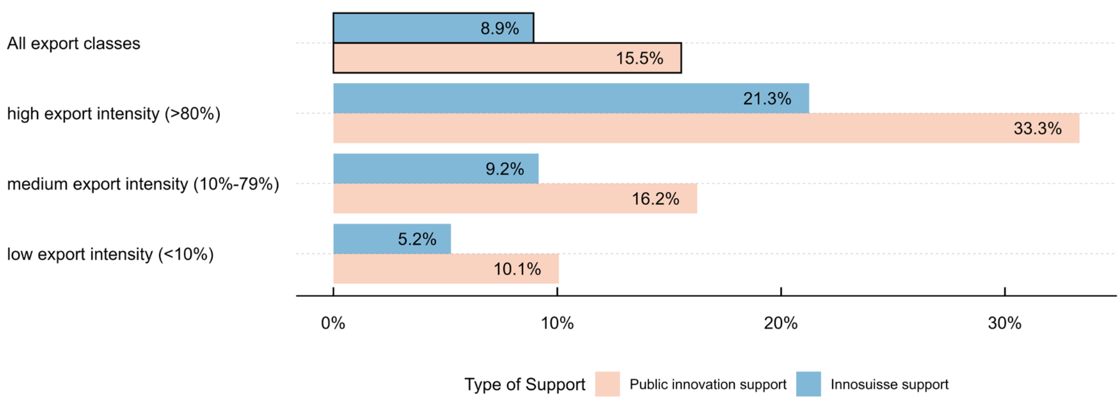
Figure 20 shows the commonness of the innovator types among the three groups of companies with low export intensity (up to 10% of sales), medium export intensity (10-79% of sales) and high export intensity (80% or more of the sales). The proportion of R&D innovators grows with export intensity, whereas the proportion of non-R&D innovators and non-innovators gets smaller.

Figure 20. Innovator types by importance of exports among sales



Public innovation support and Innosuisse support are also more common among export-intensive companies than among companies that export not or merely small shares of their sales (Figure 21).

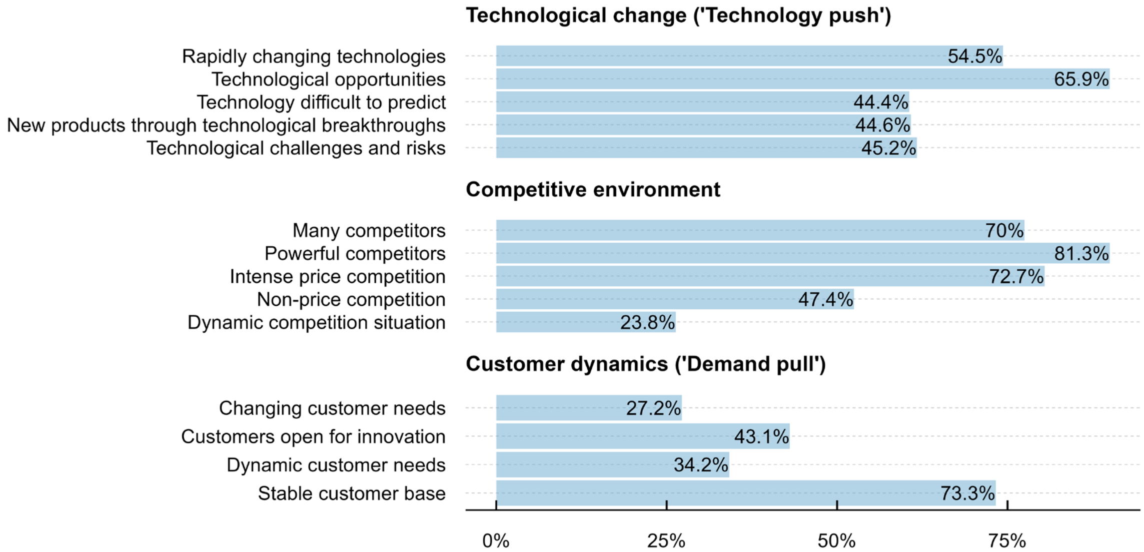
Figure 21. Use of public innovation support and Innosuisse support by importance of exports among sales



3.3 Technology, competition and market dynamics

In order to identify the dynamics that companies see in their environment and whether this perception is linked to their innovation activities, the companies were asked five questions about each, the competitive environment and technological dynamics, and four on customer dynamics. The highest level of agreement was found in relation to questions concerning the intensity of (price) competition and the opportunities and speed of technological change (see Figure 22 and Appendix 7 to Appendix 9, pp. 106ff). Non-price competition and the overall degree of customer-related dynamics, including stability of the customer base (negative item with regard to customer dynamics) were assessed as comparatively unimportant.

Figure 22. Important aspects of technological change, competition and customer dynamics (in %)

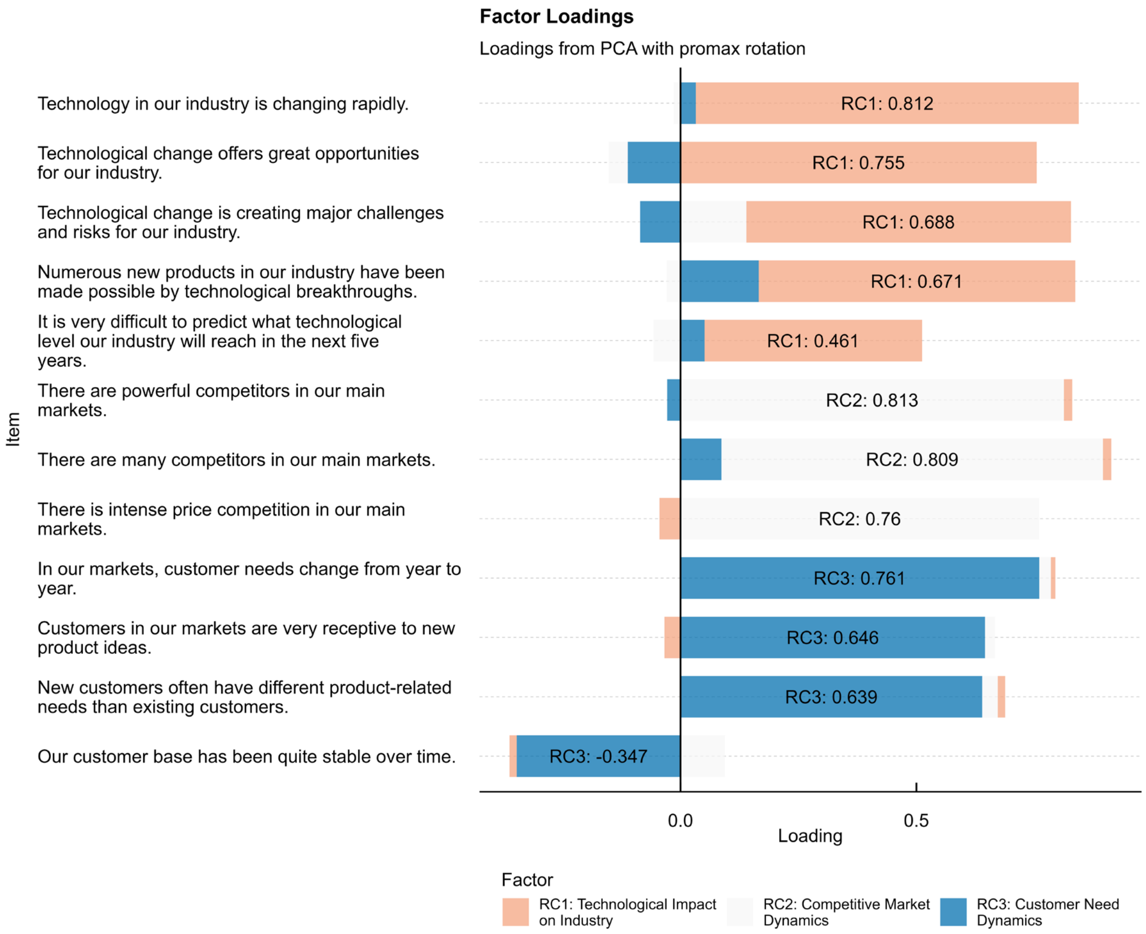


We then conducted a principal component analysis (PCA) with 12 of these 14 items which resulted in three distinct components (RC1, RC2, and RC3, see Figure 23):[3]

- Factor RC1 primarily relates to the technological dynamics within the industry, with strong loadings from speed of technological change (0.812), and the other technology-related variables. This factor covers perceptions on technological change and its impact on the company (challenges and opportunities).
- Factor RC2, with high loadings from all three variables, existence of powerful competitors, a large number of competitors along with intense price competition, represents competition-related aspects. We excluded non-price competition and dynamics with regards to market entry and exit of competitors, as these variables did not load highly on a single factor, had high cross-loadings and reduced the suitability of the dataset for this type of analysis.
- Factor RC3 captures the shifting nature of customer demand and openness to new product ideas, with the highest loading from changes of customer needs (0.761) and respectable contributions from customers' openness to innovation. The stability of the customer base has only a modest negative loading on this factor, but does not have high cross-loading on any of the other factors.

[3] PCA with a KMO measure of 0.743 and the three factors explaining 49% of the variance of the responses.

Figure 23. Factor loadings from a PCA on customer, technology and market dynamics



The factor loadings differentiated by sector illustrate to what extent the sectors are affected by these customer-related, technological, and competition dynamics (Figure 24). Two of the sectors, chemicals, pharmaceuticals and biotechnology and the residual of other services are not different for any of the factors from the overall sample (only bars with a black frame contain significant differences between factor values for a sector and for the overall sample).[4]

– ICT companies gave the highest priority to technological change (by far) and customer dynamics, and the lowest priority to competition in comparison with other sectors.
– Medical technology companies also see technological change as the most important factor, whereas they do not differ from the overall sample in terms of competition and customer dynamics.
– The MEM industry reports lower levels of concern about technological change and customer dynamics. Other manufacturing is very similar to MEM.
– Technological developments appear to be significantly less relevant for the food industry than for other industries, while it points most strongly to the influence of competition.
– Last but not least, technological change is strong, and customer dynamics are of little significance in the financial industry.

[4] However, one aspect of competition is lost for the chemical, pharmaceutical and biotechnology sector, as non-price competition was excluded from the factor analysis (as it does not correlate with the other aspects of competition): companies in this sector are disproportionately affected by non-price competition. This also applies to the group of R&D innovators, which includes four out of five companies from the pharma sector.

Figure 24. Mean factor loadings of customer, technology and market factors by sectors

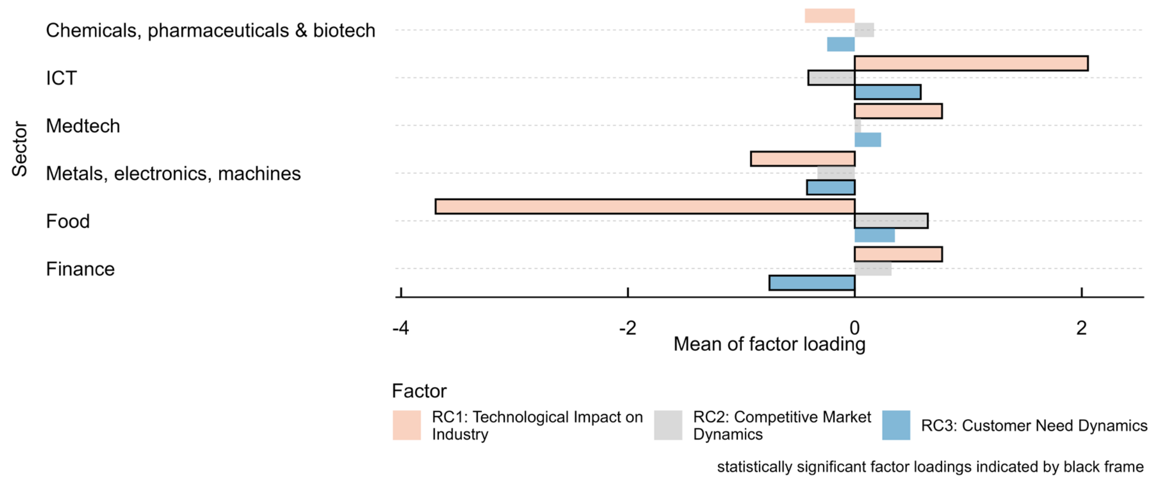
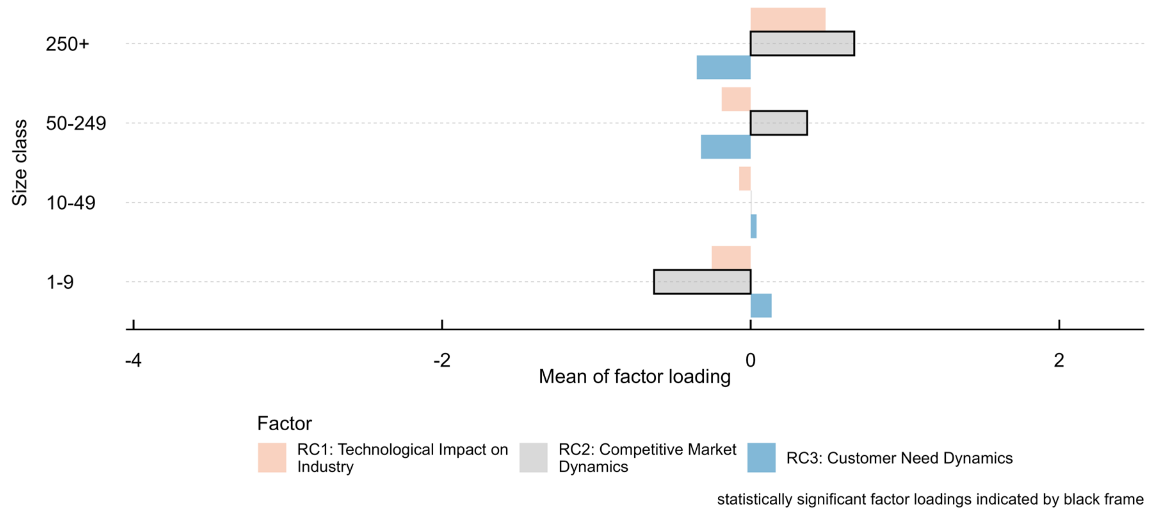


Figure 25 contains the factor loadings by company size. While there seems to be a tendency that the larger a company, the higher it assesses the importance of competition and technology-related dynamics, and the lower it rates the importance of customer-related dynamics, the differences between size groups are only significant for the competition factor RC2.

Figure 25. Mean factor loadings of customer, technology and market factors by company size



The assessments of the contextual influences on the companies also vary by innovator type (Figure 26). Interestingly, there are no differences between the innovator types for the competition factor, i.e. R&D-innovators, non-R&D innovators and non-innovators do not assess competition in a distinct manner. However, for the other two factors we see differences: above all technological dynamics are perceived as less pronounced by non-innovators and more pronounced by R&D innovators. Customer need dynamics are perceived as less pronounced by non-innovators. Non-R&D innovators do not assess any of the factors differently than the overall sample. Start-ups also have a significantly different perception of technological dynamics as more pronounced and relevant and competition as *less* pronounced and relevant (Figure 27).

Figure 26. Mean factor loadings of customer, technology and market factors by innovator type

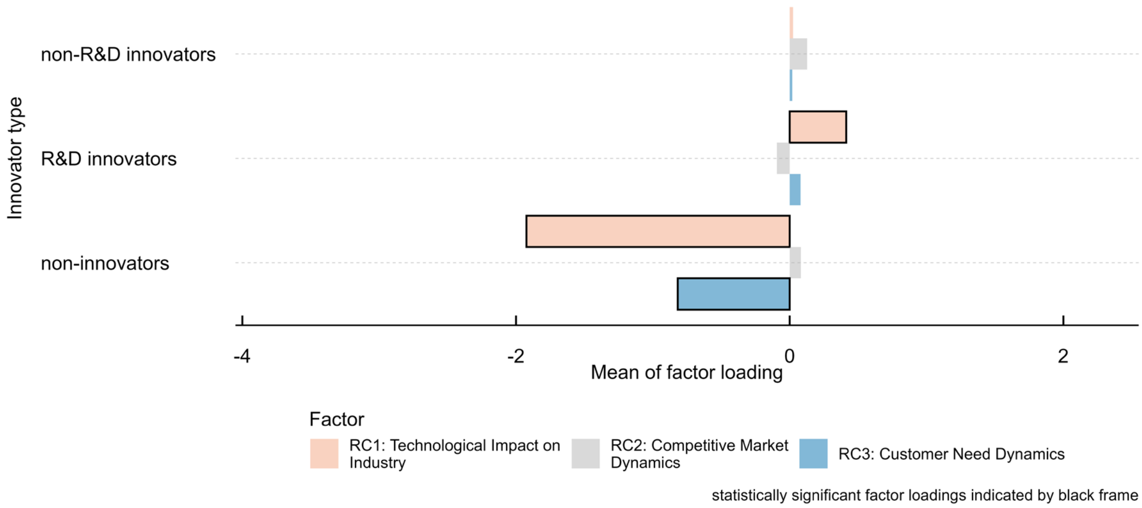
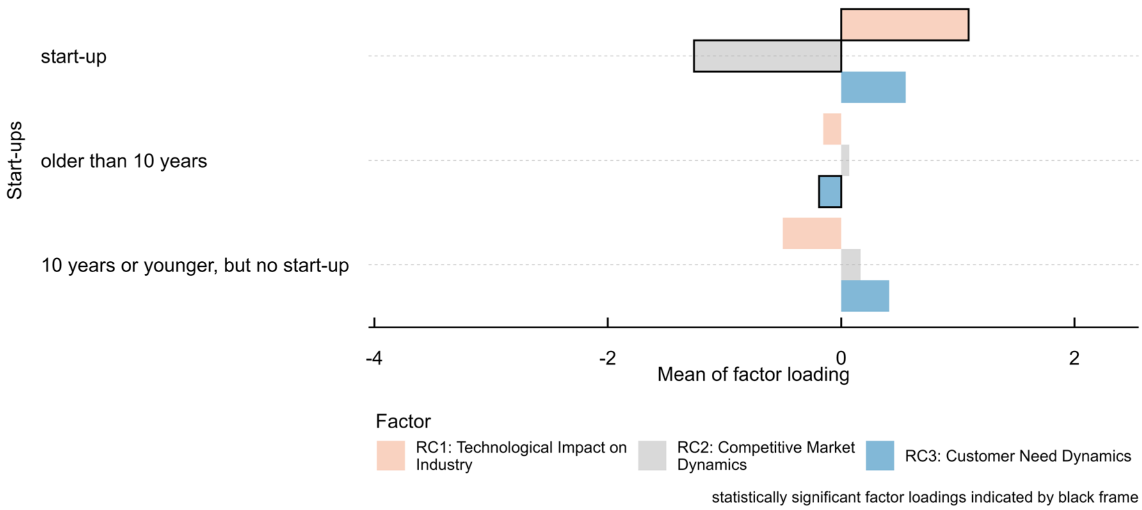


Figure 27. Mean factor loadings of customer, technology and market factors by start-up and company age



In sum, the assessment of the contextual dynamics shows that the sectors differ in their assessments of all three types of dynamics, but predominantly of the technological dynamics. The influence of competition is the most important common factor among companies of similar size, with medium-sized and larger companies attaching greater importance to it and small companies attaching less importance to it. Lower relevance of technological dynamics and – to lesser degree – of customer-related dynamics characterises non-innovative companies.

As these factors reflect perceptions and not any factual dynamics, we can say that non-innovators perceive lower technological dynamics than innovators, above all than R&D innovators: While innovators agreed to the statement that technological change offers opportunities for the industry, non-innovators gave a neutral reply. And, on average, they perceived less often that technologies in their industry are changing rapidly. Moreover, the non-innovators see less often customer-related dynamics, i.e. more non-innovators than innovators perceive that their customers are not open for innovations.

This perception of a more stable technological and market environment could shift expectations regarding the costs and benefits of innovation away from the benefits, thereby reducing the willingness to invest in innovation projects. As we saw in Figure 24, above, the perception of technological dynamics differs across sectors: while companies in the ICT, medical technologies, and finance sectors see technological dynamics, food, MEM, and the residual of other manufacturing don't. While in ICT customer needs are also perceived as dynamic, in finance and MEM this is not the case. This would contribute to explaining the large share of innovators in the ICT industry and the lower share in finance (Figure 11, above). In MEM, however, we would also expect a lower share, if the perception of a stable technological and customer environment reduces the propensity to innovate, but in fact MEM has the second highest share of innovators after the ICT sector. Company size may be overshadowing the influence of the technology and customer environment: the MEM sector has the highest proportion of medium-sized and large companies of all sectors (Figure 1, p. 18) and we also find a higher propensity to innovate among the larger companies than among smaller companies.

3.4 Digitalisation and data

The Swiss economy is on the eve of a new generic (or general purpose) technology (GPT) which involves the conjunction of pervasive digitization, automation, big data and artificial intelligence. Harnessing the power of this emergent digital GPT is an imperative to sustain the growth of productivity of the Swiss industries and services and is a matter of fostering digital innovations within firms in any sector of the economy. This module is about providing the quantitative information about the way Swiss companies are dealing with this imperative.

3.4.1 Importance of advances in digital technologies

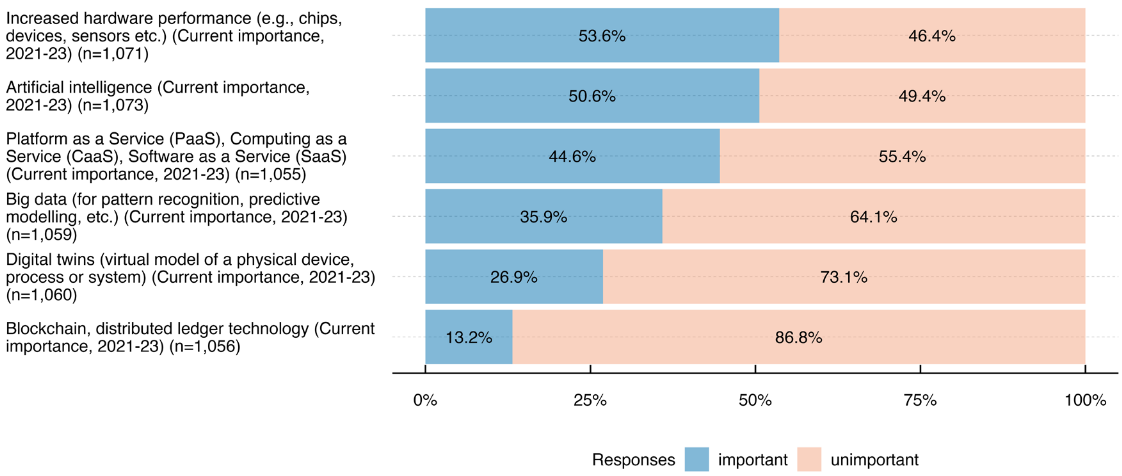
To provide an overview of differences at sector, size and innovator's type levels, we have developed an indicator of the extent to which companies engage in digitalisation. This indicator is based on *Question 28. How important were the following advances in digital technologies for the innovation activities of your company in 2021-23?* Companies had to assess the level of importance of eight technologies on a four level Likert scale (*unimportant*, *rather unimportant*, *rather important*, *important*. For each technology, we assign a dummy variable that is equal to 1 if a company indicates that the technology is *important* or *rather important*, and 0 otherwise. Summing up across all technologies generates the indicator that ranges from 0 (no digital technologies is important) to 6 (all digital technologies are important).

General findings

Figure 28 shows that three technologies are assessed as important: hardware performance (the most important), AI and new platform-based business models (PaaS & CaaS). This is an interesting preliminary finding that the hardware side of digitalisation is still ranked first in terms of importance (and will be repeatedly ranked first in the course of the survey). This shows that increasing computer power capacities is important, as it enables to harness complementary progress in software and data.

Three technologies are assessed as less important: big data, digital twins and blockchain. This assessment will call for a few comments as we will observe the results by sectors.

Figure 28. Advances of digital technologies by importance (in %)

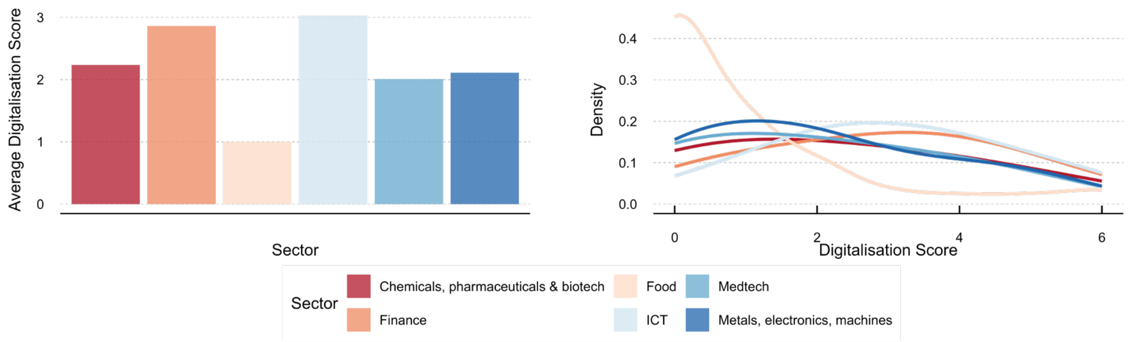


Findings by sector

The analysis of digitalisation by sector during the period 2021-2023 based on the digitalisation score reveals substantial sectoral variation in both the extent and type of innovation activities.

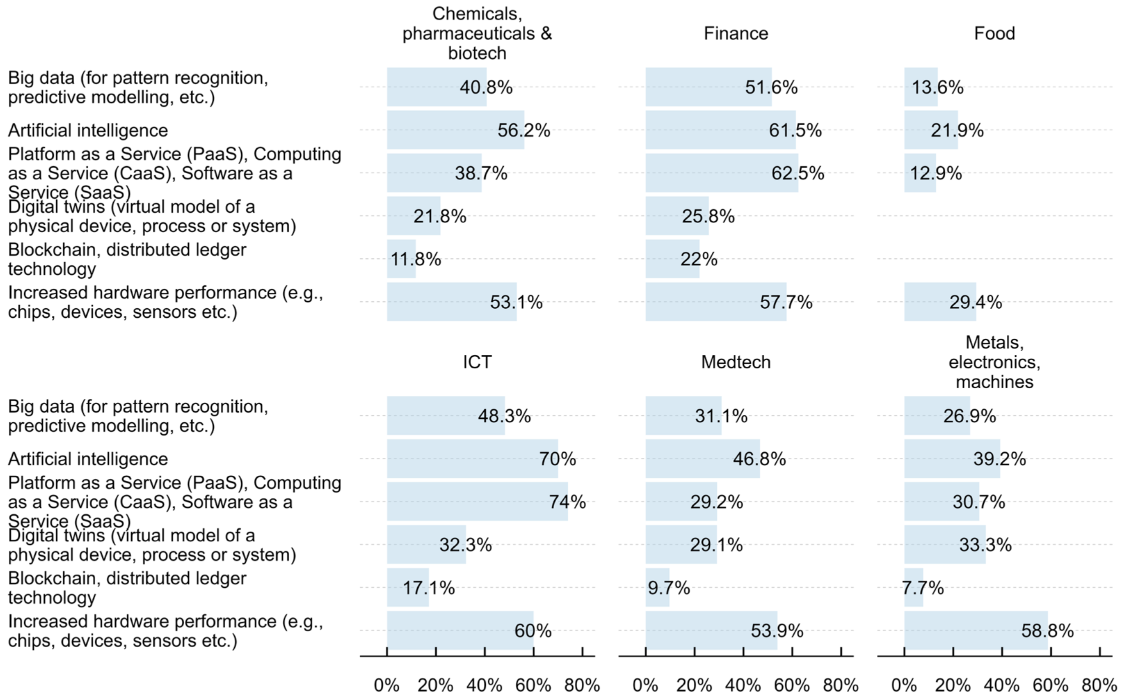
As can be expected, the ICT sector is the one that is most impacted by new digital technologies. The finance sector is a close second. The other sectors are quite close to each other, mentioning an average of two technologies as important, as shown by Figure 29. The food sector emerges as an outlier, with about half the companies indicating that no digital technologies are important (see Figure 29-Figure 30). Interestingly, looking at the technology, companies in the food industry indicated increases in hardware performance as the most important technology. This may indicate slow adoption of digital technologies in this sector.

Figure 29. Sector digitalisation-score (mean) Figure 30. Sector digitalisation-score (density)



Beyond the sector digitalisation score which helps to get a broad picture of sectoral patterns of digitalisation, one can observe at a finer level the types of technologies which are the most popular/unpopular within each industry (Figure 31).

Figure 31: Share of companies perceiving advances in digital technologies as important by sector



Note: Due to the small n<10 some technologies are not shown for the food sector.

The findings by sectors confirm the general result: Increased hardware performance is really taken as an imperative for all sectors (but food); AI is also assessed as important in several sector.

A few sectoral patterns emerge from the sectoral analysis:

– ICT and finance have a similar assessment. First, these are the two sectors which are assessing the highest number of technologies as important (see Figure 29). They are also the two sectors which rank new platform-based business models as the most important technologies. These findings about ICT and Finance as leading the digital dynamics are consistent with the results of the analysis provided above about the assessment of external factors by sectors (3.3, p. 35): ICT and finance are the two sectors which give technology a high degree of importance.
– Interestingly, ICT and finance do not consider blockchains as very important for the innovation activities of their companies, as only 17% and 22% indicated it as being important (see Figure 31). This is an interesting finding because blockchain technologies were generally considered as an essential condition for the expansion of financial transactions based on digital money. Nevertheless, these two sectors are the ones that have a larger share of respondents answering that bockchain is important, compared to the other sectors.
– Following these two sectors, the chemicals/pharma & biotech sector assesses two technologies as important: hardware performance and AI.
– Some sectors seem to be lagging the digital transformation dynamics. These are those sectors which don’t assess any technologies as important (food) or just highlight the importance of hardware performance (MEM and medtech). The scores by medtech and MEM are surprising and not consistent with the fact that, for instance, medtech assesses the technology factor as important (3.3, p. 35). This could mean that for these two sectors the technological focus remains on the hardware side of the innovation process.

Findings by size

To provide an overview of the size differences, we again refer to the above-mentioned digitalisation indicator (Figure 32-Figure 33). Figure 32 reveals a clear size-related gap. Digitalisation appears to be an increasing function of size. Larger firms have more resources and as competing globally, may have larger incentives to invest in digital technologies.

The density plot in Figure 33 provides additional insight into the distribution of digitalisation performance across company sizes. The difference across size is significant: while small firms are concentrated at the lower end of the digitalisation-score range (peak around 0.5), large firms are concentrated at the higher end (peak around 4). Medium firms are in between, with a flatter distribution and a peak around 2.5.

The results suggest that firm size is an extremely important factor for digitalisation, and that SMEs may require support to incentivize them initiating and/or implementing digitalisation plans. This reinforces something that innovation economists and policy makers know well: size is an important factor to consider for designing and targeting policy programs.

Figure 32: Digitalisation-score by size (mean)

Figure 33: Digitalisation-score by size (density)

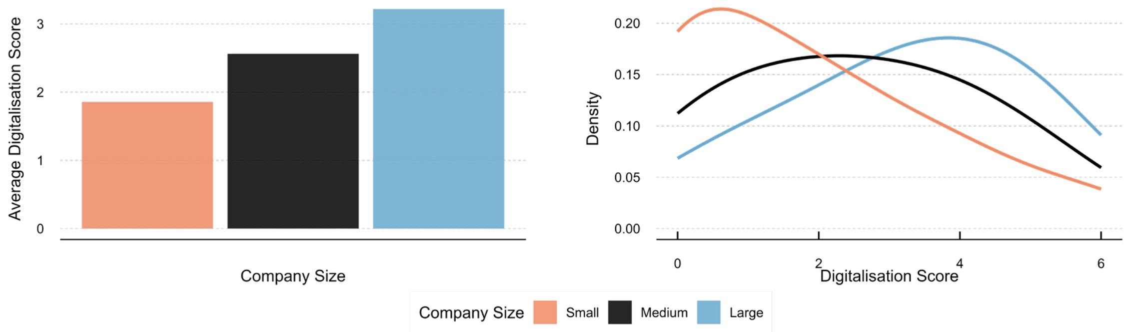
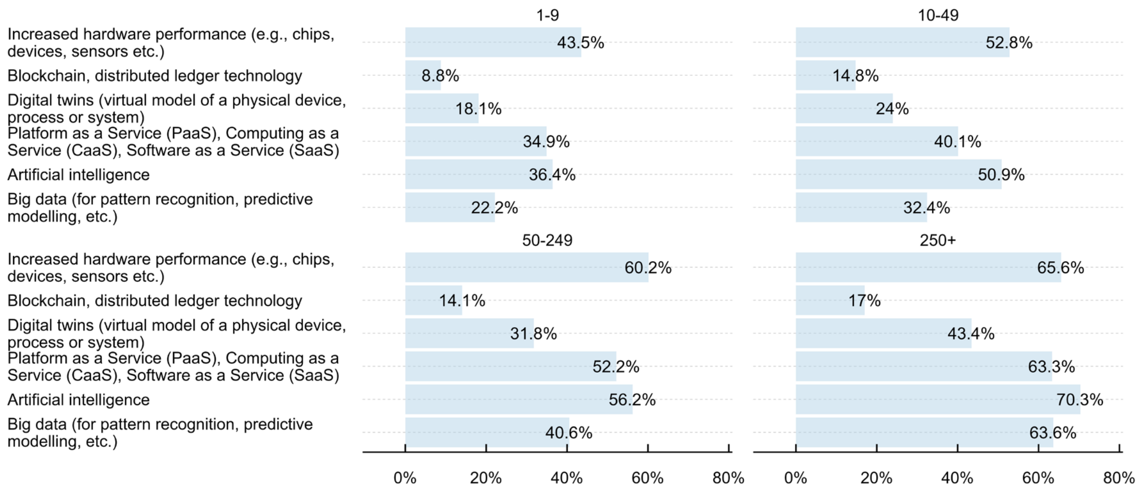


Figure 34: Share of companies perceiving advances in digital technologies as important by size class



Analysis by size and by technologies is consistent with the digitalisation score by size and reveals systematic and somewhat predictable disparities: large companies are assessing the highest number of technologies (4) as important while very small companies don't assess any technologies as important. Consistent with the general findings, increasing hardware performance and AI are assessed as important in all size classes (except for the very small companies).

Only large companies assess AI and Big data as important. For all other size classes, the new AI-driven transformation seems not to be central in the innovation strategy yet. But the firms with 50-249 employees are close to the large firm's assessment.

Findings by innovator types

Figure 35 and Figure 36 indicate clearly that digitalisation is particularly important for R&D innovators. While non-R&D innovators have a somewhat medium digitalisation score, it is interesting to see that there is a peak around 0.5, similar to non-innovators. This suggests that firms engaging in structured innovation activities (e.g. based on formal R&D) are more likely to take on the digital revolution compared to other types of innovators.

Figure 35: Digitalisation-score by innovator (mean)

Figure 36: Digitalisation-score by innovator (density)

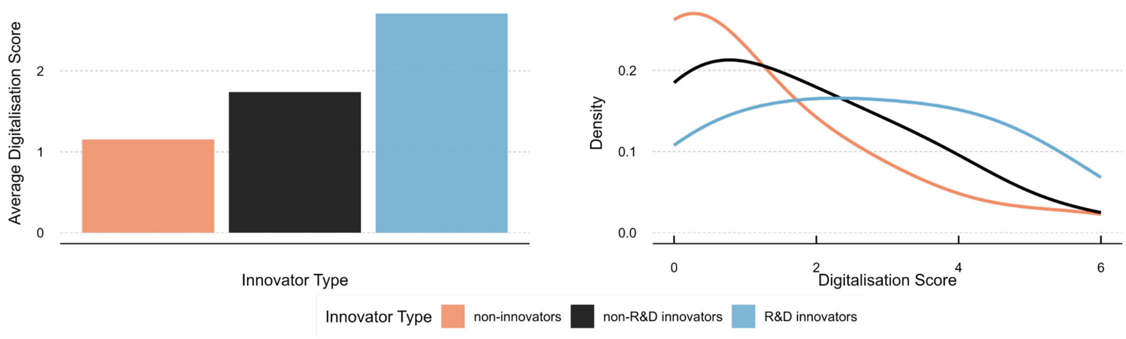
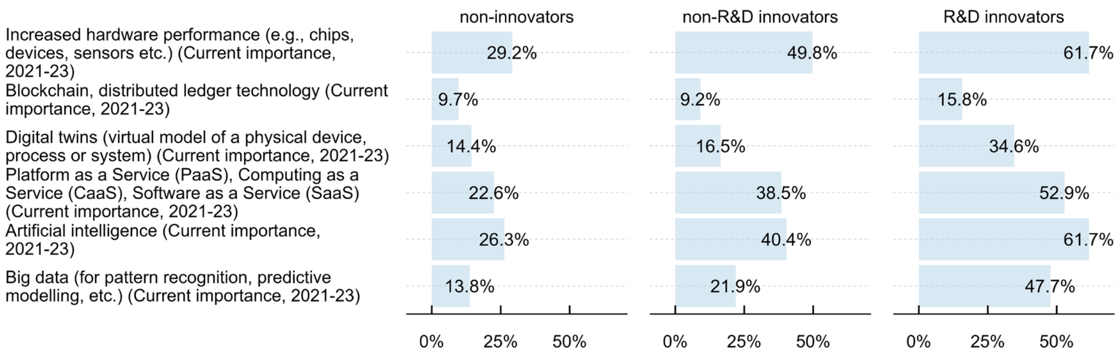


Figure 37: Digital technology advances considered as important by innovator type



Not surprisingly, non-innovators assess all technologies as unimportant. R&D innovators assessment is similar to the general assessment above: AI, new platform-based business models and hardware performance are important. Non-R&D innovators do not really have a "best technology" (while hardware performance is close to being one). As for large companies, which are already very much committed to Big Data and AI systems, the R&D innovators have a much greater assessment of Big Data and AI than the two other categories.

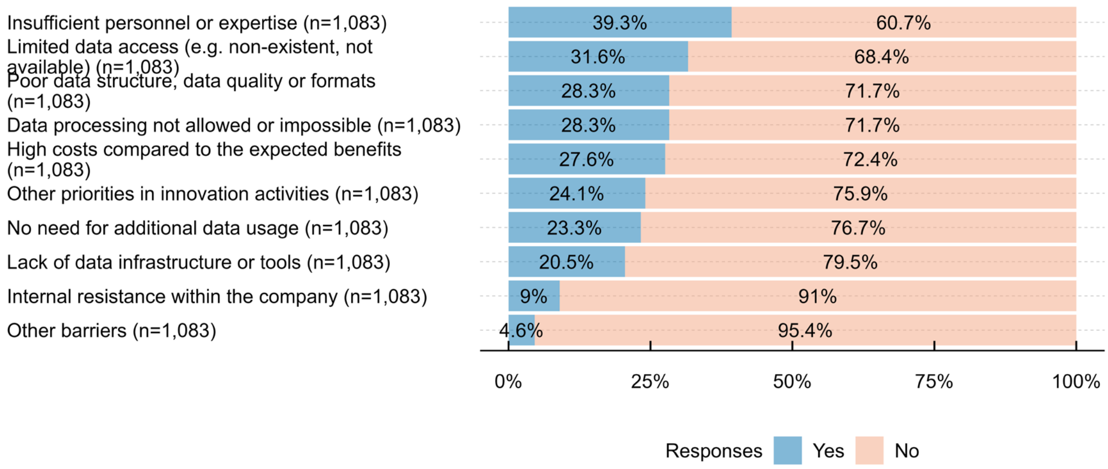
Typical digital champion and laggard. A general figure of a digital technology champion emerges as “large firm, doing R&D and belonging to ICT, finance or chemicals, pharmaceuticals & biotech”. Laggards are typically the very small firms, non-innovators, in the food sector or the residual of other services.

3.4.2 Barriers to digitalisation and data usage

General findings

The lack of skilled personnel is ranked as the highest barrier followed by missing or insufficient data, data processing issue and poor data structure or quality (Figure 38). Barriers can therefore be summarized as being about “people and data”. An additional finding is that “Internal resistance” is viewed as a negligible barrier - which means that for a majority of companies, in a sense the time of “raising awareness and understanding the potential of digital technologies” is over. Barriers now concentrate on implementation issues.

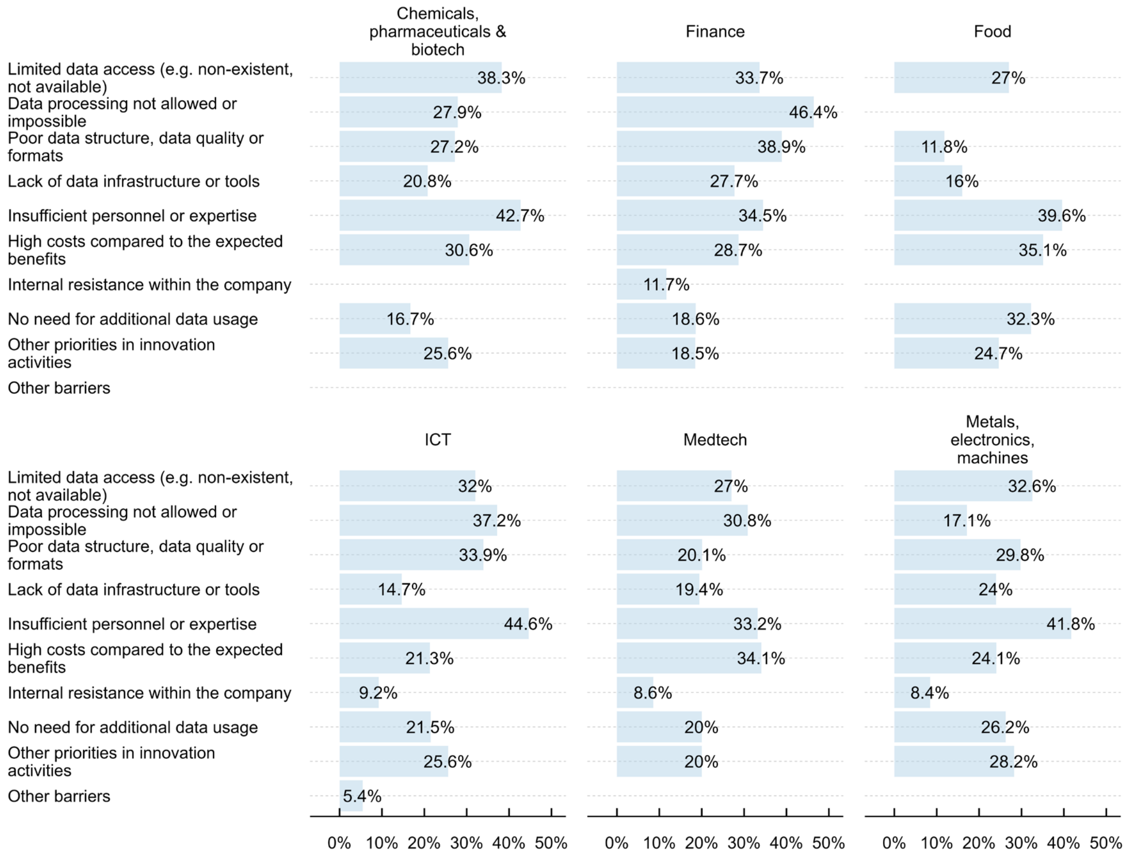
Figure 38: Barriers to data usage



Findings by sectors

We can observe a large homogeneity of assessments across sectors with slight variations (Figure 39): There is no highly dominant barrier although the lack of skilled personnel is ranked first in most sectors (but in finance and Medtech). Limited data access and data processing issues are ranked second or third, depending on sectors. The important finding here is that in all sectors, companies have to deal with multiple barriers – all of moderate importance. Because of this multiplicity of barriers, implementation of digital technologies is not obvious and requires certainly dedicated resources, efforts and policy support. Poor data structure seems to be particularly important in finance. This is probably due to legacy systems in a sector dominated by large institutions.

Figure 39: Barriers to data usage by sector (in % of responding companies)

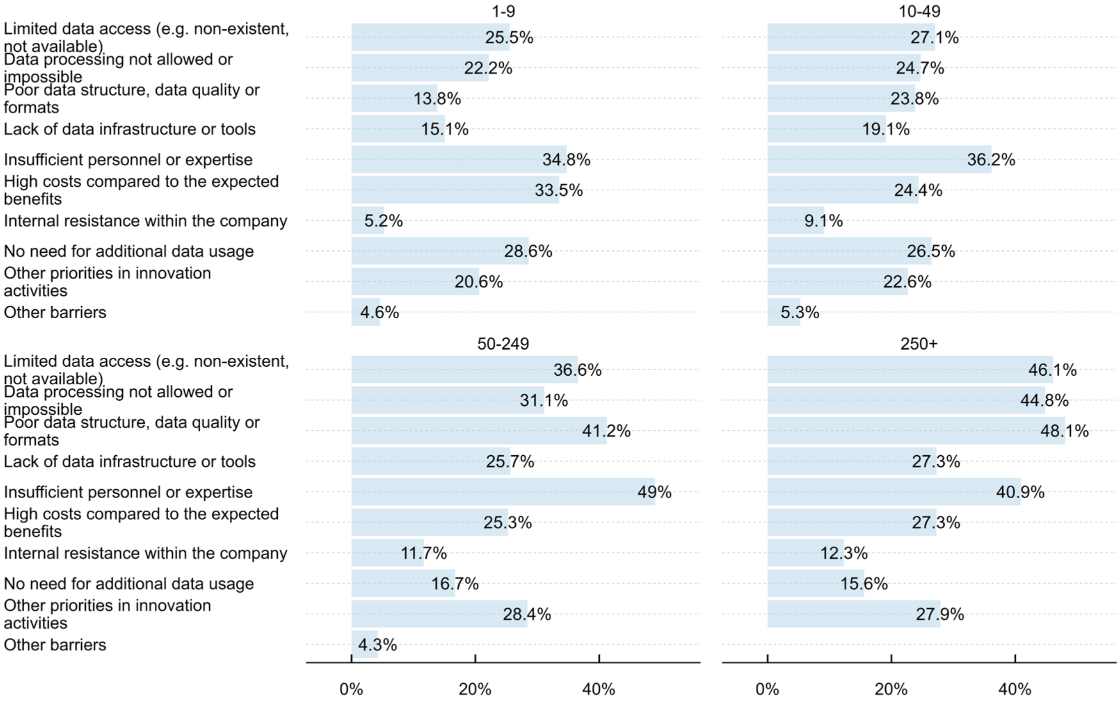


Note: Due to the small n<10 some barriers are not shown for certain sectors.

Findings by size

Size differences create differences in the nature of barriers. Resource constraints are important obstacles for small companies (skills, costs) while data issues – availability and quality – are the main barriers for the large companies (Figure 40). Interestingly, large companies are the only size class which does not rank the lack of skilled personnel as the most important obstacle. All obstacles dealing with data are assessed as important particularly by the large and medium-sized firms. For the very small companies, other big obstacles (beyond skills) are high cost versus benefits and no need for additional data use. This might reflect some lack of understanding of the future value of digitalisation for performance.

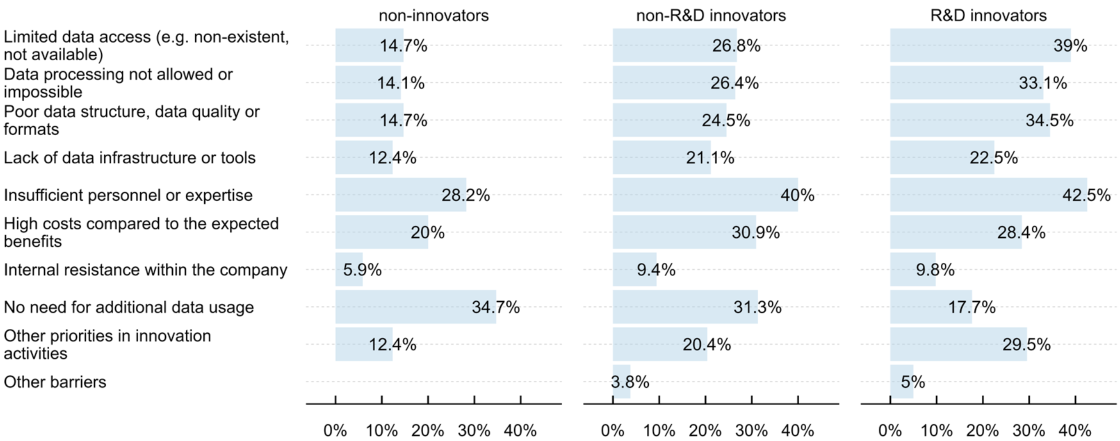
Figure 40: Barriers to data usage by size class (in % of responding companies)



By innovator type

Non-innovators and to a certain degree non-R&D innovators show the same pattern as very small firms (Figure 41): lack of understanding (cost/benefit and no need for additional data use). On top of that, lack of skills remains an important barrier for non-R&D innovators. R&D innovators are struggling with “people and data” issues.

Figure 41: Barriers to data usage by innovator type (in % of responding companies)



3.4.3 Synthesis about digitalisation

Not surprisingly, the conjunction of being a very small firm, non-innovator and operating in low or medium tech sector such as food make such firms disconnected from the dynamics of digital innovations. They don’t rank any technologies as important, and barriers are about understanding and awareness of the importance of digitalisation as well as resource constraints (costs and people).

By contrast, large companies which are also R&D innovators and operate in sectors like ICT, finance or chemicals/pharma & biotech are proactive, have multiple digital technology objectives but struggle with data and skills issues.

Finally, medium-size companies in most sectors can be more or less proactive with multiple or little technological targets – depending on whether they are R&D innovators and R&D non-innovator or neither.

3.5 Sustainability innovations

Like many other countries, Switzerland has committed to the climate targets set out in the Paris Agreement and to the ESG principles. This also increases the pressure on companies to integrate sustainability aspects into their innovation projects. For example, the industrial sector is expected to reduce CO2 emissions by 90% by 2050 (based on 1990 levels). The financial sector is also expected to ensure that Switzerland's financial flows follow a path towards low greenhouse gas emissions and climate-resilient development.

Below we show whether these requirements have already found their way into companies' innovation models and whether they have introduced sustainability innovations. Moreover, we will show how these sustainability innovations benefited the environment, society or corporate governance so far and what barriers reduced or prevented the introduction or use of sustainability innovations.[5]

3.5.1 Sustainability innovations: sector differences

To provide an overview of sectoral differences, we have developed an indicator of the extent of successful sustainability innovation. This indicator ranges from 0 (no sustainability innovation) to 4 (sustainability innovation in environmental, social, governance, and other areas).

This indicator reveals that the highest average sustainability innovation scores are observed in the chemicals, pharmaceuticals & biotech sector, followed by finance, and metal, electronics & machines (Figure 42). On average, the top sector reach a score of above 1.5 out of 4, indicating a moderate average level of integration of sustainability aspects into their innovation activities. In contrast, the medtech and ICT sectors score the lowest in terms of average performance.

However, when we examine the distribution of sustainability scores across sectors (Figure 43), a more detailed picture emerges. At the lower end of the distribution – that is, among companies whose innovation models are barely influenced by sustainability – we find that ICT, food, medtech, and metals, electronics & machines have the highest densities, suggesting that the innovation models of a substantial share of firms in these sectors are relatively untouched by sustainable aspects. By comparison, chemicals, pharmaceuticals & biotech has fewer companies in this low sustainability category.

At the top end of the distribution scale, chemicals, pharmaceuticals and biotechnology, and finance are again strongly represented. These sectors have the highest density of companies at the top of the scale, indicating that sustainability innovation is highly prevalent in many companies. ICT, metals, electronics & machines, food, and medtech show lower densities in this high-performing group, pointing to fewer leaders in sustainable innovation.

Notably, the within-sector variation appears particularly high in ICT. There is a wide range of companies in these sectors - some with innovation models that address specific sustainability issues, but very few that address the full range of environmental, social and governance (ESG) aspects.

[5] A sustainability innovation refers to a new or significantly improved product (good or service), process, organisational/management method or marketing method that creates environmental, social or governance-related benefits compared to existing alternatives.

Figure 42. Sustainability-Score (mean)

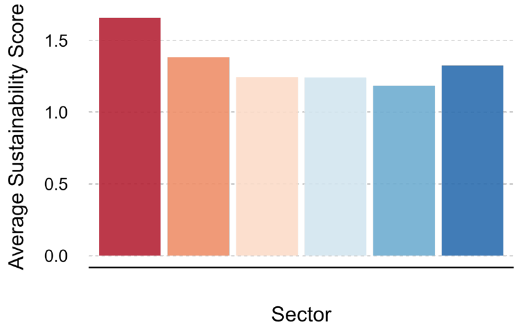
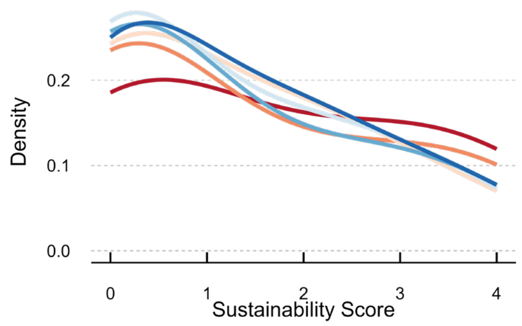


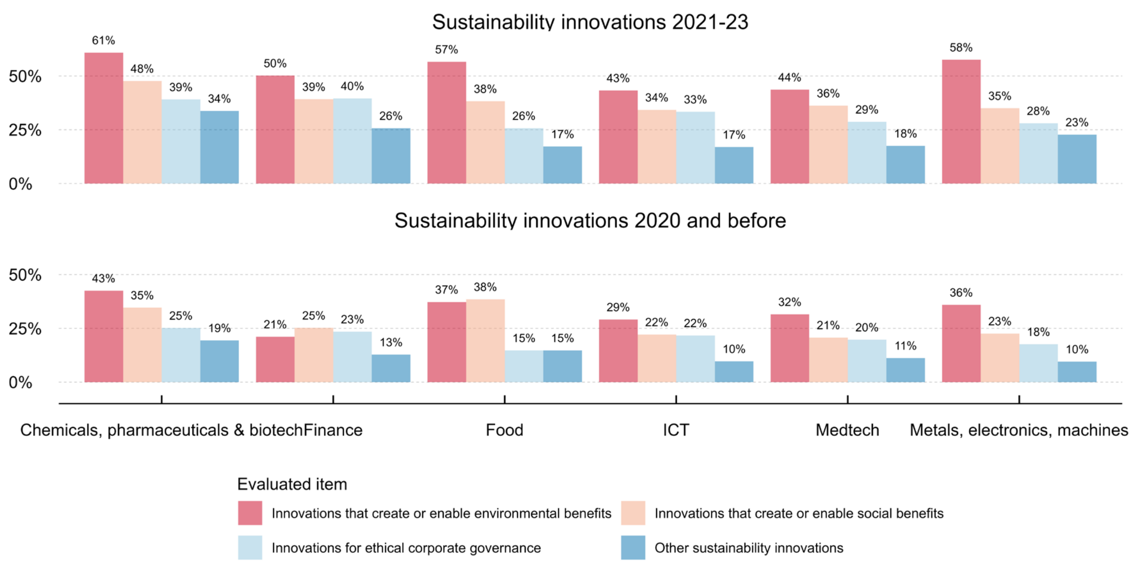
Figure 43. Sustainability-Score (density)



Sectoral differences for sustainability innovations in detail

The analysis of recent developments in sustainable innovation between 2021/23 and the period before 2021 reveals substantial sectoral variation in both the extent and type of innovation activities (Figure 44). The finance sector demonstrates the most significant overall progress, with notable increases across all categories, particularly environmental benefits, which rose by 29 percentage points. The other sectors also show balanced improvements, reflecting a broad-based integration of sustainability considerations.

Figure 44. Sustainability innovations by sector in 2021/23 and 2020 and before (in %)

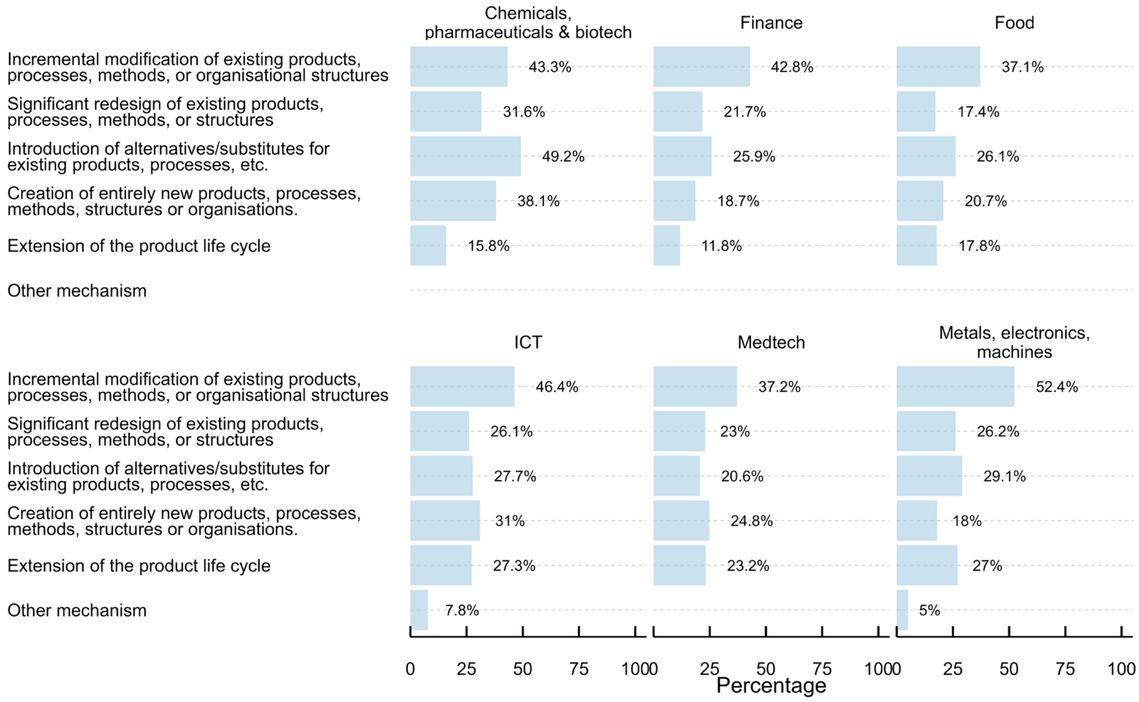


The food sector emerges as an outlier, with a stagnation in innovations that enable or create social benefits, relatively strong growth in innovations that create environmental benefits and comparatively modest growth in other dimensions. This may indicate sector-specific barriers or slower diffusion of sustainability practices. Conversely, the metals, electronics & machines sector displays strong environmental gains but comparatively limited progress in social and ethical governance innovations, pointing toward a more technology-driven sustainability focus. Overall, the dominance of environmental innovation is evident across most sectors, yet the data reveal that some industries pursue a more balanced sustainability strategy or, as in the case of food, stagnate in terms of social innovations – highlighting varying priorities and challenges in sustainable innovation development.

Figure 45 provides insight into how sustainability-related innovations have translated into specific benefits for the environment, society, and corporate governance. Across all sectors, incremental changes to existing products, processes, or organizational structures remain the most frequently reported innovation mechanism, particularly in metals, electronics & machines (52.4%), and finance (42.8%). This suggests that in many sectors, sustainability innovations tend to be integrated into existing innovation pathways rather than driving transformative change. However, sectors such as chemicals, pharmaceuticals and biotech are characterised by a higher proportion of significant changes (31.6%) and a strong focus on introducing substitutes (49.2%) and creation of new products (38.1%), indicating a greater tendency to make fundamental changes to product composition, processes or management structures in response to sustainability requirements.

These findings suggest that while most sectors still emphasize incrementalism, there is evidence of deeper innovation dynamics in certain industries where sustainability acts as a catalyst for more transformative innovation models. In particular, the combination of high scores for significant redesign and life-cycle extension in sectors like chemicals, pharmaceutical & biotech, metals, electronics, machines, and ICT indicates a shift from conventional R&D approaches toward systemic innovation, driven by environmental, social, and governance considerations.

Figure 45. Mechanisms of sustainability innovations with benefits for the environment, society, or governance by sector (in %)

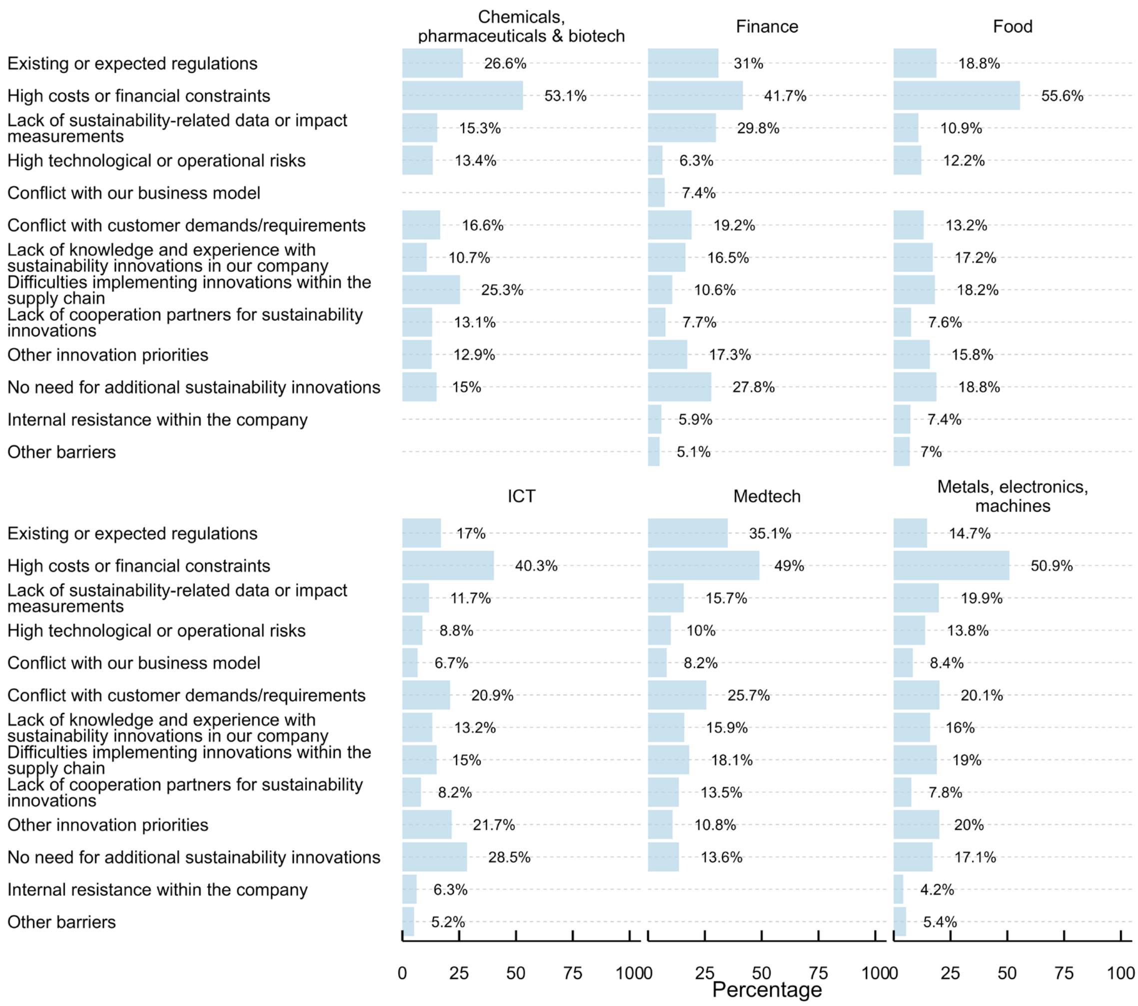


Note: See OECD (2009) for the foundation of this survey question. Due to the small n<10 some mechanisms are not shown for certain sectors.

Figure 46 reveals that high costs are by far the most frequently mentioned barrier to implementing sustainability innovations across all sectors, with reported rates exceeding 40% in all cases. This barrier is particularly pronounced in the chemicals, pharmaceuticals & biotech, food, and metals, electronics & machines, indicating that the financial requirements associated with sustainable product development, scaling, and technological upgrades continue to limit broader adoption. Other significant barriers include conflict with customer demand - especially for ICT and medtech sectors - suggesting that misalignment between market expectations and sustainability offerings presents a critical challenge. Regulatory related barriers are notably present in sectors like chemicals, pharmaceuticals & biotech, finance, and medtech and supply chain implementation issues are predominantly visible in chemicals, pharmaceutical & biotech pointing to structural difficulties in adapting existing production networks to new sustainability standards.

In addition to structural and financial challenges, several sectors report significant resource-related barriers. For example, a lack of data is reported as a major barrier in the financial sectors, suggesting that information gaps continue to hamper the innovation process. Interestingly, "lack of need" remains an important barrier in ICT and finance sectors, suggesting that many companies do not see a strategic importance of sustainability. Internal resistance, on the other hand, is much less frequently reported. All this suggests that practical constraints, rather than attitudinal resistance, are the main barriers to sustainable innovation. Although many companies are committed to sustainability innovation, significant resource constraints continue to hamper progress.

Figure 46. Barriers against sustainability innovation by sectors (in % of all responses)



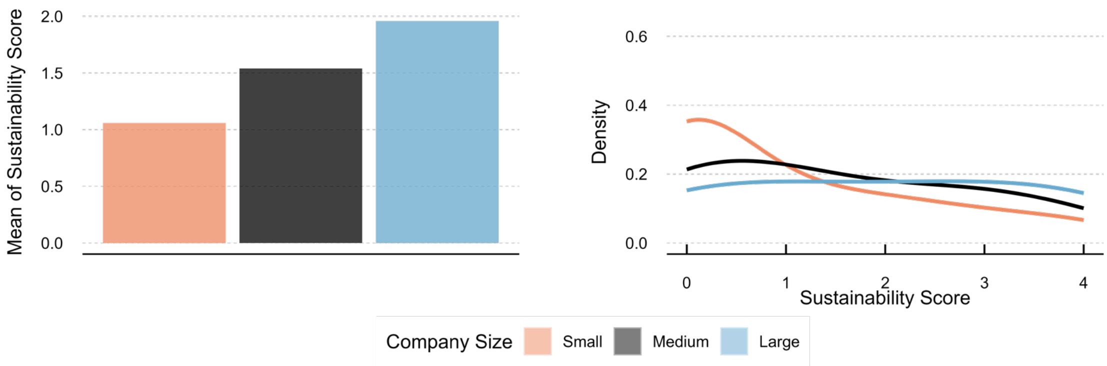
Note: Due to the small n<10 some barriers are not shown for certain sectors.

3.5.2 Sustainability innovations: size differences

To provide an overview of the size differences we again refer to the above-mentioned indicator (see 3.5.1, first paragraph). Figure 47 reveals a clear size-related gap. Large companies report the highest average sustainability score of about 2.0, followed by medium-sized firms, while small enterprises exhibit the lowest average score. This pattern suggests that firm size is positively associated with the integration of sustainability aspects into innovation activities. Larger firms may have more financial resources, dedicated personnel, and strategic capacity to invest in environmental, social, and governance-related innovations. In contrast, smaller firms may face more significant resource constraints, reducing the breadth of their sustainability activities.

The density plot in Figure 48 provides additional insight into the distribution of sustainability performance across company sizes. Small firms are concentrated at the lower end of the sustainability score range (no sustainability activities). Medium-sized firms display a more balanced distribution, while large firms show a broader and flatter distribution with relatively higher density towards the upper end of the scale. This indicates that while large firms perform better on average, there is also greater heterogeneity among them, some are highly advanced in sustainability innovation, while others lag behind. Overall, the results suggest that firm size plays a significant role in enabling firms to innovate sustainably, and that policy measures aimed at enhancing sustainability in SMEs may require targeted support.

Figure 47. Sustainability score by size (mean) Figure 48. Sustainability score by size (density)



Size differences for sustainability innovations in detail

The data presented in Figure 49 offer insights into the development of sustainable innovation across different company size classes between the period 2020 and before and 2021/23. The results show that although large firms are more active in advancing sustainability-oriented innovation (see Figure 47), medium and small firms have made notable progress in specific dimensions.

Medium-sized firms with between 50 and 250 employees account for a considerable share of recent growth, especially in environmental innovations. While very small firms (1-9 employees) contribute less overall, they show a decent development particularly in ethical governance and also in environmental innovations. This suggests that although resource constraints may limit their overall sustainability performance, targeted innovation efforts are taking place among SMEs, potentially reflecting growing responsiveness to regulatory and market pressures. The trend implies that while large firms lead in the expansion of sustainable innovation, a broader diffusion process is underway, in which medium and small enterprises are increasingly contributing to sustainability transitions by adapting their innovation models.

Figure 49. Sustainability innovations by size categories (employee FTEs)

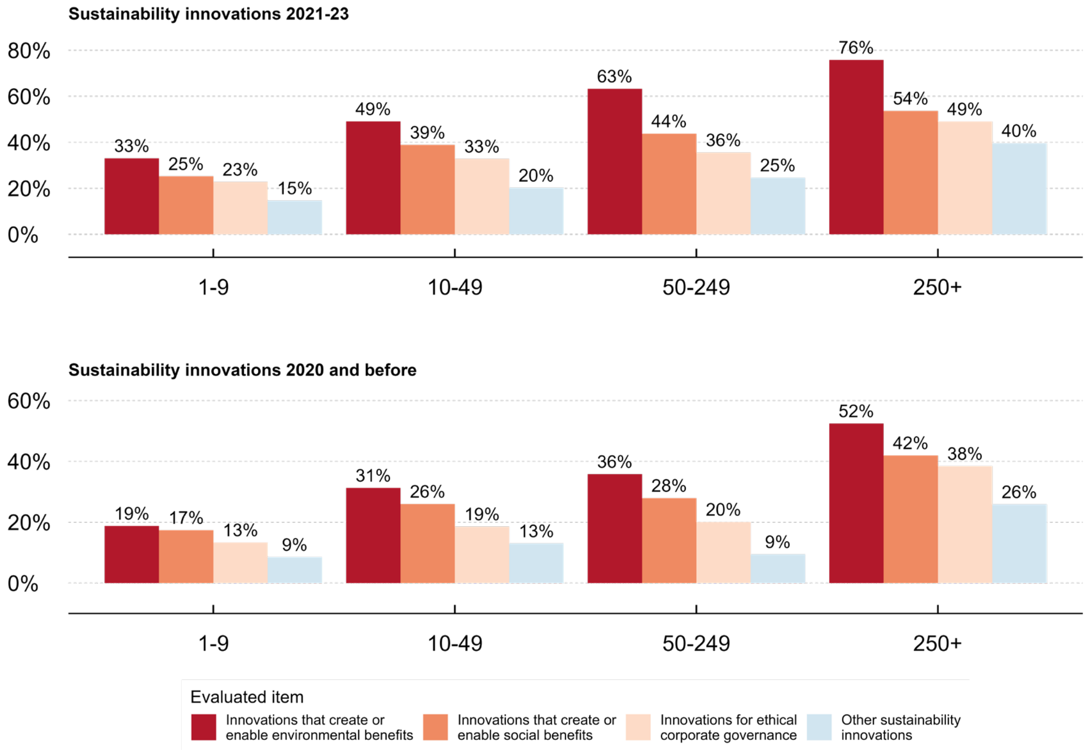
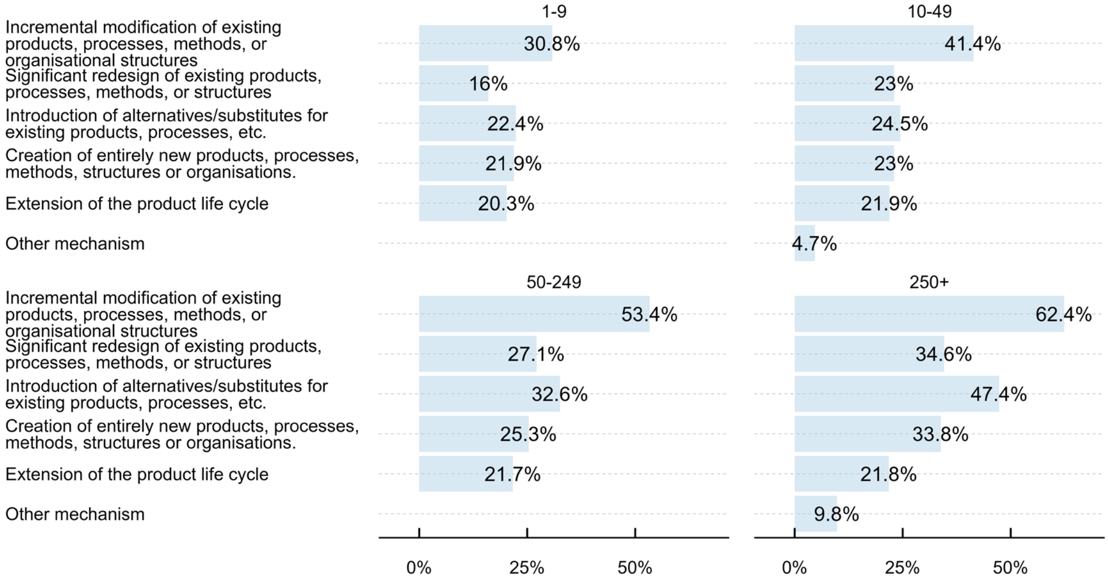


Figure 50 presents the distribution of reported forms of sustainability innovations, disaggregated by firm size. The results show that incremental change - referring to modifications of existing products, processes, or organizational structures - is the most frequently reported mechanism across all firm sizes. This approach is particularly prevalent among large firms, with approximately 62% of respondents indicating such activity. This underscores the tendency of larger firms to integrate sustainability through gradual improvements, likely reflecting their capacity to embed sustainability principles into established innovation models.

Other mechanisms, including the introduction of substitutes, significant redesign, and creation of entirely new products or processes, are also more frequently reported by large firms compared to their smaller counterparts. In particular, about 47% of large firms report the introduction of substitutes for existing products and processes, compared to roughly 33%, 25%, and 22% among medium and small firms, respectively. This trend continues across almost all categories, albeit with narrower differentials. In the area of product life cycle extension, small firms report levels comparable to those of medium-sized and large firms. These results suggest that large companies use a wider range of innovation mechanisms, while smaller companies in our sample tend to focus relatively more on areas that require strategic flexibility, such as developing new products and extending product life cycles, as they benefit from fewer existing constraints.

Figure 50. Mechanisms of sustainability innovations with benefits for the environment, society, or governance by size-class (in %)

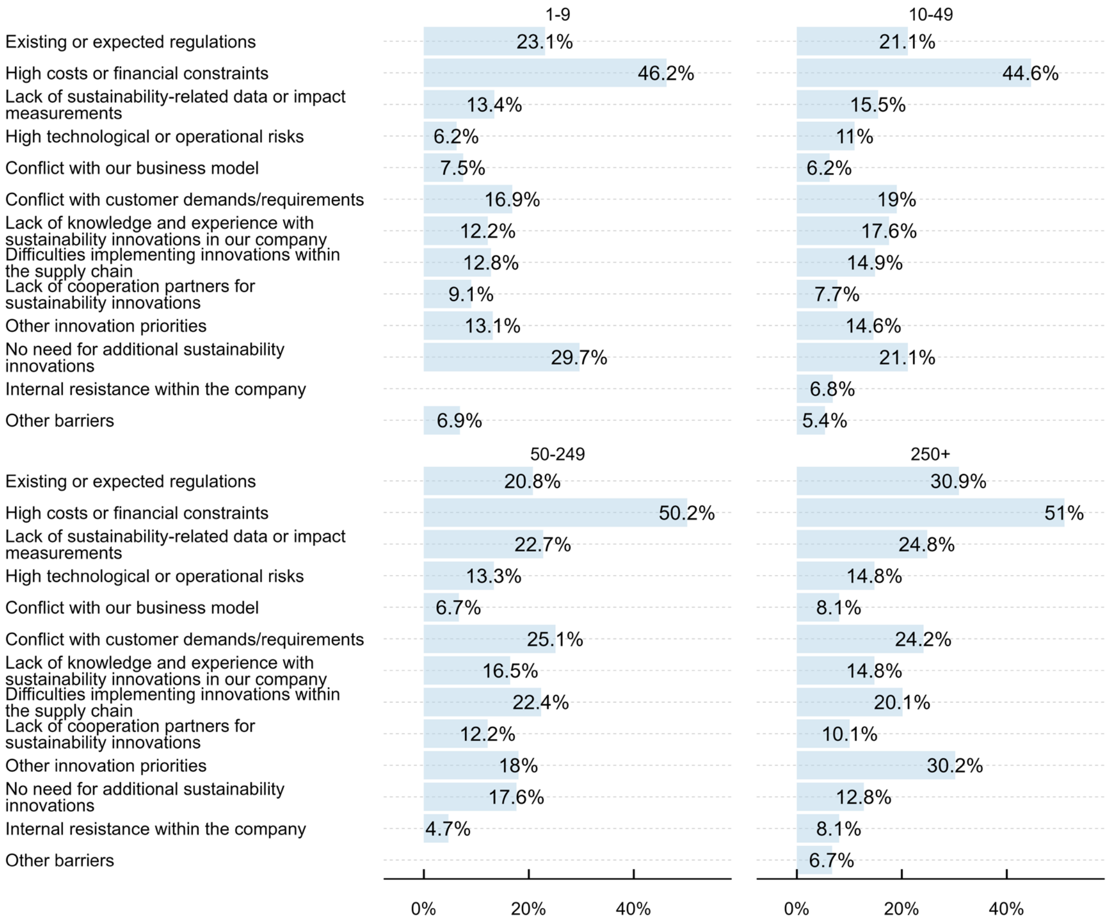


See OECD (2009) for the foundation of this survey question.

The descriptive results also indicate that high costs represent the most frequently cited barrier to sustainable innovation across all company sizes, with around 50% of large (250+) and medium-sized firms (50-250), and a lower share of smaller firms, reporting this constraint (high costs, Figure 51). This reflects the financial challenges associated with developing, scaling, or implementing sustainability-oriented solutions. Regulatory concerns (regulation) and competing innovation priorities (other priorities) also emerge as widespread barriers, particularly for larger firms, suggesting that sustainability goals may be deprioritized in the face of existing compliance burdens or alternative strategic focuses.

In contrast, medium-sized companies (50-250) quite often report barriers related to lack of data, conflicts with customer demand and implementation problems along the value chain. Smaller companies are less likely to mention the individual barriers overall, which could be related to the fact that they very often state that they have no need for additional sustainability innovation. This naturally renders many of the other barriers irrelevant. It is notable that internal resistance and conflicts with business models are less pronounced across all size categories. Overall, the data suggest that while financial and regulatory constraints dominate across the spectrum, medium-sized companies are additionally hampered by implementation problems along the value chain.

Figure 51. Barriers reducing or preventing sustainability innovations by company size (in %)



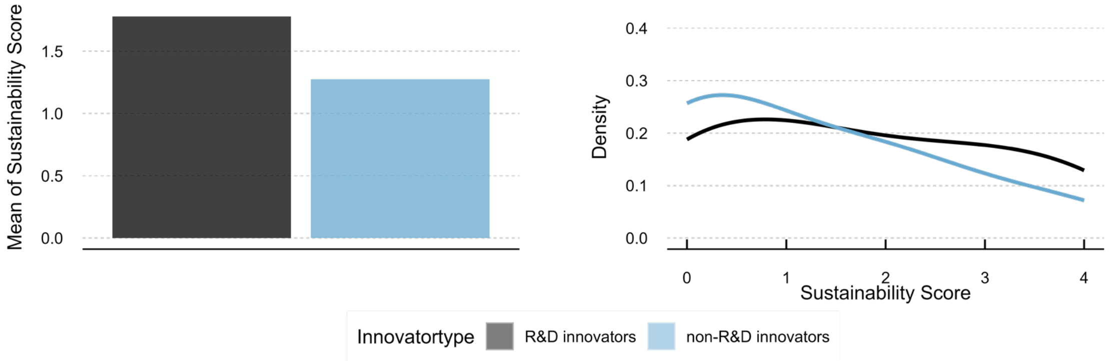
3.5.3 Sustainability innovations: innovator type

Figure 52 and Figure 53 provide a clear indication that R&D-based innovation is strongly associated with higher sustainability performance. As shown in Figure 52, R&D innovators exhibit a higher average sustainability score than non-R&D innovators. This suggests that firms actively engaged in structured and R&D based innovation activities are more likely to integrate environmental, social, and governance aspects into their innovation models. The result confirms that R&D capability is a key enabler of sustainability-oriented transformation.

Figure 53 supports this conclusion by illustrating the distribution of sustainability scores across innovator types. R&D innovators perform better on average and also exhibit a broader and more evenly distributed range of high sustainability scores. Non-R&D innovators occupy the lower position, indicating that innovation outside formal R&D structures contributes positively to sustainability outcomes.

Figure 52. Sustainability score – innovator type (mean)

Figure 53. Sustainability score – innovator type (density)

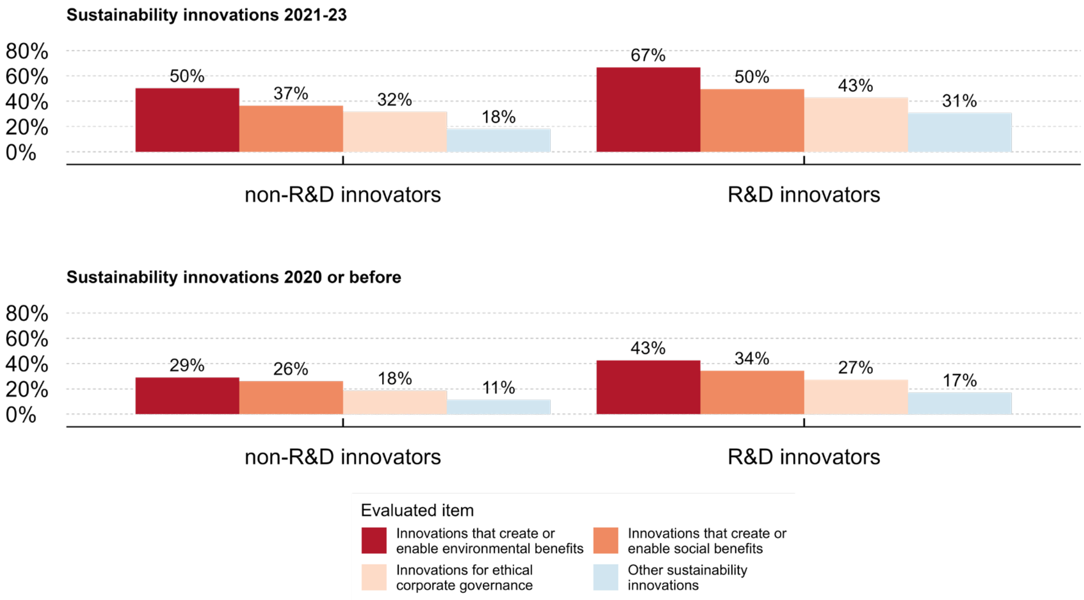


Innovator type: Sustainability innovations in detail

Figure 54 illustrates the introduction of sustainability innovations in 2021/23 and the period 2020 or before, disaggregated by innovator type. Across all four dimensions R&D innovators report the most substantial growth, indicating that sustainability innovation has a significant influence on their innovation models. The increase in environmental innovations is particularly pronounced, with R&D innovators showing a 24%-point gain, compared to 21% for non-R&D innovators. This highlights the critical role of structured research and development activities in advancing innovations aimed at environmental sustainability (e.g., energy efficiency, reduced emissions, or green technologies).

Similarly, R&D innovators lead in the development of innovations with social and ethical governance benefits, which include improvements in occupational safety, diversity, compliance, and auditing practices. These results reinforce the conclusion that R&D intensity is a key driver of sustainability innovations.

Figure 54. Sustainability innovations by innovator type (in %)



Note: The graph is based on four questions. Innovations that create or enable environmental benefits (e.g. increased sustainability of energy / material use, reduced emissions, green mortgages, etc.) (environmental benefits). Innovations that create or enable social benefits (e.g. improvements in occupational safety, human rights, diversity) (social benefits). Innovations for ethical corporate governance (e.g. improvements in accounting, auditing, compliance or corruption management) (ethical governance). Other sustainability innovation.

Figure 55 shows clear differences in the way companies of different innovator types achieve sustainability innovations. R&D innovators stand out across almost all categories, particularly in reporting the creation of new products and processes, and significant redesign. This suggests that firms with formal R&D activities are more likely to implement transformative or systemic innovations.

Non-R&D innovators are frequently reporting incremental changes and the introduction of substitutes, reflecting more limited or adaptive innovation strategies. While these types of improvements still contribute positively to sustainability, they tend to reflect modifications to existing structures rather than more ambitious innovation models. Overall, the results underscore that the depth and scope of sustainability-related benefits are closely tied to a firm's innovation capacity, particularly its engagement in R&D.

Figure 55. Mechanisms of sustainability innovations with benefits for the environment, society, or governance by innovator type (in %)

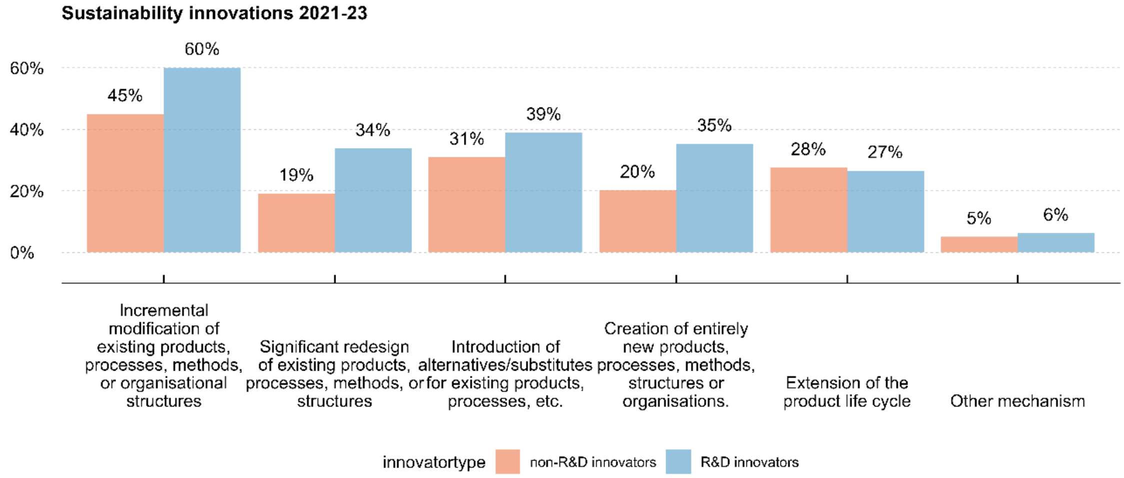
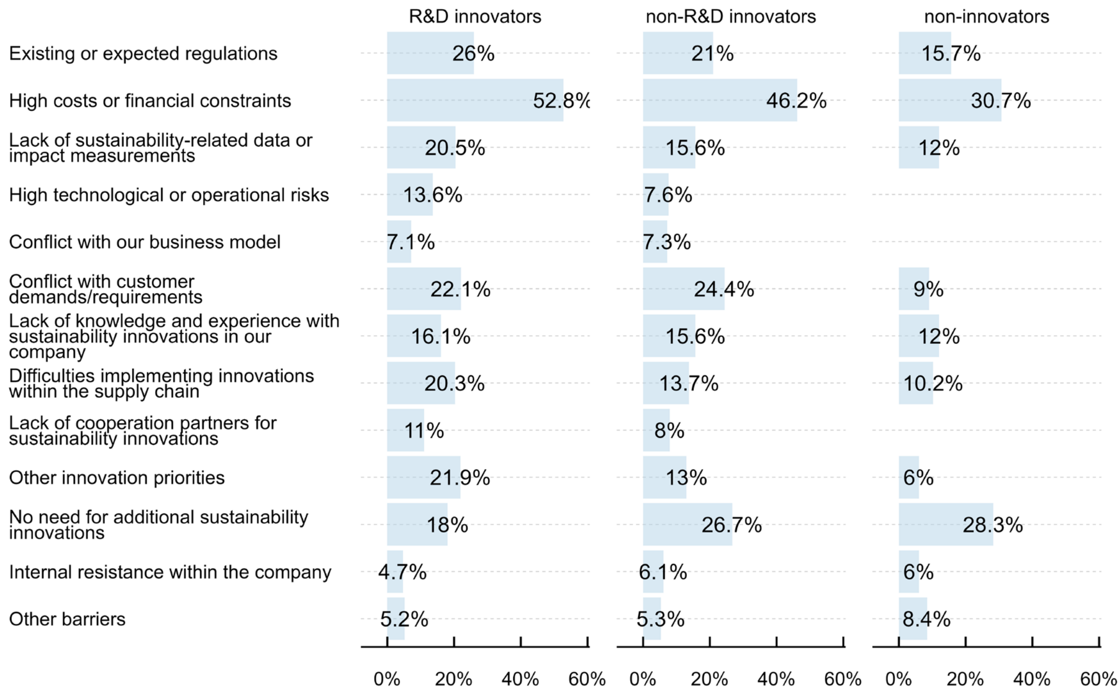


Figure 56 reveals that high costs are the most frequently reported barrier to sustainability innovation across all innovator types, with particularly high shares among non-R&D innovators and R&D innovators, suggesting that financial constraints represent a widespread structural challenge irrespective of innovation capability, firm-size classes and sectors. Existing or expected regulation and conflict with customer demands/requirements are also prominently reported, especially by innovative firms. By contrast, non-innovators and non-R&D innovators more often report a perceived lack of need for sustainability innovation, pointing to lower levels of awareness or strategic engagement with sustainability-related objectives.

Additional barriers show variation by innovator type. R&D innovators report fewer problems related to lack of partners, internal resistance and conflict with the business model reflecting their stronger internal resources and network capabilities. Non-R&D innovators report quite often conflict with customer demand, possibly indicating tension between market expectations and sustainability offerings in less structured innovation environments. Overall, the findings suggest that barriers to sustainability innovation are shaped both by external constraints (e.g. customer demand) and internal innovation capacity (e.g. financial constraints), with non-innovators facing more foundational challenges and innovators encountering more systemic obstacles (e.g. regulation).

Figure 56. Barriers against sustainability innovation by innovator type (in %)



Note: Due to the small n<10 three barriers for non-innovators are not shown.

3.5.4 Summary on sustainability innovations

The analysis of sustainability innovation across sectors reveals a marked heterogeneity in both the intensity and nature of innovation activities. Sectors such as chemicals, pharmaceuticals & biotech, and finance exhibit the highest average sustainability scores, driven by broad integration of environmental, social, and governance (ESG) considerations. In contrast, ICT and medtech lag behind in average performance, with a higher concentration of companies showing minimal or no sustainability innovation. Density distributions further indicate that while some sectors feature a critical mass of firms deeply engaged in sustainability, others remain polarized or fragmented, suggesting uneven diffusion of sustainability-oriented practices.

A key feature emerging across all sectors is the dominance of incremental innovation. Most companies report sustainability improvements through minor adjustments to existing products, processes, or organizational structures rather than through fundamental redesigns or the creation of new solutions. This trend is particularly pronounced in metals, electronics & machines, where incremental change exceeds 50%. Sectors like chemicals, pharmaceuticals & biotech show more frequent occurrences of the introduction of substitutions. The strong reliance on incremental mechanisms indicates a prevailing “path dependency”, where existing innovation models are adapted to incorporate sustainability concerns without disrupting established technological or organizational routines.

In addition to sectoral differences, firm size and type of innovator play a critical role in shaping sustainability innovation. Large firms report higher average sustainability scores and demonstrate a broader use of innovation mechanisms, likely reflecting greater financial resources, regulatory exposure, and internal capabilities. Small and medium-sized enterprises (SMEs), while less engaged overall, show meaningful progress – particularly in specific areas like ethical governance – and they are quite often focusing on flexible strategies such as product life-cycle extension. Moreover, R&D innovators consistently report higher levels of sustainability integration and a greater capacity for transformative change compared to non-R&D innovators and non-innovators. This confirms that both scale and innovation capability are central enablers of sustainability-oriented transformation.

Despite widespread commitment to sustainability, significant barriers persist. Across all groups, high costs remain the most frequently cited obstacle. Regulatory burdens and other innovation priorities are particularly pronounced among large and innovative firms, while SMEs relatively often report issues such conflict with customer demand, or supply chain implementation issues. Interestingly, non-R&D innovators and smaller firms are also more likely to cite a perceived lack of need, suggesting that limited strategic engagement with sustainability remains a barrier in important parts of the business population.

3.6 Regulation and innovation

Regulations are playing an increasingly important role in innovation behaviour and influencing innovation models. They are perceived as a challenge, particularly in an initial transition phase, because they can create uncertainty. Later regulations can, of course, provide stability (including for innovation activities) because they define the rules and reduce risks at company/project level.

3.6.1 Regulation: sector differences

Similar to sustainability innovations, we have designed an overall regulation indicator that shows the extent to which the innovation models of an industry are affected by regulations. This indicator ranges from 0 (no regulatory aspects is important or rather important for innovation activities) to 8 (all regulatory aspects are important or rather important). The type of regulation considered is presented in Figure 59 shows how regulatory frameworks influence innovation in various industries. For example, more than 70% of the surveyed companies in the chemical, pharmaceutical, and biotechnology sectors, as well as in medtech, metals, electronics, and machines, state that product-related regulations have a significant impact on their innovation activities. Similarly, data protection is a particularly important driver in industries such as finance, ICT, and medtech. Environmental protection is one of the most important factors in metals, electronics, and machinery, food, and chemical, pharmaceutical, and biotechnology sectors. These sectoral differences show that innovations are often determined by the specific regulatory requirements that are most relevant to the products and risks of a sector. Regulations therefore often act as incentives for technological and organizational change.Figure 57 presents the average regulatory score by sector, indicating how strongly companies perceive regulation as a relevant factor for their innovation activities. The results show clear sectoral differences: chemicals, pharmaceuticals & biotech, medtech, and finance show the highest average regulation scores, reflecting the stronger role of compliance and regulatory standards in their innovation processes. In contrast, food, metals, electronics, machines, and ICT report the lowest average scores, suggesting that regulation plays a comparatively less prominent role in shaping innovation in these sectors.

Figure 58, the corresponding density plot, provides further insight by illustrating the distribution of regulation scores within each sector. The distributions are not normally shaped and vary considerably across sectors. In sectors such as chemicals, pharmaceuticals & biotech, metals, electronics & machines, finance, and medtech, most companies cluster around mid-to-high regulatory scores, indicating consistently strong exposure to regulatory requirements. By contrast, ICT and especially the food sector show higher concentrations of firms at the lower end of the scale, with fewer firms experiencing strong regulatory influence. At the same time, the distribution within each sector is also heterogeneous, revealing significant variation in how firms experience regulatory impact - even within the same industry. For example, in the food sector, a notable share of firms reports very low regulatory exposure, while others fall in the mid-range, with very few reporting high levels. In contrast, chemicals, pharmaceuticals & biotech has a low density of firms with minimal exposure and a clear concentration of firms with high regulatory relevance. These patterns underscore that while regulation is an important aspect of innovation across all sectors, its intensity and relevance vary considerably both between and within sectors, likely reflecting differences in product types, market access requirements, and compliance environments.

Figure 57. Regulation indicator by sector (mean)

Figure 58. Regulation indicator by sector (density)

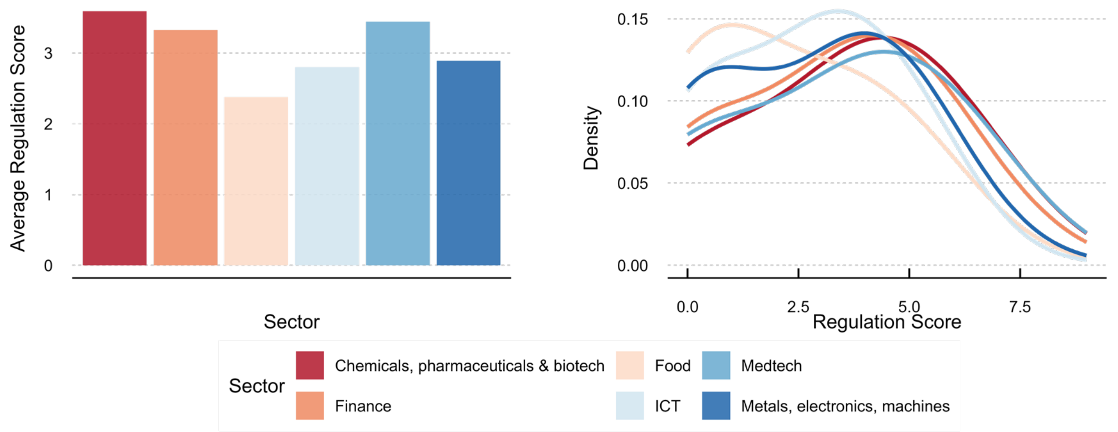
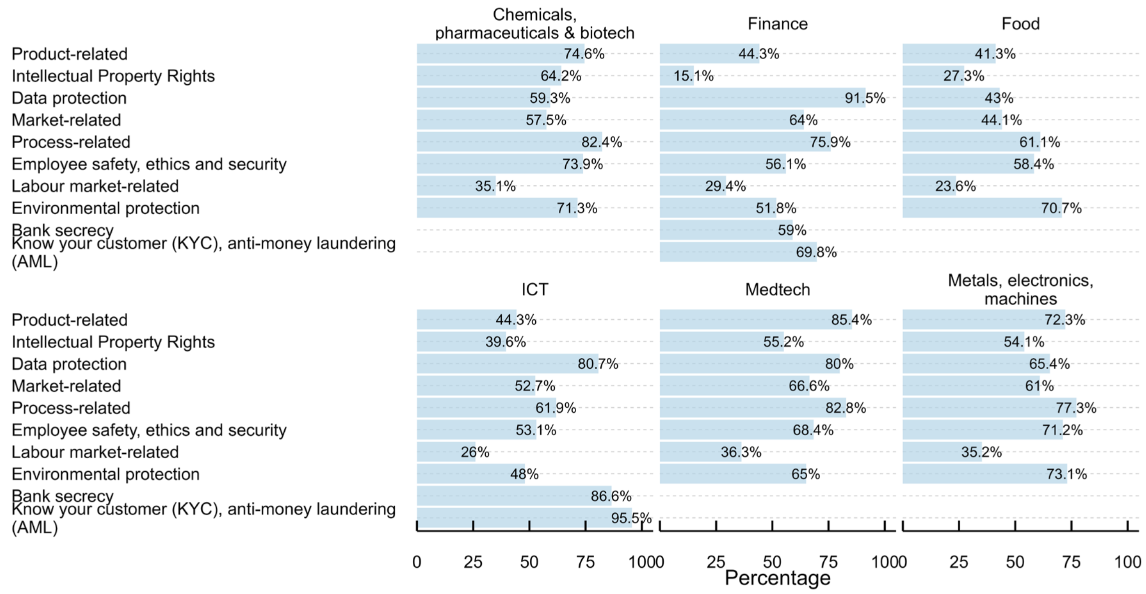


Figure 59. Important regulations for innovation activities (in %, by sectors)

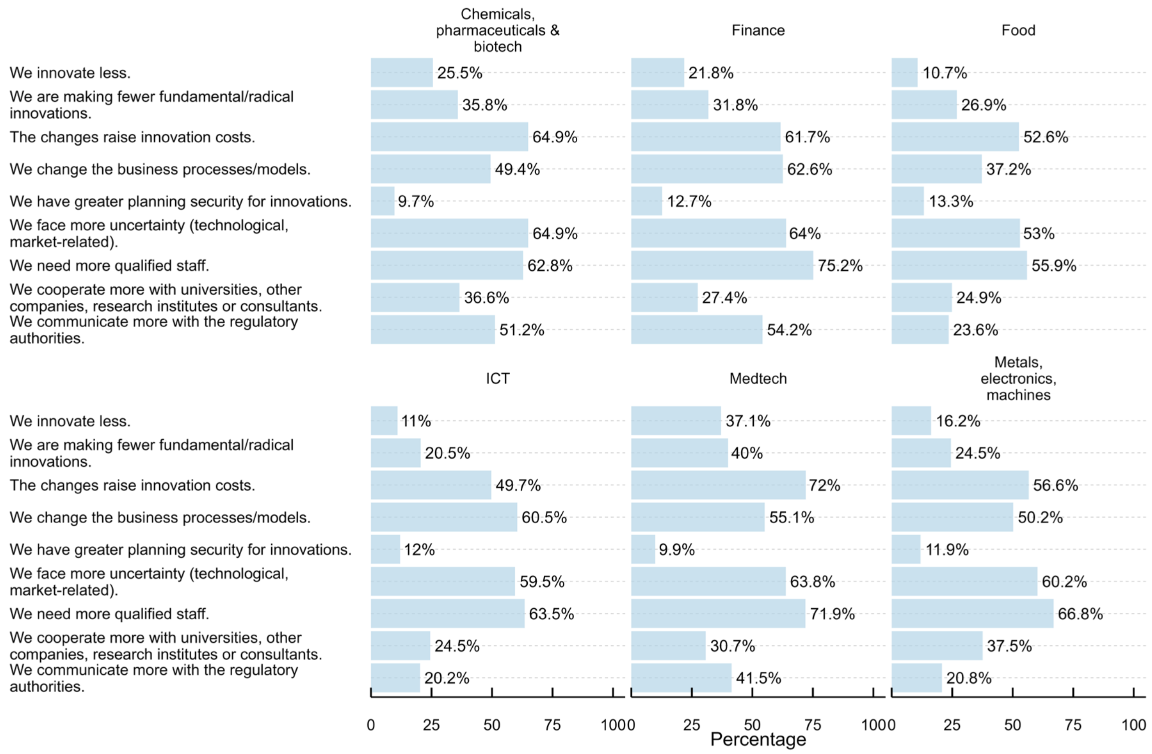


Note: Only finance and ICT companies were asked about the two items 'bank secrecy' and 'know your customer'.

Figure 59 shows how regulatory frameworks influence innovation in various industries. For example, more than 70% of the surveyed companies in the chemical, pharmaceutical, and biotechnology sectors, as well as in medtech, metals, electronics, and machines, state that product-related regulations have a significant impact on their innovation activities. Similarly, data protection is a particularly important driver in industries such as finance, ICT, and medtech. Environmental protection is one of the most important factors in metals, electronics, and machinery, food, and chemical, pharmaceutical, and biotechnology sectors. These sectoral differences show that innovations are often determined by the specific regulatory requirements that are most relevant to the products and risks of a sector. Regulations therefore often act as incentives for technological and organizational change.

Sectors: effects of regulatory changes on innovation. Figure 60 provides an overview of how companies across sectors have adapted their innovation activities in response to regulatory changes between 2021 and 2023. The results show that regulatory adjustments have had a broad and diverse impact. The most frequently reported effects include demand for more qualified staff, increased uncertainty, higher innovation costs, and changes in business processes. A significant share of firms also reports greater communication with regulators and enhanced cooperation with external partners, indicating that regulation not only introduces constraints but also prompts firms to expand their networks.

Figure 60. Impact of regulation on the innovation activities in the years 2021-2023 by sectors (in %)



Sector-specific patterns reveal particularly strong effects in finance, medtech and metals, electronics & machines, where over 66% of firms report increased needs for qualified staff and over 56% reported rising innovation costs. These sectors also report relatively high levels of uncertainty and changes in business processes, reflecting their exposure to complex compliance and safety regulations. Chemicals, pharmaceuticals & biotech, finance, and medtech also stand out with a higher frequency of interaction with regulators, suggesting a more regulatory-driven innovation environment. In contrast, companies report less frequently an increase in cooperation in the ICT and food sectors, and in the food sector in particular, there are fewer reports of more qualified staff, suggesting a comparatively more restrictive or defensive response to regulatory changes. Overall, the results underscore that while regulation can create barriers, it also acts as a stimulus for organisational change and cooperation, with sector-specific effects on innovation models.

Notably, a considerable number of firms report that regulation has led them to innovate less or pursue fewer radical innovations. This effect is most prominent in sectors such as medtech, finance, and chemicals, pharmaceutical & biotech where over 30% of firms indicate a shift away from fundamental or disruptive innovation approaches. These findings suggest that regulatory changes can result in more risk-averse innovation strategies, especially in sectors with fast-paced technological change or strict compliance environments. At the same time, sectors such as ICT, food, and metals, electronics & machines appear somewhat less affected in this regard. Overall, while regulation changes are not necessarily suppressing innovation broadly, it may discourage more radical forms of innovation in certain industries.

3.6.2 Regulation: Size differences

Figure 61 and Figure 62 provide insights into how firms of different sizes perceive the importance of regulation for their innovation activities, based on a composite indicator ranging from 0 to 8 (see above). Figure 61 shows that large firms, on average, report the highest regulation scores, followed by medium-sized firms, while small firms score lowest. This suggests that regulatory requirements are more deeply embedded in the innovation processes of larger companies, likely reflecting their greater exposure to formal compliance frameworks and international regulatory obligations.

Figure 62 further shows that large firms' responses are more concentrated around high values, with fewer firms indicating low regulatory relevance. In contrast, small firms display a notable share with low regulation scores and a low share of companies with high scores. This indicates that while regulation is relevant across all firm sizes, it is more consistently experienced as a central factor for the innovation models of large firms, whereas smaller firms experience more variation, with some largely unaffected and others facing significant regulatory influence.

Figure 61. Regulation score by size classes (mean)

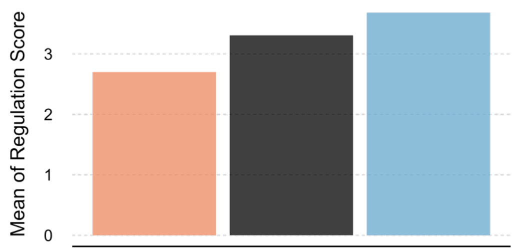
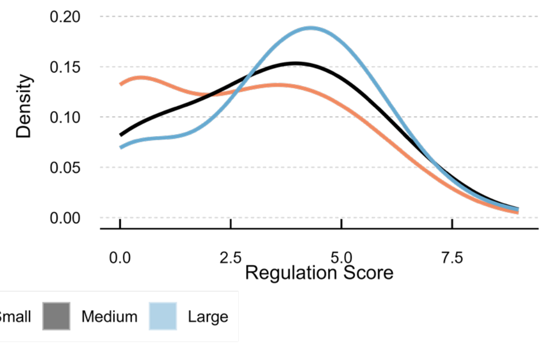


Figure 62. Regulation score by size classes (density)

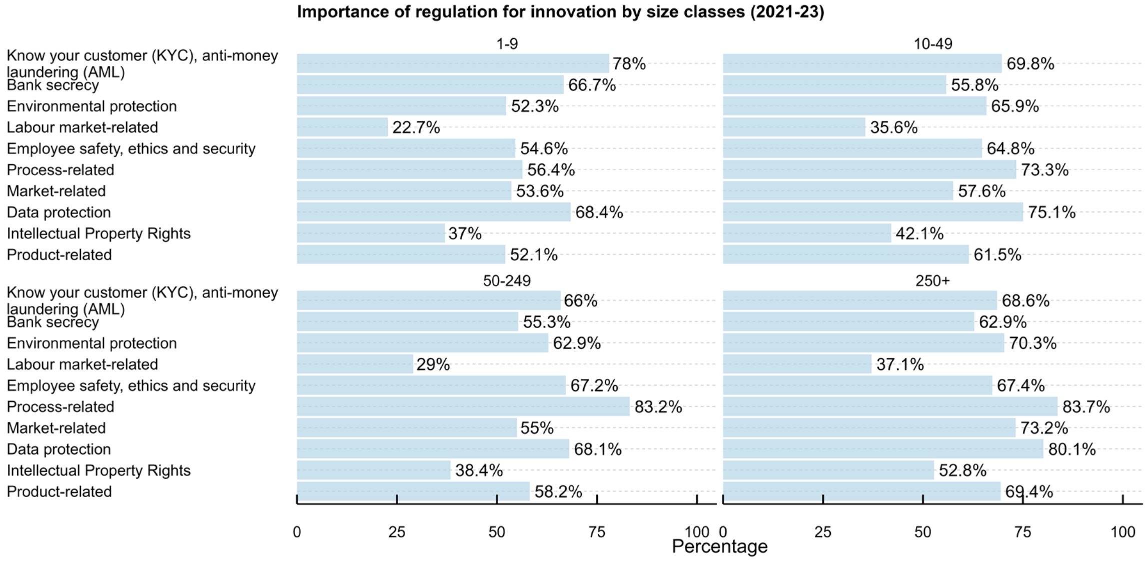


Size categories: Importance of regulation for innovation activities. Data protection and process-related regulation – including audits, quality management, supply chains, R&D, risk management, compliance, and reporting – are the two most frequently reported types of regulation influencing innovation activities, for companies with more than 10 employees.

Process-related and data-related regulations most frequently influence the innovation activities of companies, regardless of their size. While employee safety, ethics, and security rank third for SMEs, market-related regulations are significantly more important for large companies with more than 250 employees than for smaller companies (see Figure 63). However, the change in the significance of the various types of regulation is essential for changing innovation models. Since 2021, the importance of data protection regulations for innovation activities has increased significantly across all company size-classes, with large and medium-sized companies reporting this very frequently. This is followed by environmental and process-related regulations, both of which have become significantly more important. Not surprisingly, environmental regulation has had a particularly strong impact on the innovation strategies of large companies, suggesting that this group is more exposed to or responsive to sustainability-related compliance requirements.

In the financial sector, anti-money laundering (AML) regulations have become much more important than banking secrecy. In line with the reduced dynamism in these areas, the importance of labour market regulations and intellectual property rights (IPR) for innovation activity has increased significantly less across all size classes.

Figure 63. Importance of regulation for innovation by company size (in %)



Note: Only finance and ICT companies were asked about the two items ‘bank secrecy’ and ‘know your customer’.

Impact of Regulatory Changes on Innovation Activities by Firm Size. While medium and small firms also report significant impacts – especially in areas such as need of qualified staff, cost increases, more uncertainty, and process adjustments – they do so to a lesser extent. Notably, communication with regulators is more often cited by large firms (49.7%) than by smaller firms, reflecting the more formalized regulatory interactions typical of larger organizations. Interestingly, planning security was by far the least frequently cited effect across all firm sizes, suggesting that while regulation may prompt adaptation, it does not necessarily reduce uncertainty or improve strategic clarity for most companies.

An interesting pattern applies to the statement “we innovate less.” Although between 13% and 22% of companies report reduced innovation activity due to regulation, a clear majority of large firms (58.9%) and medium firms (54.1%) disagree with this statement. Among small firms, only 46.8% disagree – suggesting that regulatory burdens may weigh more heavily on innovation activity in smaller enterprises. Overall, the results highlight that the size of a firm plays an important role in shaping both the frequency and type of regulatory impacts on innovation.

Figure 64 presents the percentage of companies by firm size that reported various positive changes in their innovation activities as a result of regulatory developments between 2021 and 2023. The data show that large firms are consistently more likely to report regulatory impacts across most of the dimensions compared to medium and small enterprises. The most frequently cited effects among large firms include the need for more qualified staff (79.6%), increased uncertainty (69.2%), changes in business processes (63.6%), and higher innovation costs (62.4%). These findings suggest that larger firms, likely due to their broader regulatory exposure, are more intensively affected by evolving compliance and governance requirements.

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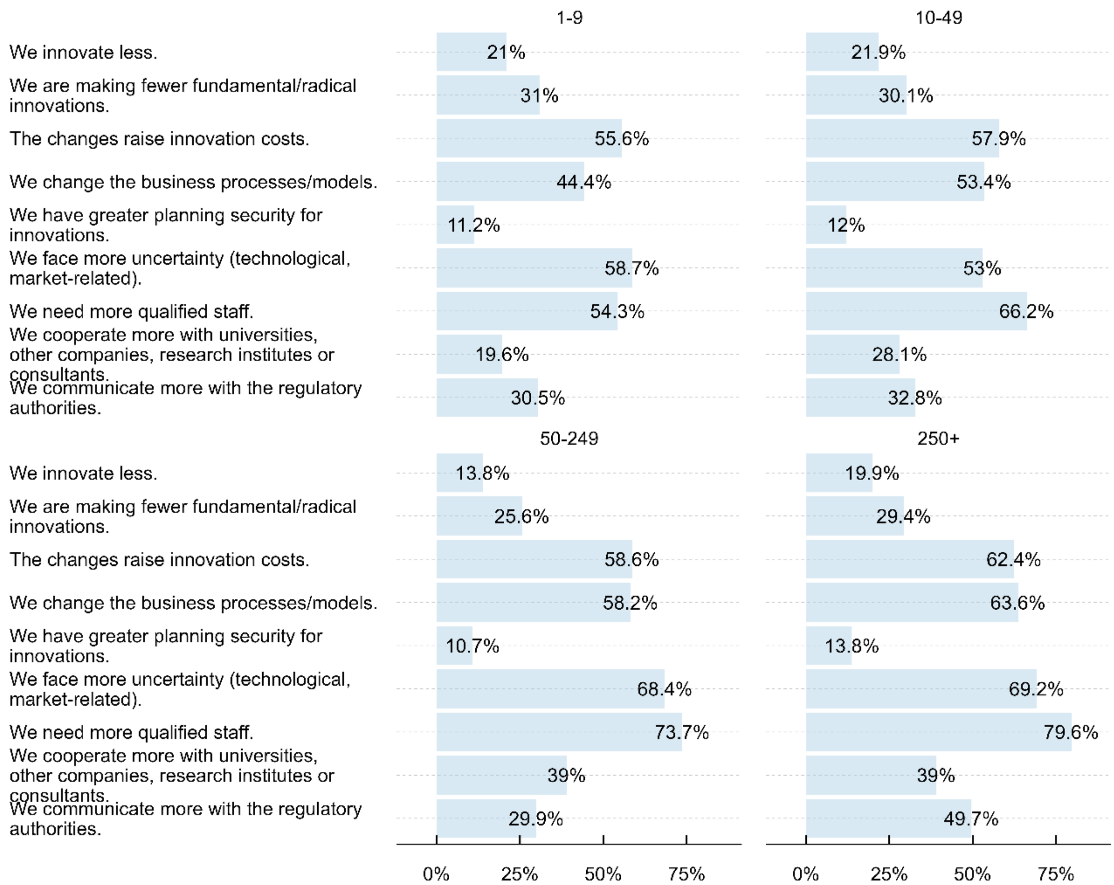
Figure 64. Impact of regulatory changes on innovation activities in the years 2021–2023 by firm size (in %)



3.6.3 Regulation: Type of innovator

Figure 65 and Figure 66 illustrate the perceived importance of regulation for innovation activities in the different types of innovators, based on a composite regulatory indicator ranging from 0 to 8. As shown in Figure 65, regulatory factors are on average most important for

R&D innovators, followed by non-R&D innovators. Non-innovators attach the least importance to regulatory factors, i.e. the regulatory framework is insufficient to become innovative. This pattern reflects the fact that the innovation models of R&D active companies are more influenced by regulations. These include, for example, product safety standards, data protection and process-related regulations, which are often required for market approval and risk management.

Figure 66 illustrates the distribution of regulatory scores across different types of innovators. The R&D innovators display a distribution that is clearly concentrated in the mid-to-high range, with a peak around scores 4 to 5. This indicates that for most R&D-active firms, regulation is consistently experienced as a central factor shaping their innovation activities. The distribution for non-R&D innovators peaks slightly lower, around the score 4, and is somewhat more dispersed, suggesting that while regulation is still relevant, its importance varies more strongly within this group.

In contrast, non-innovators have the highest density at the lower end of the regulatory scale. This implies that many of these firms experience limited regulatory influence on innovation, which aligns with their lack of engagement in innovation activities. However, the presence of some non-innovators reporting higher regulation scores also suggests that regulation may act as a latent pressure or barrier, particularly in sectors where compliance obligations exist regardless of innovation intensity. In this sense, regulation may not only shape the innovation process for active firms but also serve as an entry barrier to innovation, especially for resource-constrained or very risk-averse enterprises.

Overall, the figure confirms that regulation plays a more important role as firms become more innovation-intensive, with R&D innovators most affected probably due to the technical complexity, safety requirements, and compliance demands associated with their innovation models.

Figure 65. Regulation indicator by type of innovator (mean)

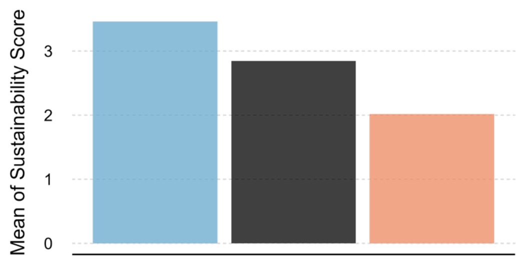
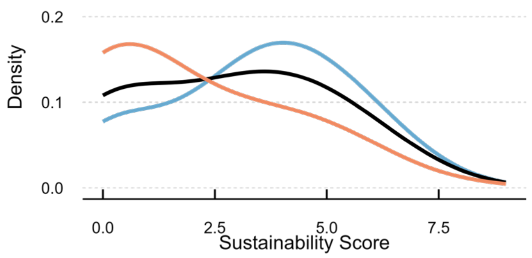
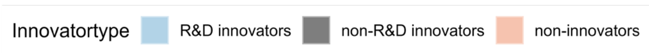


Figure 66. Regulation indicator by type of innovator (density)



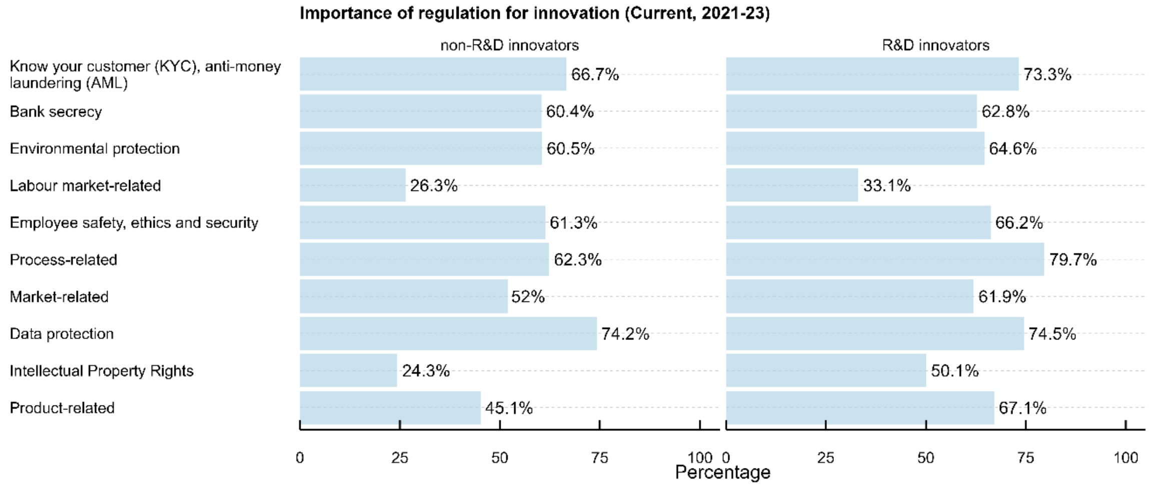


Type of innovator: Increasing importance of regulation for innovation activities. Independent of the type of innovator, process-related and data protection regulations are the two most frequently reported regulatory areas influencing companies' innovation activities. However, there is an interesting dynamic when looking at how this influence has evolved over time.

Figure 63 shows that regulation is more often of great importance to R&D innovators in all dimensions. Data protection and process-related regulations are most important regardless of innovation status. It is important to note that intellectual property rights are among the least important regulations for both types of innovators. In addition to the level, it is interesting to discuss the development of the significance of individual types of regulation. R&D innovators report a more substantial shift in regulatory influence than other groups, particularly in relation to data protection (50.8%), environmental protection (43.5%), and process-related regulations (41.4%). These areas appear to have become increasingly central to innovation models that are more formalized and research-intensive, reflecting rising influence of digital compliance, environmental regulation, and quality assurance on the innovation models.

Non-R&D innovators report particularly high sensitivity to data protection (46.9%), process-related regulation (35.2%) and anti-money laundering (37.7%), the latter being specific to the finance sector. Overall, the results confirm that the degree of innovation activity correlates with the degree to which regulation shapes innovation models, with R&D-intensive firms most affected by evolving regulatory measures, especially in domains related to digital, environmental, and organizational (process) compliance.

Figure 67. Importance of regulation for innovation by innovator type (in %)

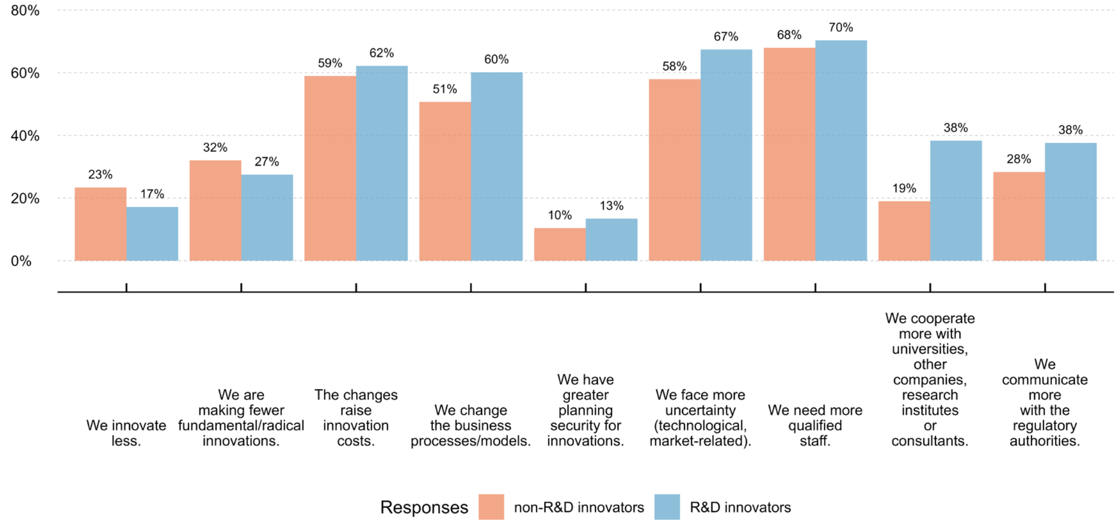


Impact of regulatory changes on innovation activities by type of innovator. Figure 68 presents how R&D innovators and non-R&D innovators have been affected by regulatory changes in terms of their innovation activities between 2021 and 2023. Overall, R&D innovators report a stronger impact across most categories, particularly regarding the need for more qualified staff, increased uncertainty, changes in business processes, and higher innovation costs. These findings indicate that regulation is not merely a compliance issue but has increasingly become a structuring element in shaping the direction and organisation of innovation activities - especially among firms engaged in formal R&D.

Both groups also report that regulation has affected the nature and intensity of innovation. Approximately 27% of R&D innovators and 32% of non-R&D innovators state that they are pursuing fewer radical innovations. However, when looking at disagreement levels, a different dynamic becomes clear: 49% of R&D innovators disagree with the statement, compared to only 34% of non-R&D innovators. Similarly, about 59% of R&D innovators disagree with the idea that they “innovate less”, while just 41% of non-R&D innovators say the same. This suggests that R&D-active firms are better able to sustain both the volume and depth of innovation, even under changing regulatory conditions. Regulation does appear to constrain some aspects of innovation - particularly among non-R&D innovators - however, the majority of R&D innovators continue to pursue innovation actively and with ambition, indicating a higher degree of adaptability within this group.

While regulation may narrow the innovation scope for some firms - particularly with regard to radical innovation - most R&D-active companies continue to sustain or adapt their innovation strategies rather than scaling them back.

Figure 68. Impact of regulatory changes on innovation activities by type of innovator (in the years 2021–2023)



3.6.4 Summary on regulation

Regulations have become an increasingly important factor shaping firms' innovation strategies, particularly in the context of the twin-transformation (sustainability and digitalization). While initially perceived as a source of uncertainty, regulatory frameworks can also stabilize expectations and provide direction for innovation. Their relevance varies significantly across sectors, firm sizes, and innovation profiles, influencing both the extent and nature of innovation activities.

At the sectoral level, the regulatory burden is most pronounced in chemicals, pharmaceuticals & biotech and medtech where compliance with product safety, environmental, and quality standards is deeply embedded in innovation processes. In contrast, sectors such as food, and ICT report lower average regulatory scores and a higher share of firms with minimal regulatory exposure. However, even within sectors, the perception of regulatory impact is highly heterogeneous, reflecting diverse product types, market environments, and compliance demands. Over time, data protection, environmental, and process-related regulations have become more important for firms in nearly all industries, underlining a broader trend towards regulation as a systemic driver of innovation model adaptation.

In terms of firm size, large companies consistently report higher average regulation scores and greater exposure to a diverse regulatory framework, which quite often requires more qualified staff, causes more uncertainty, requires an adaptation of business processes, and increases costs. While small and medium-sized enterprises (SMEs) are also affected, they experience regulation less uniformly, with an accumulation of firms that are only marginally impacted. R&D innovators face the highest regulatory relevance and intensity, especially in domains like digital compliance (data protection), environmental standards, and organizational processes.

The impact of regulatory changes is multifaceted. While many firms report increased uncertainty, higher costs, and a growing need for qualified staff, others experience positive shifts such as greater cooperation and closer engagement with regulators. However, a significant share of companies - especially in sectors like medtech, and chemicals, pharmaceuticals, and biotech - report that regulation has led them to pursue fewer radical innovations. This suggests a possible trade-off, where compliance pressures reinforce incremental adaptation and risk aversion. Yet, among R&D-active firms, the majority still sustain or adapt their innovation strategies, demonstrating a relatively high degree of resilience and flexibility.

3.7 Innovation collaboration

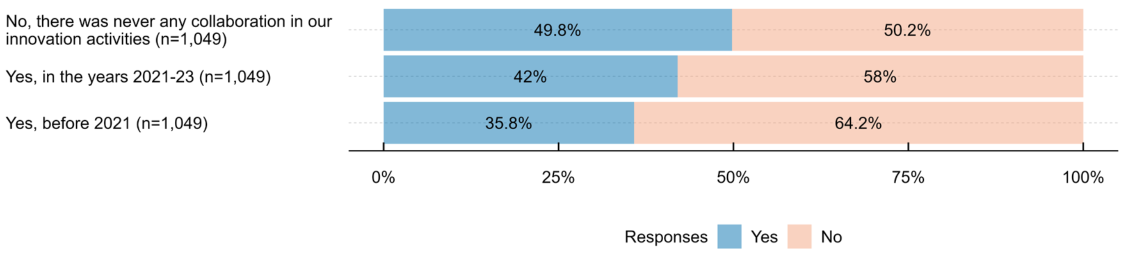
Collaboration is unanimously considered (by academic scholars, policy makers and practice-oriented experts) as a key mechanism to enhance innovation performance. This survey module provides quantitative information about the importance of collaboration, the main partners and the most critical barriers as assessed by Swiss companies.

3.7.1 Commonness of collaboration

General findings

The first finding is rather intriguing since Figure 69 shows that 50% of all responding companies are not engaged in any innovation collaborations. However, the trend is slightly positive: more companies tended to collaborate in 2021-23 compared to the previous period.

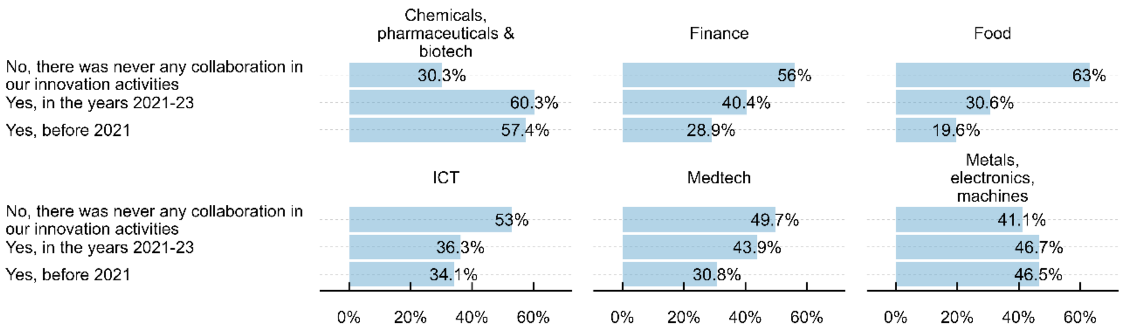
Figure 69: Participation in innovation collaboration



Findings by sector

In only one sector – chemicals/pharma & biotech – a majority of firms has engaged in innovation collaborations in both periods, 2021-23 and 2020 and before (Figure 70). In MEM and medtech less than 50% of the companies has never engaged in innovation collaborations, while in food, finance and ICT more than 50% have never collaborated. However, here again the trend is positive in all sectors: more companies collaborated in the 2021-2023 period compared to before 2021.

Figure 70: Innovation collaboration by sector (in %)

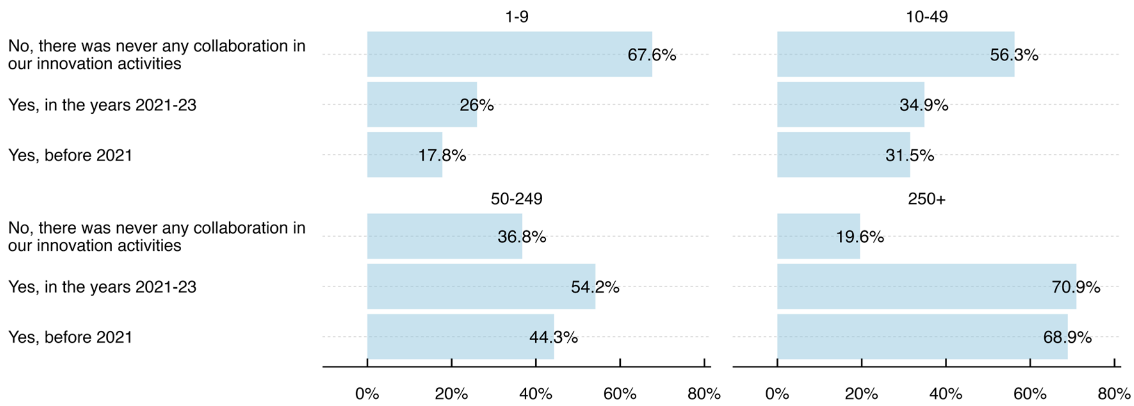


Findings by size

We can observe that the commonness of collaboration is an increasing function of size, meaning that the vast majority of large firms do engage in collaborations for innovation, while this is the case for only one quarter of very small companies (Figure 71).

Regarding small companies, a rational expectation could be that small companies consider collaboration important to compensate for the disadvantages of small size in many strategic dimensions (complementary assets, diversity of competences, access to market). However, the resource constraints from small size seem to be predominant here, meaning that small size is a barrier to collaboration due to a lack of financial or personnel resources needed to engage in collaborations. Nevertheless, an interesting point to note is the significant increase in the importance of collaboration from one period to the next in the case of very small companies (+9%), small (+3%) and medium (+10%).

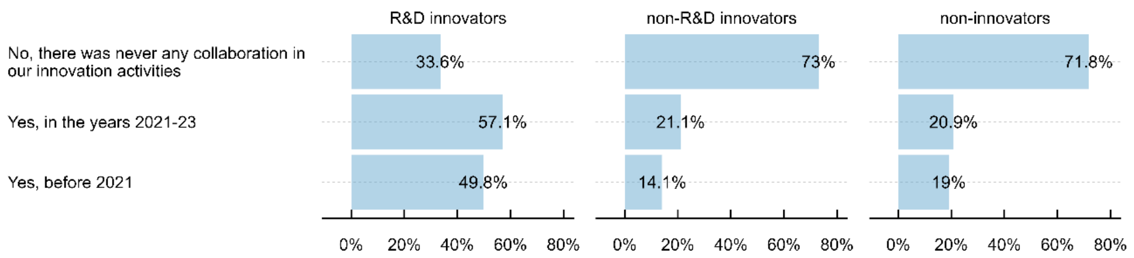
Figure 71: Innovation collaboration by size class (in %)



Findings by innovator type

More R&D innovators collaborate than non-R&D innovators and non-innovators (Figure 72). It is interesting to see that the collaboration intensities of non-R&D innovators and non-innovators are nearly identical. This suggests that collaboration is often connected in one way or another to conducting R&D. Again, the percentage of firms engaging in collaboration increased across the board even if only slightly for non-innovators.

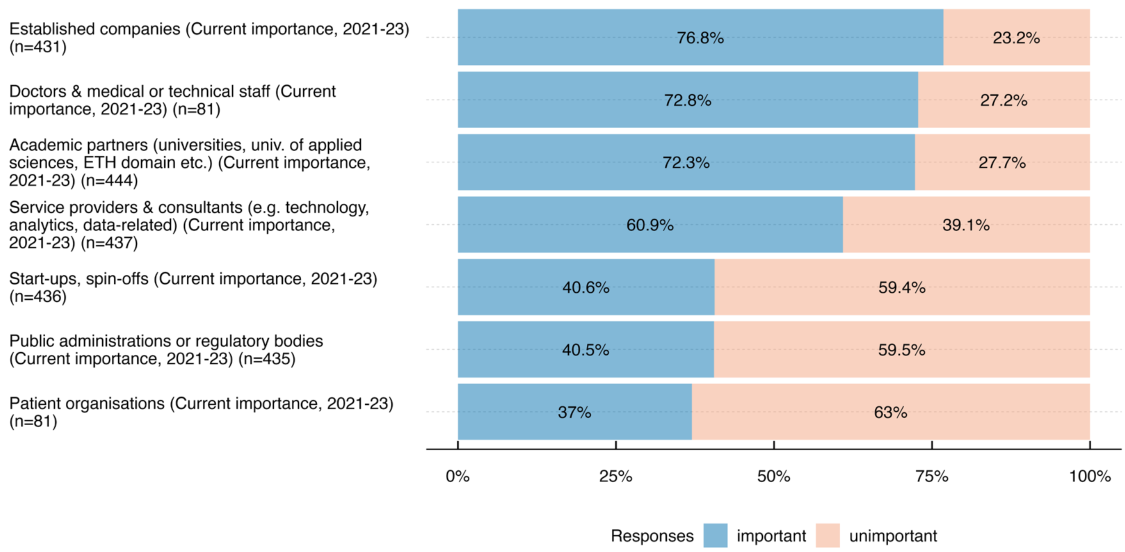
Figure 72. Innovation collaboration by innovator type (in %)



3.7.2 External partners in innovation collaborations

Academic partners are the key partner (Figure 73), which reinforces the policy imperative of having a strong higher education and public research system, oriented towards industry R&D and innovation problems. Established companies are another key partner, as well as service providers and consultants. This supports the idea that innovation happens in an eco-system. Interestingly, start-ups are not seen as an important player in innovation collaborations. Neither are administration and regulatory bodies.

Figure 73: Importance of external partners by partner type (in %)



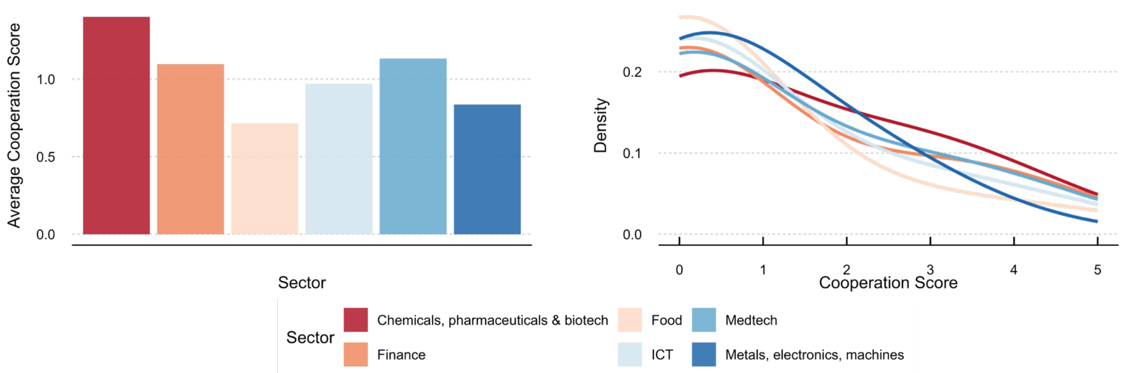
Note: Only companies in the pharmaceutical/chemical & biotech and medical technology sectors were asked about collaborations with 'doctors and medical or technical staff' and with 'patient organisations'.

Findings by sector

The cooperation score is calculated by summing the number of partner types a company reports collaborating with (e.g., academic institutions, established companies). A higher score indicates collaboration with a broader range of partners.

Analysis of the cooperation score (see Figure 74) reveals three distinct groups by sector: the chemicals/pharma & biotech sector shows the greatest diversity of partnerships, likely due to the nature of its activities, which require collaboration with doctors, medical staff, and patient organisations. The second tier includes finance, MEM, medtech and ICT, which on average engage with one type of partner. Finally, the food sector emerges as the least collaborative. Consistent with the findings in Figure 75 shows that a significant share of companies in the sample do not engage in any cooperation at all.

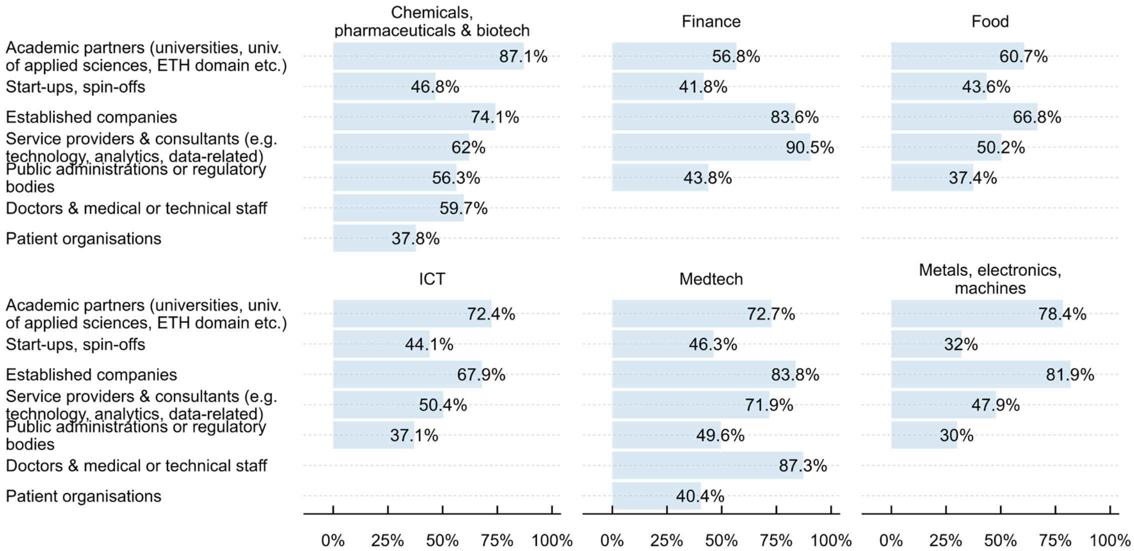
Figure 74: Sector cooperation-score (main) Figure 75: Sector cooperation-score (density)



All sectors rank academic partners very high (particularly chemicals/pharma & biotech, Figure 76). All sectors rank also other companies at a high level. Relying heavily on these two sources and moderately on start-ups, service/consulting providers and administration and regulatory bodies is standard. Medtech and chemicals/pharma & biotech are consistently assessing highly the importance of their own sector's specific partners such as doctors and medical staff or patient organisations.

However, we can observe a few exceptions: Finance relies less on academia but strongly on service providers & consultants. In that sense the pattern of collaboration for finance is unique. The consequence is that finance companies (which also conduct below average R&D, due to the nature of their "innovation activities", which may not be accounted for in R&D expenses) are not obvious targets for innovation policies which essentially focus on the support of science-driven innovations. As a consequence, they hardly get public support for their innovation activities (see Figure 12, p. 27).

Figure 76: Important collaboration partners by sector (in %)



Note: Only companies in the pharmaceutical/chemical & biotech and medical technology sectors were asked about collaborations with 'doctors and medical or technical staff' and with 'patient organisations'.

Findings by size

Figure 77 shows that cooperation is strongly influenced by firm size, with larger companies collaborating across a broader range of partners. Figure 78 further underscores the importance of size for enabling cooperation: over 90% of small companies appear not to engage in any collaboration, whereas the majority of large and medium-sized firms cooperate with at least one type of partner.

Figure 77: Cooperation-score by size (mean) Figure 78: Cooperation-score by size (density)

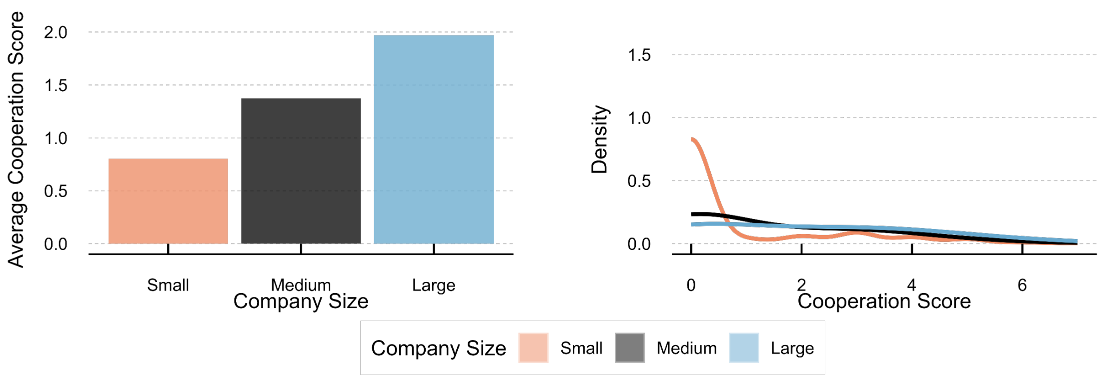
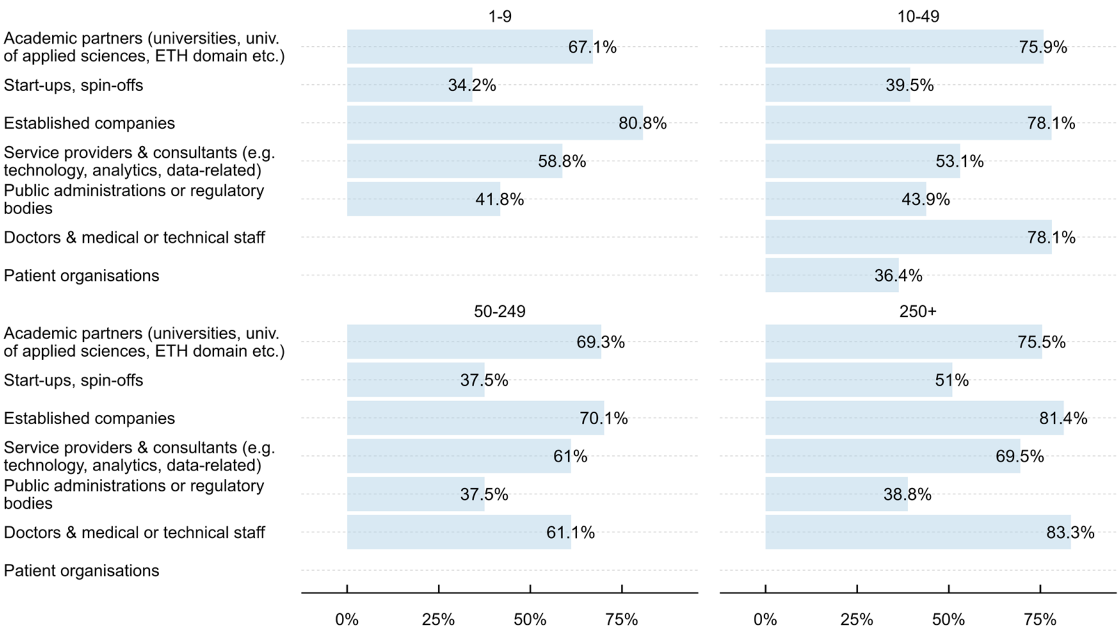


Figure 79. Important collaboration partners by size class (in %)



Note: Only companies in the pharmaceutical/chemical & biotech and medical technology sectors were asked about collaborations with 'doctors and medical or technical staff' and with 'patient organisations'.

Interestingly, even very small companies collaborate a lot with academic partners (Figure 79) which is counter-intuitive since the literature predicts that in order to collaborate with academic partners a company needs absorptive and financial capacities. This number is probably related to the fact that within the 1-9 population in our sample, a large fraction of firms is actually providing business services in R&D and engineering or are science-based start-ups and spin-offs.

For all categories the same important partners are quoted: academia, companies. Start-ups are identified as an important partner by a majority of large companies but they are less important than the other categories (with the exception of public administration and regulatory bodies).

Findings by innovator type

Figure 80 and Figure 81 show that having a variety of collaboration partners plays a particularly significant role among R&D-based innovators. Non-R&D innovators and non-innovators record similarly low scores of 0.5 collaborators. Almost 80% did not collaborate in 2021-23 (see Figure 72, p. 66 above) and only few collaborated with more than one partner type.

Figure 80: Cooperation-score by innovator (mean)

Figure 81: Cooperation-score by innovator (density)

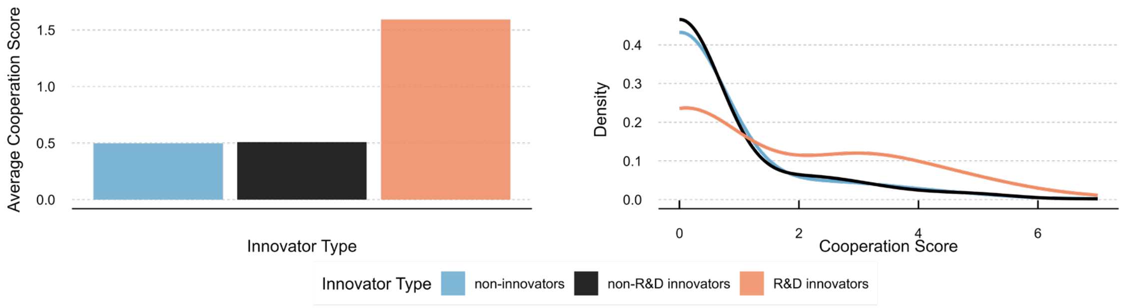
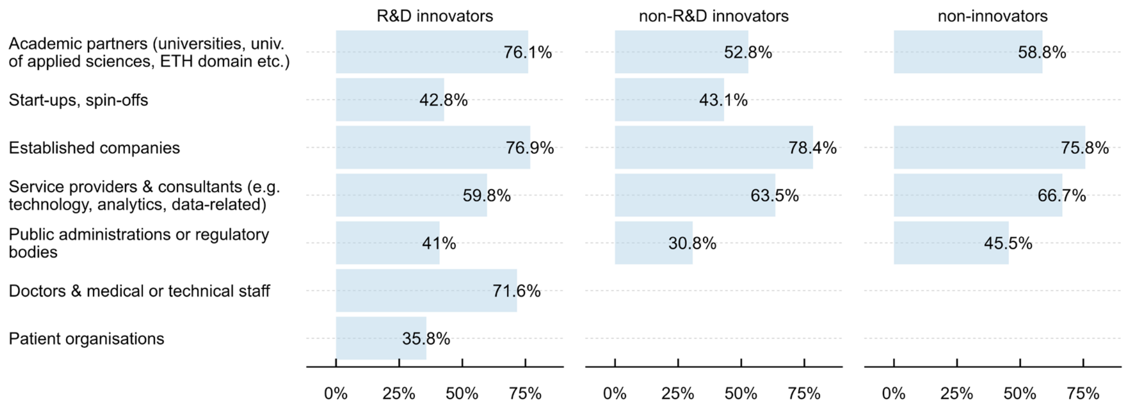


Figure 82 shows which collaboration partners are important by innovator type. It should be remembered that two thirds of the R&D innovators collaborated, but merely 27-28% of the non-R&D and non-innovators (see Figure 72, p. 66 above). The non-R&D and non-innovators which collaborate, collaborate with similar partners as the R&D innovators. That they do not collaborate with doctors, medical staff and patient organisations is due to the fact that only few companies from the pharmaceutical and medical technology sectors belong to these two groups of non-R&D and non-innovators and the percentages are not shown. Not surprisingly, R&D innovators are more inclined to collaborate with academia than non-R&D innovators, but even for the latter, academic partners remain the most important type of partner.

Figure 82. Important collaboration partners by innovator type (in %)



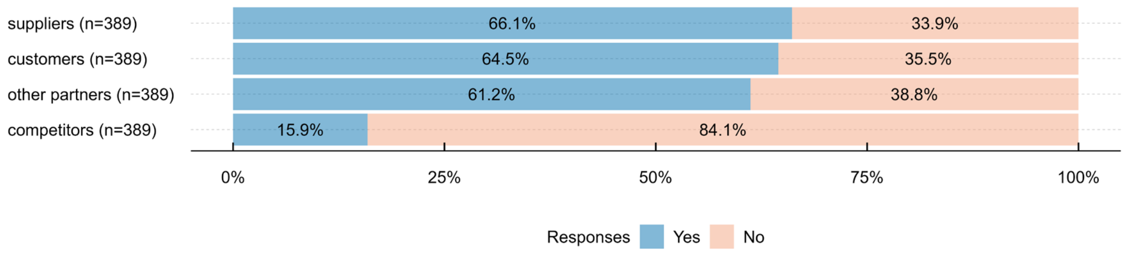
Note: Only companies in the pharmaceutical/chemical & biotech and medical technology sectors were asked about collaborations with ‘doctors and medical or technical staff’ and with ‘patient organisations’. Due to the small n<10 some partners are not shown for certain innovator types.

3.7.3 Relationship with partners

General findings

When looking at the nature of the relationship with partners, it is interesting to see that they mostly appear with other actors of the supply chain (suppliers, customers) than with competitors (Figure 83).[6]

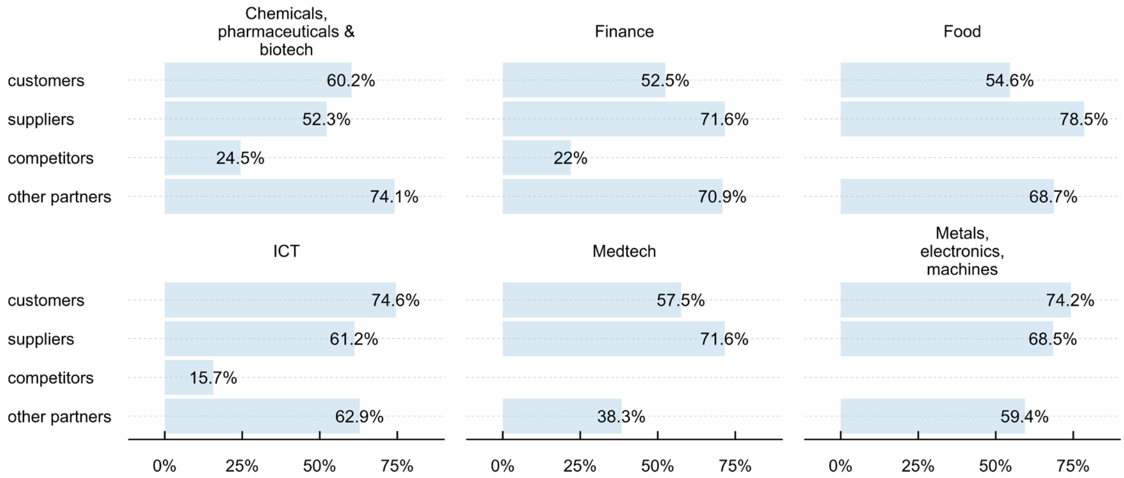
Figure 83: Nature of the relationship with partners



Findings by sector

Figure 88 highlights some differences across sectors: customers are the most common collaboration partner among ICT and MEM companies and less so in finance, food and medtech. With regard to suppliers it is the other way around, and while they were mentioned most often in food, finance, and medtech, they are notably less common in pharmaceuticals, chemicals and biotech firms. Pharma, chemicals and biotech, finance and food companies also collaborate extensively with other partners. In finance, this may be driven by the need to work with providers of new digital technologies (such as technology suppliers, start-ups, and similar actors) and in pharma to collaborations with hospitals, doctors and medical staff. Collaborations with competitors are only shown for chemicals, pharma & biotech, finance, and ICT, and in all three sectors they are of relatively low importance.

Figure 84. Nature of the relationship with partners by sector (in %)



Note: Due to the small n<10 collaboration with competitors is not shown in some sectors.

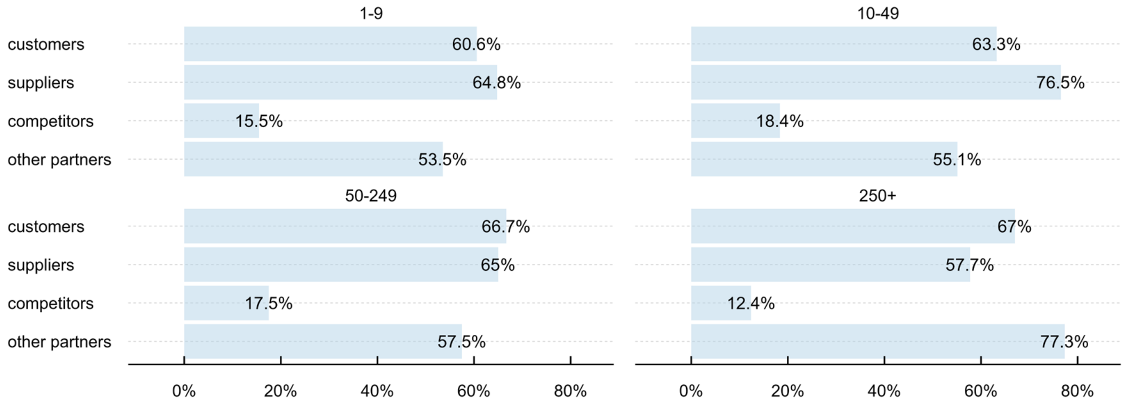
[6] These results are consistent but somewhat more extreme compared to those issued from the latest KOF survey, which provide the following numbers (Spescha et al., 2025):

- Share of collaborating companies that have collaboration with competitors in the period 2020-22: 32%;
- Share of collaborating companies that have collaboration with companies from other industries in the period 2020-22: 51%;
- Share of collaborating companies that have collaboration with customers in the period 2020-22: 51%.
- Share of collaborating companies that have collaboration with suppliers in the period 2020-22: 49%.

Findings by size

An analysis by company size (see Figure 85) reveals notable patterns. Smaller firms primarily collaborate with supply chain partners (customers and suppliers) whereas larger firms more often engage with a broader range of partners. This may be linked to the fact that larger firms typically undertake more ambitious research projects. Interestingly, larger firms are less likely to cooperate with competitors than smaller ones. A possible explanation is that smaller firms often pool resources with competitors to pursue innovation projects, compensating for their limited size and comparatively fewer resources.

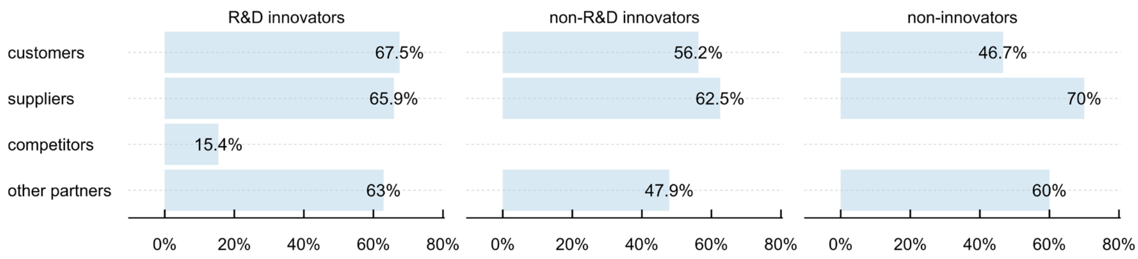
Figure 85: Nature of the relationship with partners by size class (in %)



Findings by innovator type

Figure 86 indicates that R&D innovators collaborate to a similar extent with suppliers, customers, and other partners. Non-innovators, by contrast, tend to collaborate less with customers than the other two groups but slightly more with suppliers. Still, across all types of innovators, collaboration with suppliers emerges as a consistently important factor.

Figure 86: Nature of the relationship with partners by innovator type (in %)



Note: Due to the small n<10 collaboration with competitors for is not shown non-R&D and non-innovators.

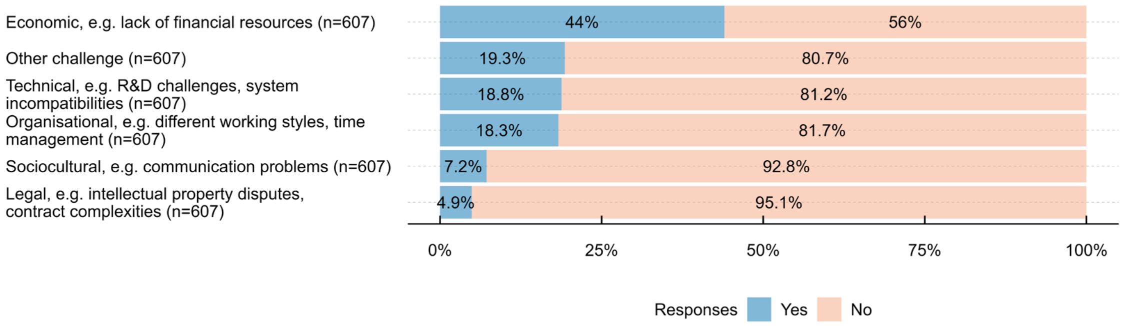
3.7.4 Obstacles to innovation collaboration

General findings

Financial constraints are clearly obstacle number one very much ahead of any other (Figure 87). This is, of course, highly relevant for innovation policy, since the main Swiss instrument, the Innosuisse innovation programmes, does not provide any direct support to companies and only funds the academic partner.

It is also interesting to see that legal aspects of IP and contract issues are mostly viewed as a negligible obstacle. This can mean two things: either the IP legal framework is perfect and provides the needed legal infrastructure to collaborate, or the political discourse about how critical legal/IP issues are for successful collaboration is an overstatement.

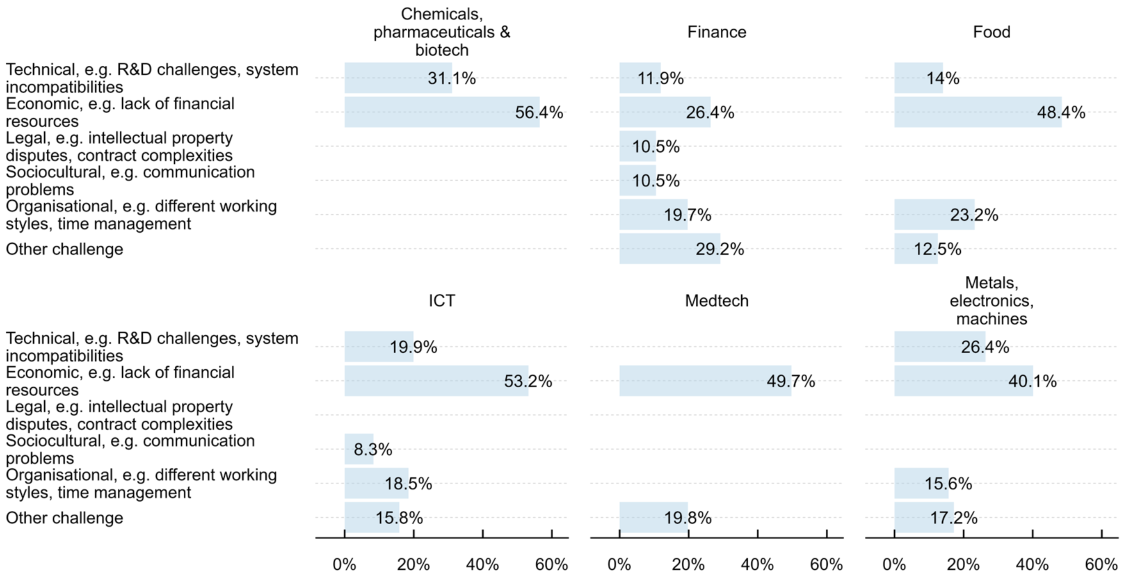
Figure 87: Obstacles to innovation collaboration



Findings by sector

We find the same pattern by sector: financial constraints are dominating in all sectors except for finance (Figure 88). Technical constraints matter most in chemicals, pharmaceuticals and biotech and MEM industries and they are less relevant in medtech, finance, food and ICT. Organisational obstacles are noted by about a fifth of the companies in food, finance, and ICT and they are hardly important in pharma and medtech.

Figure 88. Obstacles to collaboration by sector (in %)

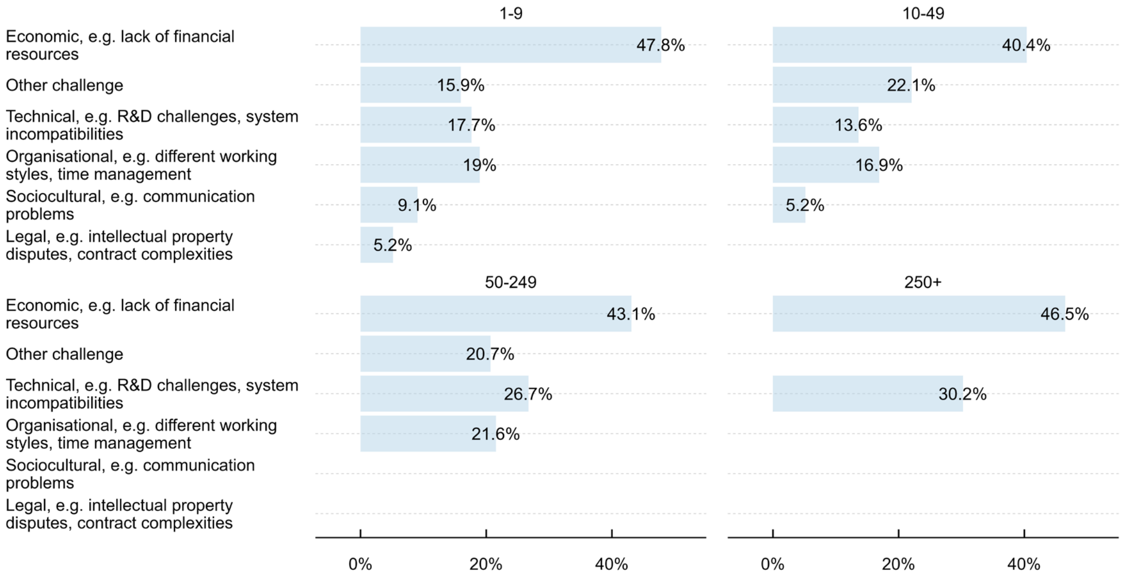


Note: Due to the small n<10 some collaboration obstacles are not shown for some sectors.

Findings by size

Financial constraints are key independent of company size and even larger companies single them out as the main innovation obstacle (Figure 89). Technical challenges are noted more by mid-size and larger companies than by smaller ones. Organisational obstacles are felt to about the same degree in small and mid-size companies – for larger companies this cannot be evaluated due to the small n.

Figure 89: Obstacles to innovation collaboration by size class (in %)

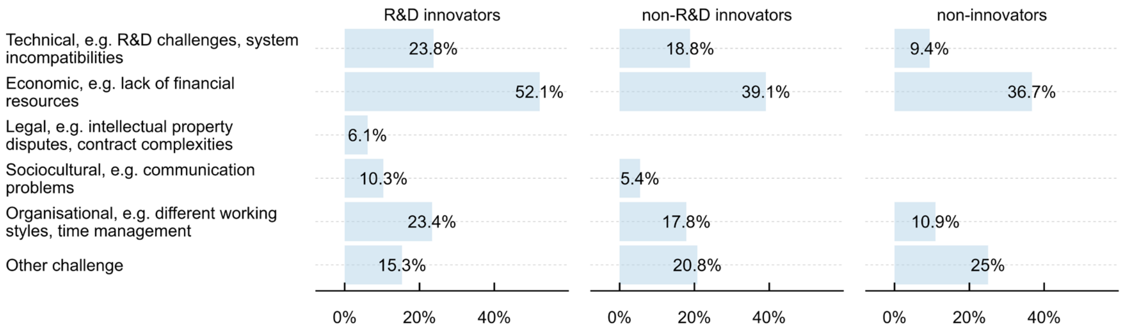


Note: Due to the small n<10 some collaboration obstacles are not shown for some size classes.

Findings by innovator type

Again, financial constraints are dominating for all innovator types (Figure 90), but the obstacle is more salient for R&D innovators than for non-R&D innovators and non-innovators. It is possible that the absolute cost of a collaboration is higher in the case of R&D innovators because precisely collaboration in this case involves the development of collaborative R&D initiatives implying teams, shared infrastructures and equipment. Non-R&D innovators are likely to prefer simpler and cheaper collaboration modes. Non-innovators often cited other reasons for their unwillingness to cooperate. In their responses to the open-ended question, they frequently referred to a lack of innovation activities, a lack of need for cooperation, and regulations that prevent cooperation.

Figure 90: Obstacles to innovation collaboration by innovator type (in %)



Note: Due to the small n<10 some collaboration obstacles are not shown for some innovator types.

3.7.5 Summary

There is general trend of increasing collaboration over the two periods. In addition, the salient findings regarding collaborations are:

a) The companies surveyed work primarily with academic partners and other established companies,
b) the main obstacle to collaborations are financial constraints and
c) IP/legal issues are not viewed as an important barrier.

While all sectors are quite well described by the above mentioned salient features, finance and the food feature slightly different patterns: the foot sector is the sector that engages the least in innovation collaborations; the financial sector does engage in innovation collaborations - though at a somewhat lower proportion than most other sectors - but these tend to happen mostly with other established companies and more rarely with academic partners.

3.8 Key insights on innovation challenges and directions

The descriptive analyses of the survey data highlighted a few issues with policy implications:

1) Conditions and incentives for the introduction of radical, transformative innovations in products, processes and business models,
2) Specificity of requirements (e.g. by sector, firm size, innovator type) for innovations and flexibility needs,
3) Specific issues resulting from the digital transformation and sustainability transition of the Swiss economy, regulatory dynamics and collaboration patterns.

1) Conditions and incentives for the introduction of radical, transformative innovations. The results suggest that radical innovations, which often arise from R&D results and consist of market novelties, fundamentally new products, or new business models do not emerge to the desired extent among the surveyed Swiss companies. As a matter of fact, the optimal rate of innovation for an economy is a notion that is rarely discussed (David, 2012). However, at a time when comprehensive technological changes are taking place in many areas and consumption habits and production conditions are subject to a great deal of dynamic adjustment, this should also be reflected in the innovation activities of companies. However, the continuous decline in the share of sales of Swiss companies accounted for by radical innovations (Spescha et al., 2025) and the strong focus on incremental innovations in individual sectors (finance, medtech, food and beverages) in our survey indicates that this is hardly the case.

2) Specificity of requirements for innovations and flexibility needs. The responses on innovation activities and innovation support suggest that the surveyed companies in four of the six sectors are integrated well into the current Swiss public innovation promotion system: chemicals, pharmaceuticals & biotechnology, MEM sector, ICT sector, and medical technologies. As they conduct innovation mainly by investing in R&D and technological development, co-funding applied R&D and innovation projects through Innosuisse grants connects to their innovation models.

The surveyed companies in the two remaining sectors, finance and food, have a lower importance of R&D-based innovation and predominance of incremental innovation in common. With regard to process innovation the surveyed finance companies are more active, but food companies also fall behind the other sectors. In both sectors further analyses are needed to understand better, whether market failures cause under-investments in R&D respectively whether coordination failures lead to the low engagement with academic research or low collaboration in general (in food).

- It would be important to understand, to what degree the current innovation funding requirements, e.g. with regard to partner constellations, limit the possibilities for finance companies to engage in R&D-based innovation projects or whether the dominant innovation pattern in this sector is just different
- Though food sector companies perceive competition as a relevant factor, they do not see technology in general and digitalisation specifically as the possible solutions (see below). Their main innovation focus are new goods generated and introduced with the

help of new machinery and facilities. It would be important to understand better whether this focus is part of the solution or part of the problem.

Small and micro enterprises lack behind medium-sized and large enterprises participating in the survey in almost all topics covered in this analysis:

- They engage less in innovation, above all R&D-based innovation, new to market product innovation, and process innovation, and obtain less often innovation support;
- they have less often digitalized their innovation activities and introduced new digital tools due to cost and personnel-related barriers;
- a smaller proportion has introduced sustainability innovations, again mainly because of resource limitations and as they perceive no specific need for this type of innovation;
- they also collaborate less with other organisations in their innovation activities (two thirds said that they never engaged in innovation collaborations).

However, micro-enterprises also perceive less competitive dynamics and fewer regulations with relevance, but the regulation-sensitivity of their innovation activities is higher than in medium-sized firms, i.e. they more often stated that due to regulatory changes they introduced fewer innovations overall and fewer radical innovations, in particular.

Even though start-ups often fall into this size category, they differ in terms of innovation activities and innovation promotion in a positive sense and do not fit this description.

Low-threshold support channels for innovation activities of micro-enterprises might reduce the problems of these companies and raise their innovation capacity. There are undoubtedly already instruments in place that work in this direction, such as the Innosuisse Innovation Cheques and the recent 2025 call for SME projects(https://www.innosuisse.admin.ch/en/sme-call-for-projects). However, the question is whether they should be extended, and, if so, what type of support would meet the specific requirements of micro enterprises.

In summary, sectoral and size-related characteristics indicate that 'one-size-fits-all' policies are not suitable for supporting all company types equally in their innovation efforts and more flexibility in the design and application of the policies would be desirable.

3) Further issues resulting from the digital transformation and sustainability transition of the Swiss economy, regulatory dynamics and collaboration patterns:

- *Digital transformation with sector-specific and size-specific implications.* While developing and adopting digital technologies (defined as the conjunction of digitization, automation, big data and artificial intelligence) is an imperative to enhance productivity and develop new products and services in any company and at the level of the economy, the survey highlights significant disparities in terms of digital innovation performance between sectors as well as firms of different sizes. Many large companies in sectors such as ICT, finance or chemicals, pharmaceuticals & biotech conduct R&D and are digital technology champions, but they nevertheless also identify barriers and problems, for instance, with regard to digital innovation. These problems relate to the skills required and underline the importance of higher education and training, as well as the provision of an adequate data infrastructure. Not surprisingly, the conjunction of being a very small firm, non-innovator and operating in low or medium tech sectors (such as food) make such firms rather disconnected from the dynamics of digital innovations. These firms don't rank any technologies as important and face barriers related to understanding and awareness of the importance of digitalisation as well as resource constraints (costs and skills). It would be key to know whether measures to raise awareness about the potentials of new digital and other general-purpose technologies could be useful as a first step; moreover, whether there is a need for a more ambitious policy initiative combining multiple interventions such as information provision, training and adoption subsidies.

- *Sustainability innovations influenced by path dependency and regulation.* To counter path dependency and stimulate more transformative innovation, better framework conditions, such as better incentives and regulatory clarity are essential, particularly in segments where sustainability engagement remains low or narrowly focused. Given the stronger performance of firms with established innovation structures, policies that reinforce R&D capacity can act as a driving force in scaling sustainability transitions across the economy.
- *Facilitating regulation-pull innovation.* Overall, the findings confirm that regulation is increasingly a structuring force in innovation systems, shaping how firms across sectors, sizes, and innovation capacities pursue competitiveness. A regulatory reform could therefore aim not only at reducing the regulatory burden, but also at promoting innovation, especially among SMEs and innovators not involved in R&D, and at ensuring that regulation can serve as a stable (predictable) and supportive framework for pioneering innovation.
- *More innovation collaboration through more flexible forms of support and funding conditions.* The survey results suggest that collaborations could be an important policy case. While both the academic literature and policy experts recognize collaboration as a key mechanism to solve complex and risky innovation problems, a significant part of the surveyed firms do not collaborate. They identified financial constraints as one of the most important barriers to innovation collaborations. Firms pointed to academic partners and established companies as the two most important types of collaboration partners. However, it would be key to know whether support to a wider set of collaborations involves some finetuning of the policy instruments or programs, since the challenges and problems arising from building partnerships are different when the partner is an academic institution or an established company. This could be particularly important for the financial sector, where collaborations appear to be realised mostly among established firms. Other sectors while appearing to be well served by the current model, might also be interested in more flexibility.

These issues were taken to the next methodological task of Delphi interviews and discussions with companies in the six sectors.

4 Results of the Delphi interviews with companies

This section summarises the results of 70 bilateral online interviews which we conducted with experts from the participating six sectors. The main patterns and policy suggestions are being used in a second round of discussions to generate the policy recommendations. In the second Delphi round, experts from a particular industry met in person to discuss the results of the first round and reach a consensus on specific policy proposals (in total 35 experts).

The statements made in the interviews and discussions are subjective perceptions and opinions that reflect the interviewees' level of information and not necessarily the true state of affairs.

4.1 Delphi round 1

4.1.1 General comments

The first Delphi round yielded a set of general reflections on the state and direction of innovation in Switzerland. These general comments highlight both the strengths of the Swiss innovation landscape and the more general challenges companies face. Many experts pointed to Switzerland’s strong research infrastructure, supportive networks, and generally favourable framework conditions as key for innovation activities. At the same time, they identified significant barriers, including regulatory complexity, funding gaps for scaling, high costs, talent shortages, and limited market size. The synthesis below groups these observations into recurring opportunities, challenges, and structural trends.

Opportunities and positive conditions for Innovation

- *Strong framework conditions and infrastructure.* Switzerland offers excellent research institutions (ETHs, universities, UAS), good networks, and supportive programmes such as Innosuisse.
- *Stable or increasing innovation activity.* Many firms reported no decline, or even growth, in R&D and innovation, often focusing on incremental improvements, digitalisation, or sector-specific trends like AI, plant-based nutrition, or sustainability.
- *International collaboration and openness.* Access to talent and partnerships abroad are seen as vital for competitiveness.
- *Sectoral strengths.* Some respondents (e.g. from food, pharma) are experiencing an innovation push through new technologies and consumer trends.

Barriers and challenges

- *Regulatory and compliance burdens.* Regulatory hurdles increase time, costs, and complexity, particularly in medtech, chemistry, and finance; firms call for a focus on removing barriers rather than adding funding instruments.
- *Funding gaps for scaling.* There is a lack of large-scale financing (€50–100 million range), making it hard to scale ambitious projects; medtech VCs in Switzerland are scarce.
- *High costs and competition from abroad.* Innovation is expensive in Switzerland, and companies often move R&D or production to lower-cost countries.
- *Talent shortages.* Difficulty attracting and retaining qualified personnel, especially in specialised technical fields, weakens innovation pipelines.
- *Market and demand limitations.* Small domestic market, federalism, and limited customer willingness to adopt innovations slow growth.
- *Sectoral conservatism.* In some sectors, innovation is incremental due to risk aversion, conservative customers, or low margins.
- *Disconnect between public and private sector innovation agendas.* Public instruments are not always aligned with the needs of private firms.

Structural or strategic observations

- *Shift toward incremental innovation.* Many companies focus on process improvements or design differentiation rather than radical breakthroughs, often due to cost, risk, and market constraints.
- *Polarisation of the innovation landscape.* Large companies and start-ups drive most innovation; medium-sized firms risk being left behind.
- *Need for global thinking.* Calls to promote Swiss innovations internationally, create global champions, and ensure that the benefits of Swiss innovations abroad flow back into the country.

4.1.2 Digitalization – opportunities and challenges

The first Delphi round also explored how digitalization influences the innovation activities of companies across sectors. Experts provided a wide range of perspectives, highlighting both the opportunities created by digital technologies and the barriers that limit their use. Many participants see digitalization as a driver of process optimisation, product innovation, and improved customer service, as well as a means of opening new business areas. However, they also emphasised significant obstacles, such as gaps in Switzerland's digital infrastructure, high costs, cybersecurity risks, regulatory fragmentation, skills shortages, and cultural resistance to change. The synthesis below groups these insights into key opportunity and risk categories.

Opportunities and positive effects

- *Process optimisation and automation* improves internal efficiency, reduces mistakes, and streamlines workflows: e.g. automation for targeted customer service, optimisation in production processes, automated client answers for customised products, more efficient, fully digital workflows, faster problem cause identification, or end-to-end digital workflows.
- *Support for product innovation and enhancement.* Digital devices/applications are used for visual inspection of products, developing new products, IoT applications in devices, 3D scanning for customised products (e.g. prostheses), predictive maintenance, AI-enabled biotech R&D, digitalisation in hearing aids.
- *Improved customer interaction and service quality.* Digitalisation enables better targeted service, automation of responses, improved client reporting and information delivery, and supports both customer- and technology-driven service changes.
- *Access to new business areas and opportunities.* Digitalisation allows for entering other sectors, creation of new business opportunities from shared data pools, expansion through corporate data sharing, and new AI-based services in hearing care.
- *Integration of advanced tools and methods.* For instance, the use of cloud-based ERP/CAD systems, blockchain, IoT in energy systems, LLMs for technical queries, AI for rapid experimentation and prototyping, and generative AI solutions in banking.
- Contribution to sustainability. Digitalisation reduces paper usage and allows for a more efficient resource consumption.

Risks, barriers, and challenges

- *Lagging digital infrastructure and data access.* Switzerland is behind in digitalising patient files and enabling anonymised health data access, with cantonal fragmentation creating further delays.
- *Cybersecurity and data sovereignty concerns.* Risks from using foreign-operated platforms, high security requirements in insurance, country-specific security regulation differences, or customer rejection of external interfaces.
- *Regulatory fragmentation and compliance hurdles.* Heterogeneous regulations across countries, concerns over US Cloud Act and Chinese data rules, restrictive sector-specific regulations, and high documentation/compliance burdens.
- *Skills shortages.* Lack of IT, software development, and AI expertise, as well as calls for a stronger focus in universities.
- *High costs and low return on investment.* Difficulty amortising digital investments in low-margin sectors like food, high costs for insurance/health interfaces, inability of small firms to afford AI expertise, high licensing and SaaS (software as a service) fees, unclear added value for small companies.
- *Technical and validation challenges.* In particular, in medtech, the validation of AI models is complex, slow, and high-risk.
- *Integration and interoperability issues.* Poor customer/insurer interface compatibility, dependency on supplier platforms and lock-in, lack of necessary technologies to integrate APIs into core processes.

- *Cultural and organisational resistance.* Internal reluctance to adopt digital tools due to job security fears or risk aversion.
- *Weak client demand.* Limited customer readiness for digital innovations, making business cases hard to justify.

4.1.3 Sustainability – opportunities and challenges

The first Delphi round also examined the role of sustainability in shaping companies' innovation activities. Expert responses revealed a broad spectrum of views, from seeing sustainability as a key innovation driver and competitive advantage to regarding it as a costly obligation or even an obstacle. Many participants highlighted concrete opportunities, such as circular economy approaches, sustainable product and packaging innovations, and the integration of ESG principles into corporate strategies. At the same time, they pointed to barriers including high costs, low customer willingness to pay, complex or conflicting regulations, and heavy administrative requirements. The synthesis below groups these perspectives into key opportunity and challenge areas.

Opportunities and positive effects

- *Direct driver of innovation.* Sustainability stimulates product, packaging, and process innovation: e.g., adapting to hospital tender sustainability requirements, packaging innovations despite higher costs, shift towards naturally sourced raw materials, developing products using fewer raw materials, circular economy and recycling, photovoltaic energy and waste heat use, pesticide-free plants, glass packaging, becoming a "circular organisation", ESG data tools, scope 3 emission reduction, sustainability-linked product and process investments, circular design, pushing sustainable products despite higher price, compressed air energy savings, prevention-focused healthcare innovations.
- *Market positioning and brand value.* Sustainability used as a selling point or part of corporate DNA (e.g. SDG commitment, sustainable products as selling point, attractive employer via circularity, strategic investment in sustainability).
- *Integration with digitalisation and data.* Data and digital tools enable sustainability tracking and reporting, e.g. data sharing for the green transition.
- *Policy and regulation as enablers.* Government incentives or regulation could promote sustainability uptake, e.g. tax incentives in food, Innosuisse support of emission reduction, potential need for sustainability regulations.
- *Social sustainability benefits*. Inclusion, diversity, family leave policies enhance workplace attractiveness .

Risks, barriers, and challenges

- *Low customer demand or willingness to pay.* Market reluctance to pay more for sustainable products/services.
- *Cost pressures and long payback.* High investment costs, long amortisation periods, and margin constraints.
- *Regulatory complexity or conflict.* Overlapping or conflicting rules can block sustainable practices, e.g. international legislation is not harmonised, dangerous goods classification for disposable syringes, disposable plastic use mandated by regulation, lack of measurement standards, shifting customer focus, EU Green Deal's limited sector scope, prohibition on reusing prosthetic parts, MDR packaging requirements increase waste.
- *Administrative and compliance burden.* ESG reporting and certification demands seen as heavy, especially for start-ups and SMEs.

- *Perceived "greenwashing" or low real impact.* Sustainability efforts not seen as substantive or impactful.
- *Technical and operational constraints limit sustainability gains,* e.g. AI energy use, AI/digital scaling vs. emissions, measures implemented for operations, not innovation, reduced operational flexibility.
- *Shifting definitions and priorities.* Changing interpretations of sustainability can misalign with investments.

4.1.4 Comments on regulation

The first Delphi round also explored how regulatory frameworks influence companies' innovation activities. Experts shared a wide range of experiences, with some viewing regulation as a necessary enabler that provides stability, fosters trust, and can even create competitive advantages when rules are clear and aligned with industry needs. However, many participants described regulation as a significant obstacle, citing excessive bureaucracy, disproportionate burdens on SMEs, slow and fragmented decision-making, and international misalignments that hinder market access and testing. The synthesis below organises these perspectives into key opportunity and barrier categories.

Opportunities and enabling effects of regulation

- *Clear, stable, and well-communicated rules can foster innovation.* Examples include crypto regulation by FINMA, which created a predictable framework that attracted industry actors and supported product development, Distributed Ledger Technology (DLT) rules equating digital and physical value spurred disruptive financial innovations. Some sectors benefit from stable product rules that provide compliance certainty.
- *Regulation as a competitive advantage.* In fintech, regulation ensures process optimisation and protects the domestic market from foreign entrants. Green regulation can stimulate innovation in specific areas.
- *Collaborative regulator–industry relationships.* Positive examples of regulators listening to industry and adapting rules accordingly. Pilot-first approaches ("innovate, then regulate") seen as beneficial in Switzerland compared to more rigid EU frameworks.
- *Protective and market-shaping role.* Regulation can maintain quality standards and ensure safe market environments, creating trust that benefits innovative offerings.
- *International alignment benefits.* Adopting EU standards avoids duplicative certification requirements for exporters.

Obstacles and restrictive effects of regulation

- *Excessive regulatory burden and bureaucracy.* Widespread criticism that regulations require too much documentation, are costly to comply with, and divert resources from innovation. Especially in medtech and food, certification costs are seen as a major innovation deterrent.
- *Disproportionate impact on SMEs.* One-size-fits-all requirements overburden small firms. Many argue regulations should scale to company size and innovation risk.
- *Slow and fragmented regulatory processes.* Federalism, cantonal variation, and slow political decision-making hinder harmonisation and delay innovation. Sector-specific examples include fragmented ethics committee approvals for clinical trials.
- *International misalignment.* Divergence from EU or US rules complicates exports, market entry, and testing. Some firms point to faster approval and pilot opportunities abroad.

- *Overly rigid and risk-averse frameworks.* Excessively prescriptive rules inhibit experimentation and favour incremental over radical innovation. Some regulations prioritise potential risks over practical testing.
- *Restrictions on communication and product claims.* Regulations sometimes prevent companies from marketing scientifically supported benefits.
- *Unclear or late regulatory guidance.* Uncertainty during implementation phases can delay innovation projects. SMEs often lack clear “safe to proceed” rules.
- *Regulatory conflict with other priorities.* In some cases, sustainability or safety regulations conflict with innovation objectives, increasing waste or limiting efficiency gains. Sustainability-inherent regulatory conflicts, e.g. avoiding contamination (social sustainability) increases waste and prevents reuse/recycling (environmental sustainability).

4.1.5 Comments on collaboration

The first Delphi round also examined the role of collaboration in shaping companies’ innovation activities. Many participants highlighted the benefits of working with specific partners, such as ETH, EPFL, universities of applied sciences, research institutes, start-ups, suppliers, customers, and sector associations. Collaborations were seen as important for accessing specialised expertise, testing new technologies, developing products across the value chain, and building cross-sector solutions. Informal SME networks and structured platforms also emerged as valuable enablers. At the same time, firms reported significant barriers, including difficulties in finding suitable partners, complex and costly IP arrangements (especially with ETH), mismatched timelines and priorities between academia and industry, resource constraints for SMEs, and cultural or competitive reluctance to cooperate. The synthesis below organises these opportunities and challenges.

Opportunities and positive effects of collaboration

- *Access to specialised skills, expertise, and infrastructure.* Collaborations provide access to research facilities, technical know-how, and innovation capabilities. Partnerships with academic bodies help to access expertise, train staff, and integrate students into innovation work.
- *Collaboration across the value chain.* Joint work with suppliers, customers, and sector associations serves to develop products, improve processes, and address common challenges.
- *Partnering with start-ups.* Leveraging capacity, market access, and complementary expertise.
- *Cross-sector and interdisciplinary collaboration.* Bringing in experts from unrelated fields to apply their skills in new contexts.
- *Informal networks and SME collaboration.* Personal relationships and small informal networks enable flexible, targeted projects.
- *Collaboration platforms and organised initiatives.* Industry associations, innovation centres, and thematic roundtables facilitate cooperation when well-structured.

Difficulties and barriers to collaboration

- *Finding suitable partners.* SMEs often lack awareness of available collaboration opportunities or contact points: There is a lack of awareness of R&D services at higher education institutions for non-academic SMEs and there is an absence of effective platforms to identify academic expertise and projects and reliance on internet searches is inefficient.

- *Administrative burden and IP issues.* Complex contracts, high licensing fees, slow agreement processes: ETH shows slower negotiations and more restrictive IP/licensing terms than the UAS, and ETH licence costs deter smaller firms. Other institutions might have slow contracting processes, lengthy IP agreements, and generally standardised collaboration contracts are perceived to be lacking.
- *Misaligned timelines and objectives.* Doctorate-based project timelines (e.g. at ETH) are too slow for business cycles. Academic agendas may prioritise basic research over applied, market-relevant topics.
- *Cultural and competitive barriers.* Sectors with strong confidentiality (banking) avoid collaboration. Differences in goals and communication styles between business and academic cultures can limit effectiveness.
- *Resource constraints.* SMEs lack time, staff, or budget to join collaborative projects.
- *Regulatory limitations.* High regulatory barriers reduce the practical benefits of collaboration in some sectors.
- *Uneven partner engagement.* Success often depends on personal commitment of key individuals in academia or industry. When this is absent, projects stall or fail.

4.1.6 Criticism on current policy instruments

The first Delphi round also gathered critical reflections from the participating experts on existing policy instruments and institutions, above all Innosuisse. Only few participants expressed no dissatisfaction. It must be stressed again that these statements are subjective perceptions and not necessarily correct accounts of the true state of affairs. These comments provide valuable insights into perceived shortcomings and structural barriers within the current innovation support landscape and more specifically the support provided by Innosuisse. While some participants expressed satisfaction with the status quo, many pointed to recurring issues such as excessive bureaucracy, an overemphasis on academic partnerships, insufficient early-stage financing, and regulatory uncertainty. The synthesis below distils these observations into a few salient features.

- *Partner requirements slow down innovation processes:* The need to find a partner (e.g. for Innosuisse funding) before accessing support slows innovation projects and the lack of systematic partner-finding tools makes it difficult to identify and match with appropriate partners.
- *Lack of feedback & poor monitoring:* Funders, e.g. Innosuisse, give little feedback on rejected proposals; project monitoring is seen as poor or superficial.
- *"One size fits all" policies inadequate:* Policies should be adapted more to firm size, sector, or situation. Funding schemes not suited to large/global companies. Innosuisse bureaucracy and cantonal fragmentation hamper bigger firms' innovation.
- *SMEs are disadvantaged vs. academic start-ups:* Perceived as harder for SMEs to obtain public innovation support than for academic start-ups.
- *Innosuisse is "university-driven":* Too much emphasis on academic partners; closed ecosystem excluding experienced entrepreneurs from industry.
- *Lack of early-stage financing for start-ups:* Insufficient domestic early-stage funding; start-ups seek support abroad.
- *Excessive paperwork/reporting for funding:* Funding applications, especially Innosuisse, require too much bureaucracy, long processing times.
- *Limited flexibility in cooperation contracts & funding:* Rigid contracts with universities, slow application processes, and inflexible funding rules.
- *Weak international collaboration & knowledge transfer support:* Barriers to involving international expertise, lack of institutional continuity.
- *Regulatory uncertainty or excess regulation:* Unclear, slow, or overly complex regulations (e.g., FINMA, product classifications) and federal structure slow innovation.

- *Other structural or systemic barriers:* cultural factors limiting scaling, limited ETH spin-off visibility, high wage costs pushing work abroad, spatial planning delays.

Even though the interview partners pointed to these issues which were often operational, many participants are satisfied with the existing innovation support policies and instruments. In addition, they made policy suggestions in the interviews, which will be incorporated into the second Delphi round (see next chapter). The aim is then to reach a consensus among the experts on effective policy measures.

4.2 Delphi round 2

The second Delphi round focused on identifying specific policy measures and cross-sector priorities for strengthening Switzerland's innovative capacity. The resulting measures reflect a consensus among experts from various industries on five key directions for future innovation policy: strengthening cooperation and partnerships, improving innovation financing, more innovation-friendly regulation, increasing data openness and data exchange, and investing in talent and education. Across all sectors, participants emphasized the need for more flexible public instruments, better coordination between stakeholders, and stronger international coordination. Although there is a certain consensus on the broad direction of the measures, the specific proposals vary greatly. There is therefore no complete consensus on individual measures.

Strengthen collaboration and partnerships. Interviewees emphasized the need for stronger national platforms to foster cooperation between companies, academia, and public institutions. They suggested developing one-stop matchmaking, offering standardized IP templates, and organizing sectoral roundtables to align innovation support (including regulation) with business needs. Enhanced support for international B2B collaborations was seen as key to address important issues in innovation projects. Many also suggested that Innosuisse projects should be more business-driven, ensuring its programs better reflect the practical needs of Swiss firms across sectors. In addition, the evaluation process should be made more transparent.

Strengthen innovation financing. Participants highlighted several ways to improve innovation financing. Tax incentives for risky investments, modelled after the UK's venture capital relief schemes, could help attract more private funding. CAPEX models like in Portugal as well as ARPA-like funds, and the extension of Art. 15 Research and Innovation Promotion Act (RIPA) organizations. Other ideas included using SNB reserves for innovation support, creating secondary markets for scale financing (e.g. trading platforms, digital shares), and setting up public/private fund-matching instruments. Interviewees also called for simplifying and speeding up public innovation funding procedures by, e.g., introducing a two-stage applications process, improving technological expertise (especially at Innosuisse), providing better feedback, focusing more on commercialization, and harmonizing funding procedures regionally (e.g. DACH) and with EU platforms.

Make regulation more innovation friendly. To make regulation more innovation friendly, stakeholders proposed the use of sandboxes and test environments with clear exit strategies. These should include defined scopes, safeguards, and timelines, and foster an acceptance of failure. Conditional market access and fast tracks for clinical testing and emerging technologies following the models in Australia, New Zealand, and Canada were also mentioned. International alignment and mutual recognition were seen as essential to ensure market access and to avoid redundant "Swiss finish" regulations. This includes accepting US Federal Drug Administration (FDA) approved devices without duplication. Finally, interviewees emphasized the need for more transparency and consultation in regulatory processes, providing innovation mandates (e.g. State Secretariat for International Finance SIF), consulting SMEs, improving transparency in standardization, speeding up drug reimbursement, continuously updating financial strategy, and creating centralized information hubs via industry associations.

Increase data openness and sharing. A national data strategy and greater interoperability were viewed as central to supporting innovation activities. The experts recommended a centralized strategy following the PSD2/3 model, uniform data access across cantonal borders, and interoperable software systems. Data standardization and anonymized electronic patient files for research were also highlighted as important. Developing data-related skills was also seen as important. Clarifying data ownership would improve sovereignty and trust. Secure e-ID solutions should be promoted. To foster data exchange, cost-sharing incentives for data sharing and the development of digital ecosystems were proposed in order to allow for spillovers (e.g., Google Zurich) and reducing prohibitive costs from private data providers such as Bloomberg.

Strengthen talent development, skills, and education. Interviewees pointed out the need for faster immigration procedures for non-EU talents and simpler recruitment processes, particularly for individuals with special skills. Improving education and training was a recurring theme. Reference was made to the need to harmonize high school curricula, strengthen the foundations of higher education, train skilled workers for data-driven innovation, and introduce programming classes in schools. The dual education system, and internships should be further supported. Retaining and better deploying graduates and senior experts was also seen as important, for instance by encouraging STEM graduates to stay and work in Switzerland, offering flexible retirement options, and communicating the sector's environmental contributions to attract talent. Finally, making further education more attractive, through over-proportional tax deductions for continuous learning, was recommended.

5 Policy implications

This section gives first an overview of the reasons for innovation policy as they are discussed in the literature (5.1), summarises the Swiss innovation policy paradigm (5.2) and then goes on to discuss the approach takes in this study to develop policy recommendations before presenting nine different recommendations in the areas of funding, regulation, collaboration and skills (5.3).

5.1 Innovation policy: scope and framework

Innovation can be expensive and require high investments, e.g. for R&D, and at the beginning of an innovation project (and often even in later stages) the uncertainty about its success is high and its positive future impact on corporate performance is not guaranteed. Assuming high cost and high uncertainty, a logical consequence is that firms under-invest in innovation activities and do not allocate an adequate amount of their resources to them. Innovation policy can attempt to bear some of the R&D investment risk, thereby encouraging companies to engage in more internal innovation, or it can support links with universities and non-university research and development institutions. As these are outside the private sector and part of the education and science systems, they are subject to different organizational and governance logics, which can lead to coordination problems that limit collaboration and the transfer of knowledge and technology for innovation.

R&D not only generates results that can be used for innovative products or processes, but the concept of "absorptive capacity" adds that companies that engage in R&D are also better able to absorb and utilise external knowledge (Cohen & Levinthal, 1990). Conducting R&D is therefore not only one path to developing the foundations of innovations, it can also help with the identification and integration of external knowledge leading to further innovation and learning. Expenditures for R&D activities have therefore been a key metric to assess and judge firms' innovation efforts for many years. From the Swiss innovation surveys, we know that only approximately 40% of the product and process innovators conduct R&D and 60% do not, and the importance of the latter group has rather grown in recent years (Spescha & Wörter, 2022).

Still, other activities, such as engineering, design, marketing, employee training, or software development, have also been suggested as relevant for generating innovations (OECD & Eurostat, 2018). In some sectors, such as construction, retail and generally services, it might be as common to generate innovation through learning-by-doing, learning-by-using, and learning-by-interacting (Jensen et al., 2007). There are great variations in innovation procedures and performances across firm types and across sectors. These variations and the challenges that firms encounter in innovation activities have increased in recent years, as the target vector of innovation policy has changed (Schot & Steinmueller, 2018): beyond economic growth and corporate competitiveness, further objectives have emerged in innovation policy, which include the transformation and further development of economic systems in the direction of sustainability, conservation of natural resources, establishment of circular processes, etc. (Schot & Steinmueller, 2018; Weber & Rohracher, 2012). The even more recent spread of artificial intelligence as part of the digital transformation of modern societies has raised additional concerns about the social impact of digitalisation and technological innovation in general, and how they are changing the world of work and the social fabric.

This has triggered calls for innovation policy frameworks which are suited to the still diffuse nature of the grand challenges of the present day. These frameworks should draw on experimentation, competition and a diversity of solutions (Foray et al., 2012). Moreover, it has been suggested that they should identify and support activities that are suitable to transform sectors, secure specialized human capital, couple innovation and diffusion, understand clearly the failures that require policy attention and accept that policy experiments will be needed to find functioning solutions (Foray, 2019). All in all, this implies that there is no one single innovation policy fitting all situations and problems and that we are entering an era where the case for differentiated policies tackling different problems is strong.

5.2 Swiss innovation policy

The Swiss innovation system operates against a background of attractive conditions for innovation. These include a strong focus on technological and engineering skills at all educational levels (vocational, tertiary, continuous) and an excellent higher education system involving a good balance between fundamental and applied subjects in both research and teaching thanks to a high degree of institutional differentiation among higher education institutions (ETH domain, cantonal universities, universities of applied sciences). Moreover, the Swiss innovation system is supported by good technical infrastructure, competitive factor markets, low corporate tax rates, stable macroeconomic conditions, a stable political system and access to international factor and sales markets. These elements create a favourable environment for companies to innovate. Rather than actively directing or subsidizing companies' innovation efforts, the Swiss system promotes a bottom-up approach in which companies and universities take the lead in developing and pursuing innovative ideas. This autonomy is a key feature of the Swiss model, enabling flexibility and initiative within a stable and supportive framework. While upholding the favourable conditions for innovation, Switzerland also takes specific measures to actively promote innovation at federal and cantonal levels and it participates in international innovation support programmes.

At the federal level, the Swiss National Science Foundation (SNSF) plays a central role in funding basic research projects of higher education and research institutions and through setting up targeted programmes such as the National Centres of Competence in Research (NCCR) and the National Research Programmes (NRP). In parallel, Innosuisse, the national innovation agency, focuses on bridging the gap between science and industry, in particular by supporting knowledge and technology transfer (KTT) between public research institutions and private companies. The key instrument of Innosuisse aims at supporting partnerships by subsidizing the academic partner while the industrial partner is providing matching funds. Innosuisse also offers further support services such as start-up coaching and entrepreneurship training, networking opportunities and direct start-up financing. Finally, Innosuisse is offering opportunities for building consortia of firms and academic partners to address a societal or technological challenge (Flagship Initiative) or to support an open network to co-create radical ideas in a certain industry or technological area (Innovation Booster).

The strong focus on fundamental research, the restriction of most funding to university research institutions and non-commercial research centres, and the fact that SNSF funding is more than four times higher than Innosuisse funding clearly show the Swiss science-driven innovation policy paradigm. Other federal innovation policy instruments also foster science-industry collaboration and technological development, such as the Article 15 (RIPA) institutions (e.g., CSEM and Inspire), and the promotion of innovation parks.

At the cantonal level, the promotion of innovation continues through tailor-made measures such as tax super-deductions for R&D and patent boxes. These instruments help to reduce the financial burden on R&D-active companies and promote the formation of regional clusters and start-up ecosystems. In addition, several cantons have set up innovation promotion programmes, which are often modelled on the Innosuisse scheme for cooperative (research and practice partners) technology development.

At the international level, Switzerland actively participates in European research and innovation programmes, such as the European Framework Programmes (e.g. Horizon 2020, Horizon Europe), Eurostars and the European Space Agency initiatives. These programmes provide research institutions and (in some programmes and funding lines) Swiss companies with access to funding and opportunities for cross-border cooperation.

The new developments observed in the responses to the sector-specific survey conducted for this study pose new challenges for this system of public support for innovation, which has emerged since the 1950s and has been successful for many decades.

5.3 Innovation policy implications

The information and data generated by the survey and the 2-rounds Delphi process combined with the authors' own expertise and the discussions with the support group and the concerned industry associations has given rise to a large number of ideas dealing with policy recommendations. To put some order in this large set of ideas, we used some organization principles allowing us to characterize each recommendation according to a specific intervention mechanism (regulation, funding, collaboration, skills) and to a particular policy aim (to support radical, digital or sustainable innovations or to achieve operational improvements in a more general sense – called enabling innovations).

Intervention mechanisms: Policymakers can support companies by adjusting laws and ordinances and removing obstacles and disincentives to innovation *(intervention mechanism regulation)*. In addition, innovation policy can provide direct funding to R&D in the form of subsidies, venture capital or similar, and indirect funding, for instance by means of tax reliefs *(intervention mechanism funding).* Another type of intervention that can be separated from the other two is the provision of (public) organisations which have equipment and competencies that can be used in innovation projects. It is commonly not enough to only set up such public research infrastructure, but information on the organisations and their competencies as well as activities related to networking and matchmaking helping to set up collaborative projects and partnerships are needed as well. This is discussed here under the *intervention mechanism collaboration*. Last but not least, policy interventions can also relate to knowledge and skills that innovation actors need *(intervention mechanism skills).*

Policy aims: we distinguish four different policy aims which relate to the characteristics of the Swiss innovation system that should be strengthened:

- *To support radical innovation* – the innovation system is better capable of generating fundamentally new products (goods and services) and processes that are superior to current offerings and technologies and may even disrupt them and define new markets. They advance structural change in the Swiss economy in line with global megatrends.
- *To support digital innovation* – the innovation system contributes to digital transformation and the spread of cross-cutting digital technologies, which are increasingly expected by consumers and customers in product offers and which are often able to optimise processes and reduce costs.
- *To support sustainable innovations* – the innovation system promotes a reduction in resource consumption, enables forms of circular economy, and increases the environmental and social compatibility of economic activity.
  Note that sustainability innovations were **not** the most pressing issue in our survey and interviews. Nevertheless, given a growing world population and finite global resources, we believe that there is no viable alternative to the sustainability transformation of economies, and periods of lower public acceptance of environmental sustainability will be followed by periods of intensive change, for example in the wake of climate-related catastrophes. The Swiss economy would do well to position itself as a first mover in this area with its advanced technological capabilities and comparatively good resource endowment.
- *To enable all kind of innovations,* the innovation system enhances capacities to adjust to new developments and enables incremental changes. These can be drivers of product and process improvements, generating productivity increases and securing competitiveness.

Combining these four intervention mechanisms (dealing with regulation, funding, collaboration and skills) with the four policy aims (making the innovation system more radical, digital, sustainable and enabling) produces a 4x4 matrix which is presented in Table 9. Each "idea" is, thus, identified as part of a certain group of recommendations.

However, not all of them are equally well suited to address the decrease of innovating companies, they are not all related to a clear inhibitor of innovation and they are not all fitting well Swiss conditions and Swiss policy mindset and paradigm. Based on these selection criteria (focus, relevance, feasibility), we have deliberately discarded some recommendations, in spite of the fact that they appeared as quite relevant at first glance, but eventually did not pass our selection test:

- An example of a non-selected recommendation is the implementation of a two-step application process for Innosuisse projects with structured feedback on the first step in order to shorten the process and to help firms to rapidly adjust their proposals in case of first step rejection. However, after some discussions with Innosuisse, it seems that such a two-steps logic would not shorten the process. In fact, legal provisions make that even a first step proposal would require a full set of expertise and examination. Thus, there is no such thing as immediate desk rejection (as in the academic publication process). Secondly, the Innosuisse mechanism of innovation mentoring which is provided to support companies in writing proposals and give some informal guidelines and advice represents a strong substitute. As a consequence, and even if several firms made this point, this recommendation was discarded.
- Another example is the recommendation for setting up a Swiss National Bank (SNB) fund. i.e. SNB capital being withdrawn from alternative forms of investment abroad in order to allocate it to a VC fund targeting Swiss start-ups. However, such an SNB fund seems not to be feasible within the current institutional and regulatory framework of the country. The implementation of such a proposal not only conflicts with the independence of the SNB, but also significantly restricts the National Bank's monetary policy options and therefore was not discussed further in this report.

Table 9: Mapping of policy suggestions on intervention mechanisms and policy aims

Policy aim Mechanisms	Radical (new to the market)	Digital	Sustainable	Enabling, capacity-enhancing for all innovation types
Regulation	1 Regulatory sandboxes	1 Regulatory sandboxes 8 National data strategy (ownership, sovereignty, protection)	1 Regulatory sandboxes	2 Harmonisation of regulations
Funding	3 Mobilising start-up funding	8 National data strategy (adoption support)	4 Targeted support for transformative and sustainable innovation	5 Innosuisse operational improvements (feedback, templates, coaching, monitoring, internat. scope, B2B collaboration)
Collaboration	6 Matchmaking platforms 7 Art. 15 RIPA extension	8 National data strategy (sharing)	6 Matchmaking platforms	6 Matchmaking platforms 7 Art. 15 RIPA extension
Skills		8 National data strategy (digital/data skills)		9 Fast-track work permits

Note: Appendix 10 contains the full set of policy suggestions.

Applying the three selection criteria of focus, relevance and feasibility leads to nine selected and prioritized instruments which are presented in Table 9 – using the 4x4 matrix as explained above. Of course, not all of the instruments proposed here are equally relevant and effective in all sectors; their impact varies from sector to sector. For example, regulatory interventions are particularly effective in sectors whose innovation activities are strongly influenced by regulations, such as pharmaceuticals, medtech and finance, according to our analysis. However, it is not possible to assess the effects in advance and at this general level; more precise information on the design of the instruments is required.

1. Sector-specific regulatory sandboxes for innovation

While the origin of regulatory sandbox can be traced back to the financial sector in the UK (Financial Conduct Authority, 2015), the sandbox principles have become more and more popular both internationally and across sectors (OECD, 2025). Regulatory sandbox is about setting controlled environments within which innovators and start-ups can test new products, services or business models, without adhering to all the regulatory requirements. Different forms were distinguished in a 2022 study for seco: pilot projects, sandboxes in a narrow sense, and risk-based regulation (Schneider et al., 2022). "Innovations hubs" were added as a fourth instrument which could be enough to meet the demand for better information exchange between the regulator and companies and avoid possible trade-offs, such as picking winners (by selecting sandbox projects) and regulatory capture.

The ultimate goal being striking a better balance between supporting innovation and safeguarding consumers. The usual eligibility criteria for benefiting from a sandbox mechanism include the radical nature of the innovation, the potential benefits for consumers and the readiness of the innovation for proceeding to testing and experimentations in the "real" world. The standard process involves a testing phase including real consumers under regulatory oversight, monitoring and reporting as well as an exit strategy (transiting towards full market launch or ceasing the activity).

Under different expressions, firms from various sectors which were interviewed in this project were arguing for the development of a sandbox offer within the framework of an improved dialog between the sector-specific regulatory bodies and the industry.

Finally, while the principle of providing a safe space for experimentation is generic, the design and implementation of the principle is certainly sector specific – implying high-level collaborations between regulatory bodies and associations within each concerned industry.

2. Harmonisation of regulations

Regulations become a particular problem when the same issues are regulated differently, for example within Switzerland at cantonal level or in international comparisons in Europe or on non-European markets. Several companies pointed to differences of cantonal regulations which create additional costs; in the health sector, for example, with regard to ethical approvals of clinical trials or collaboration with hospitals; in the fintech sector, for example, with regard to digital land registers and processes for the notarisation of property transactions.

Simplifying regulations can have an immediate impact on the speed and costs of innovation and times-to-market. However, harmonisation requires coordination and cooperation with sectoral policies (to adjust sectoral laws and ordinances), across different government levels, with cantons and eventually even municipalities in the federal system, and at international level with foreign regulators.

One possibility could be to give a mandate to the SECO Regulatory Impact Assessment unit to review, e.g. upon request from industry, Swiss regulations. It could evaluate differences of cantonal regulations and suggest possibilities for harmonisation to the responsible cantonal regulators. Another task for regulatory impact assessment could be a sustainability review, in which regulations are examined for their consistency in influencing sustainability innovations. For example, in regulations for medical technology, environmental sustainability is implicitly rated lower than social sustainability, as single-use products are prescribed to prevent infections from contaminated medical devices or remedies. In such cases, it would make sense to weigh up the economic, social and environmental costs and to design regulations in an open manner so that companies can seek solutions that equally encompass social, environmental and economic sustainability.

Above all in industries that mainly rely on export markets, aligning Swiss regulations internationally and/or accepting foreign regulations for the Swiss market would help to improve export market access. However, it would also reduce eventual barriers to market entry in Switzerland for foreign companies. Hence, such a measure needs to draw on a close analysis for which markets a harmonization would be desirable. The timing and duration of harmonisation and approval of a (foreign) regulation is important, as any legal uncertainty has a negative impact on the planning of investments and innovation projects. Companies therefore also requested more flexible, fast-tracked procedures for the regulatory approval of innovations, based on a risk-based approach in cooperation with foreign/international regulatory agencies.

3. Mobilising start-up funding

Start-ups are often founded to commercialize more radical innovations. Good growth conditions for these companies are important for the competitiveness of an economy. In particular, financing conditions and the availability of venture capital were still identified in the interviews as bottlenecks. Three concrete proposals emerged as possible remedies:

1) Public-private innovation fund,
2) Tax relief for private investments in start-up companies,
3) Fund matching instrument

Ad 1) Public-private innovation fund. The Ordinance on Occupational Retirement, Survivors' and Disability Pension Plans (*Verordnung über die berufliche Alters-, Hinterlassenen- und Invalidenvorsorge, BVV 2*, https://www.fedlex.admin.ch/eli/cc/1984/543_543_543/de) allows Swiss pension funds to invest up to 15% of their assets in alternative investments such as private equity. According to the Swisscanto pension fund study, private equity accounted for only 1.5% of the investments of the pension funds surveyed in 2024 (Swisscanto, 2025, p. 41). While on the one hand, it has been found that a higher proportion of alternative investments such as private equity, hedge funds and infrastructure contributes to higher expected returns among Swiss pension funds, a strong focus on the Swiss home market works in the opposite direction (Asset Management Association Switzerland & WTW, 2025). This implies that the use of pension fund assets to finance Swiss start-ups is only partially in line with the goal of increasing the expected returns of pension funds. Further analysis is needed to understand better the causes of this contradiction and how it can be resolved in order to achieve greater involvement of pension funds in Swiss start-up financing. The establishment of a Swiss innovation fund with the possibility of participation by private investors, which has already been scientifically examined (Braun-Dubler et al., 2022; Trinkner et al., 2022), politically discussed and rejected primarily for budgetary reasons in the past (see the Postulate 23.3845 Schaffung eines Innovationsfonds), could be one way of mobilising additional private funding for start-ups alongside public funds.

Ad 2) Tax relief for private investments in start-up companies. Secondly, the introduction of a more comprehensive tax deduction for investments in start-up companies was suggested referring to a similar scheme in the UK (see Box 1). Such a scheme could mobilise additional capital for radical innovation.

Box 1: Tax reliefs for investors in the UK
(https://www.gov.uk/guidance/venture-capital-schemes-tax-relief-for-investors)
Two related schemes, the Enterprise Investment Scheme (EIS) and the Seed Enterprise Investment Scheme (SEIS) currently support private investments in companies that are not listed on any recognised stock exchange. The investment can be made directly or through a venture capital trust (VCT) that invests in, or lends money to, unlisted companies. A third scheme, the Social Investment Tax Relief, was paused in 2023. Investors and companies need to meet certain criteria for eligibility.
Depending on the scheme, investors may be able to claim:

- Income Tax relief against the investment in qualifying companies, enterprises or venture capital trusts,
- Income Tax relief against a loan or 'debt instrument' to a social enterprise,
- Capital Gains Tax relief on any gains made on the investment and re-investment of previous gains; moreover, capital losses can be set against the income (loss relief).

In the SEIS, private investors can claim up to £200,000 of investment of which 50% can be claimed against the income tax when the investment is made and against Capital Gains Tax when it is sold (earliest after 3 years). The company that qualifies for the investment has to be less than 2 years old, having max. £350,000 in gross assets, less than 25 employees and not previously carried out a different trade (https://www.gov.uk/guidance/venture-capital-schemes-raise-money-by-offering-tax-reliefs-to-investors). The capital raised by the issuing of new shares must be used for R&D, other activities that prepare a qualifying trade, and conducting the qualifying trade. Companies with more than 20% in certain trades are excluded, such as coal or steel production, farming, banking, insurance, debt or financing services, running a hotel etc. The maximum amount a company can raise through SEIS in its lifetime is £250,000 (higher limits if the company carries out R&D or innovation and meets certain conditions).

Ad 3) Fund-matching instrument. Another suggestion is connected to the difficulties that start-up companies encounter with regard to funding fundamental research after founding the company, if such fundamental research is still needed. Start-ups are not eligible for SNSF research funding and Innosuisse project funding does not cover fundamental research but is directed at applied R&D and development at higher Technology Readiness Levels (TRLs). A fund-matching instrument could be a solution which lets companies apply for matching public funds if private funding can be acquired.

4. Targeted support for transformative and sustainable innovation

In order to overcome the difficulties with regard to introducing transformative and sustainable innovations we consider two possible mechanisms:

1) Subsidies for corporate sustainability R&D
2) High-risk, high-reward instrument for transformative innovation

Ad 1) *Subsidies for corporate sustainability R&D.* Direct R&D subsidies are a controversial instrument – raising problems in terms of the efficiency of resource allocation. It is in particular difficult to avoid funding projects which would be funded in any case by firms and in such cases the public subsidies do not create any additionality; this is just a transfer of costs from the private to the public sector (deadweight loss).

This is why our suggestion is about using this instrument for one topic only – which is sustainability. We propose thus to test and implement the idea of direct R&D subsidies targeted at sustainable innovations. Our empirical observations (survey and Delphi) show a deficit of radical innovations in the area of sustainable processes, products and business models. There might be several reasons for this deficit which are studied in the literature. Beyond classical market failures, one specific reason for a deficit in sustainable innovation is path-dependency: firms with a history of non-sustainable innovation in the past are more likely to focus on non-sustainable innovations in the future because past investments were accumulated on non-sustainable physical capital and innovation – creating a productivity advantage for non-sustainable production systems versus sustainable ones (which did not benefit from such investments in the past) (Aghion et al., 2016). And since the stock of non-sustainable systems and innovations is greater than the stock of sustainable systems, the path-dependency effect will tend to lock the Swiss economy into a non-sustainable trajectory of industrial innovations, even after the introduction of a carbon tax. So, this makes the case for stronger action now, which could be relaxed in the future as the economy's stock of innovation shifts in a more sustainable direction.

We should take this suggestion as an exceptional treatment for this innovation target. The design and implementation of the instrument remains complex and deserves further analysis and a pilot test. Though studies on the effectiveness of direct R&D grants yield mixed results, they appear to be effective at least in the short term (Bloom et al., 2019). First, the deadweight issue is still there but perhaps mitigated since sustainable innovations are rarely profitable in the short-medium term so that without a subsidy no radical sustainable innovation project would be ever undertaken. Second, departing from technology-neutrality – the instrument is targeted towards a specific topic like "green R&D" – makes the phases of implementation, administration and monitoring of the instrument more complex and costly (than in the case of a neutral instrument which does not predetermine any preferential areas).

Ad 2) *High-risk, high-reward instrument for transformative innovation.* A targeted HRHR (high risk and high reward, see OECD, 2021 and Box 2) instrument could promote transformative innovation. Sustainable innovations often require breakthroughs that deviate from established technological development paths, which are associated with considerable technological, market-related, and regulatory uncertainties. These uncertainties are related to the path dependency of technological developments, whereby companies prioritize incremental improvements within known technologies over riskier alternatives requiring entirely new technologies. HRHR programmes, by their very design, encourage precisely this type of exploratory, uncertain and potentially transformative project. They give companies the institutional "permission" and financial scope to experiment beyond the prevailing paradigm, thereby reducing the risk aversion that currently hinders more radical forms of sustainable innovation. Moreover, a sustainability-focused HRHR programme could complement more conventional innovation-promoting instruments in Switzerland. While the existing instruments effectively support incremental research and development, the exploration of novel scientific approaches or disruptive clean technologies that could transform the technological basis is not supported enough.[7] An HRHR programme would enable a portfolio of ambitious projects with high levels of uncertainty that, if successful, could generate significant social and environmental benefits. As a pilot project within the sustainability agenda, such a programme could provide valuable insights into the workings of HRHR financing in a Swiss context while directly contributing to the transition to a more sustainable innovation path.

However, for an HRHR instrument to be successful, a number of aspects would need to be taken into account in its design and implementation:

1) The funding through an HRHR instrument would require significant adjustments to funders' current project evaluation and governance practices. Traditional peer review procedures tend to favour proposals with a clear methodological basis, proven feasibility and predictable results. Such criteria systematically disadvantage (HRHR) projects with a high degree of uncertainty and radical novelty. To ensure that truly transformative sustainable projects are not rejected prematurely, changes in the evaluation system would be required (see OECD, 2021, Goldstein & Kearney, 2024).
2) Next, Swiss research funding separates the promotion of basic scientific research by the SNSF from the promotion of applied R&D and innovation by Innosuisse, and both largely exclude companies from receiving public funding. Within the framework of an HRHR instrument for promoting transformative innovations, these provisions would need to be reconsidered if the two agencies were involved in implementing the instrument. Ways would have to be found to support science and business in working together on the fundamentals and on application-oriented R&D.

[7] Existing instruments, like Start-up Innovation Projects (Innosuisse), Spark (SNSF), and Bridge Proof of Concept (SNSF & Innosuisse) show some HRHR characteristics, but fund small projects. The Innosuisse Flagship Initiative and Bridge Discovery fund larger projects but not research and technology development in companies.

3) At the same time, such an instrument should be based on a portfolio-based strategy to manage the higher financial risk associated with HRHR funding (OECD, 2021). The underlying logic is that although many individual projects may fail, the societal value of the few successful breakthroughs would far outweigh the costs. Moreover, there is considerable uncertainty surrounding viable solutions to many current sustainability issues and societal challenges; the solutions are likely to emerge only through competition between different technologies (Foray, Mowery & Nelson, 2012). Implementing a diversified HRHR project portfolio requires significant and stable financial commitments – "deep pockets" – that go beyond the scope of traditional project financing.
4) Switzerland's structural characteristics pose additional challenges to the effective implementation of HRHR funding. As a small country with a limited domestic market, it is more difficult to exploit or scale radically new technologies at the national level alone, which can reduce the incentives for the private sector to engage in high-risk innovation without strong public support. Consequently, a cross-border cooperative approach may be useful, for example in the European Research Area, within which programme objectives and measures are coordinated.
5) Furthermore, HRHR programmes require long-term commitment: transformative research initiatives might last for decades, and incentives within science policy, evaluation systems and academic career structures (e.g. tenure, promotion and performance indicators) currently favour short-term results and low-risk excellence. For an HRHR programme to be successful, it would therefore need to be accompanied by complementary reforms that reward risk-taking, tolerate failure and support a sustained commitment to long-term transformative goals in both the academic research system and industrial research and development.

Box 2: High-risk, high-reward funding, for instance DARPA

In the recent past, there has been intense debate under the heading "high-risk, high-reward funding" on initiating risky technology research and development projects. The OECD (2021) describes a diverse set of HRHR programmes. They can focus on individual scientists and their breakthrough ideas or on larger, possibly interdisciplinary and/or cross-sectoral (academia and industry) research groups, cover long or rather short, "seed" funding periods, be characterised by active or laissez-faire programme management, use different types of peer review for project selection or dispense with it altogether.

The ARPA-family programmes – covering the US Defense Advanced Research Projects Agency DARPA and ARPA-E – and the conditions for generating them are probably best documented. The ARPA model has two essential features: first, the source of idea generation comes from the top (mission-inspired solicitation) and second, the control for project execution is done by an empowered programme staff (Goldstein and Kearney, 2024) – giving little freedom to the research teams in both idea generation and programme execution. ARPA puts, thus, emphasis on command-and-control mechanisms. It is quite demanding because empowered and proactive programme managers are deeply involved in the design and the execution of any ARPA programme which is targeted towards very specific and precisely defined goals. In this sense, this approach fits well the goals of developing, for instance, a specific technology or solving a specific problem.

Insights from the US experiences show that such a top down and centralized mechanism can be very effective in boosting some technological domains and achieving specific innovation targets, if properly designed. This is the story of the US ARPA model and its featuring principles such as general organizational flexibility, discretion in project selection and active project management – all these features relying on highly talented, independent and empowered programme staff. As analysed in Azoulay et al. (2018), the ARPA model showed that:

- it is possible to organize efficiently research & innovation *around a technology related mission or set of overarching goals;*
- it proved to be particularly optimal for *areas with relatively unexplored technologies with great potential for improvement*.

Predominantly qualitative analyses of ARPA-family funding have found a few positive effects: first, novel and unusual collaborations and interdisciplinarity are promoted by DARPA, thereby increasing "collaborator novelty" (Colatat, 2015). Second, the selected controversial and risky projects tend to receive mixed reviews in peer reviews but later perform no worse in short- to medium-term output metrics (e.g. publications) (Goldstein & Kearney, 2024). The ARPA approach increases the transfer and commercialisation opportunities for research, e.g. in terms of start-up activity, follow-on venture financing or targeted tech transfer measures (*An Assessment of ARPA-E*, 2017). Specific management practices (e.g. active programme management by technically skilled programme managers, ongoing milestone monitoring, rapid course corrections) are identified as reasons for the

effectiveness of ARPA funding (Azoulay et al., 2019).
A typical ARPA process involves the following stages: the ARPA board selects a broad thematic area and hires a high standing programme manager from academia, industry or elsewhere in government for a period of 3 to 5 years. The programme manager has about 1-2 years to identify the specific target, design the programme and build a network of partners. Then the programme is pitched to ARPA leadership and, if successful, several projects are launched. The execution is closely monitored and decisions about funding increases or cuts within the remaining period are made.
Policy makers willing to implement an ARPA scheme need to understand well three points:

- First, the ARPA scheme is not about enhancing innovation capacities of companies. It is rather about targeting scientific or technological solutions of wide relevance for industry or society and selecting a group of academic and industry partners whose contribution to problem solution will be tightly monitored and controlled.
- Second, a true ARPA scheme obviously entails some directional adjustment costs (the cost for a scientist to adjust her research agenda to fit a very specific mission), generated by a significant decrease of freedom to experiment and decentralized initiatives.
- Third, empowered staff and programme managers of high standing and reputation are a boundary condition. A culture of *va et vient* between the public and the private sector for high-calibre scientists and managers is a requirement. Some wage flexibility within the public administration is also key to propose attractive packages to top managers or scientists (coming from private companies or top universities) for a 3 to 5 years temporary position in the public sector to manage an ARPA programme.

5. Innosuisse: Operational improvements

Almost 10% of the responding companies in the survey have received support from Innosuisse for their innovation activities and four out of five agreed to the statement that the support has enabled them to take on projects with high technological risks and uncertainties. Two thirds agreed that the support contributed to the success of their R&D activities. Many firms also expressed their satisfaction with Innosuisse support in the interviews. Last but not least, a recent study based on the Swiss Innovation Surveys concluded that companies funded by Innosuisse increased sales by 21% and employees by 18% more than comparable companies that did not receive funding (Hulfeld et al., 2024).

Still, the list of suggestions to Innosuisse and its implementation of federal innovation support measures made in different phases of this analysis is long. They should be evaluated closely by Innosuisse before making decisions about changes.

We order them from most general or generic suggestions to more technical and specific ones:

1. First things first, there is certainly an information problem to address: too many companies – as commenting on their relationships with Innosuisse – were wishing for a particular service (e.g. mentoring) or a particular instrument (e.g. to support industry specific networks to exchange ideas), but these services or instruments are already in the Innosuisse portfolio of activities. In the second case this is the Innovation Booster. This problem is not going to be solved by Innosuisse only because this is a system failure and, for example, industry associations should be more proactive in teaching their members about Innosuisse opportunities and a 24x7 (electronic) information source enables immediate answers (see below and Box 3).
2. There is a *price* to pay for subsidising the academic partner only while the company has to provide matching funds. In some cases, misalignment happens, the academic partner does not deliver what was expected by the implementation partner – leading to poor results and effects. The *price* is putting in place stronger monitoring and oversight by Innosuisse to ensure that goals and approaches are still aligned as the project evolves. More intensive monitoring could go along with more flexibility in the conduct of the project as technological and market conditions change.
3. Guidance on contracts or contract parts (e.g. IP clauses) would facilitate the administrative set-up of projects, above all for newcomers and micro-enterprises which often

saw themselves at a disadvantage compared to academic institutions or larger companies.

4. The restrictions on the international research and implementation partners in national innovation projects should be relaxed and, for instance, the need of particular competences for project success or the generation of value for the Swiss innovation system could be sufficient for permitting foreign partners.
5. The scope of funded activities and phases in the innovation process could be broadened, including, for instance, launch of product innovations on international markets respectively the necessary market research.
6. A more elaborate and (technically) competent feedback on the rejected applications by Innosuisse should support revisions of applications and improvements for re-submissions.
7. Finally, the recent implementation of a call designed specifically for SME projects might be repeated and extended. According to this scheme, Innosuisse reduces or removes the requirement of matching funds which is the price the firm needs to pay for engaging into a partnership with an academic team. The call was successful in terms of number of applications within a short time period. Such an approach of supporting innovations that draw on R&D is not about providing direct subsidies, but more about waving the corporate cash contribution of firms in collaborative Innosuisse projects under certain conditions, e.g., for micro-enterprises and small companies.

6. Matchmaking: Current Research Information Systems (CRIS) and collaboration brokers

During the discussions with companies, it became clear in several respects that many of them have insufficient information: on the one hand, companies themselves pointed out gaps in their knowledge, while on the other hand, measures were proposed during the discussions that are already implemented in the existing funding and innovation promotion instruments. These gaps in knowledge relate to a number of issues:

- the expertise and services offered by universities, research institutions and technology competence centres,
- support measures provided by Swiss and international innovation and economic policy,
- existing regulations and those currently being developed.

Many countries have set up Current Research Information Systems (CRIS) (see examples in Box 3). CRIS can improve the information on researchers and research organisations and help them to set up collaborative research, facilitate the communication with the users of research results and stimulate knowledge and technology transfer and innovation, provide information on research performance more efficiently and effectively and contribute to more informed research policies, reduce the administrative burden on researchers (e.g., with regard to funding applications) by maximally reusing the information kept (Vancauwenbergh et al., 2016).

Box 3: Examples for Current Research Information Systems (CRIS)
1. The Flanders Research Information Space (FRIS) aggregates research data, publications, projects and expertise from all Flemish universities and public research institutes (https://researchportal.be/en). It is considered to be an effective tool to provide information for research and knowledge transfer (Vancauwenbergh et al., 2016).

2. CRIStin (https://www.cristin.no/english/), the Current Research Information System in Norway, was set up in 2004, by extending the research documentation system of the University of Oslo to three other Norwegian universities (https://en.wikipedia.org/wiki/CRIStin). In 2010, the system was transferred to the government and became a national research documentation system. CRIStin is currently being integrated into the Norwegian Research Information Repository (Nasjonalt vitenarkiv NVA, https://nva.sikt.no/). The NVA today gives access to more than 37'000 research projects, 2140'000 person profiles, and 2.4 million research results.
3. Research.fi (https://research.fi/en/) is the Finnish portal. It is offered by the Ministry of Education and Culture to collect and share information on research conducted in Finland and increase the visibility and societal impact of Finnish research. The service was launched in 2020 and is still under development. The portal automatically compiles information from the systems of universities, universities of applied sciences, research institutes, university hospitals, and research funders.
4. In the Netherlands, the NARCIS portal was taken offline and the NARCIS service ended in 2023. Research information from Dutch institutions can now be found via the Netherlands Research Portal (https://netherlands.openaire.eu/) which was initiated as a successor to NARCIS by the UKB, a joint venture of university libraries and the National Library of the Netherlands, the Dutch research network SURF and OpenAIRE. The portal collects data from 67 different sources.

The Swiss system is still rather fragmented with different portals provided by research funders, e.g. the SNSF data portal (https://data.snf.ch/), the ARAMIS portal for federal research and innovation projects (https://www.aramis.admin.ch/Projektsuche/), the SWISSUbase portal of several different universities and research organisations (https://www.swissubase.ch/) and individual universities' portals (e.g. the ETHZ Research Collection https://www.research-collection.ethz.ch/home). This fragmentation makes it extremely difficult, especially for companies, non-scientific institutions and newcomers to the Swiss research and innovation system, to gain an overview of skills, experience and research results. This situation should be remedied by creating a central platform that collects information and makes it available to the various stakeholders.

Insofar as innovation cooperation often cannot be based solely on written information, but rather requires the translation of practical problems into the language and specialist areas of science and synchronous communication between the parties involved, it would also be sensible and desirable to intensify existing activities in the areas of intermediation and project initiation. Multiple intermediaries exist at federal level (Innosuisse), cantonal and regional levels (e.g. Switzerland Innovation Parks, cantonal economic promotion offices), university level (technology transfer and innovation offices), private and mixed organisations (e.g. of industry associations and cluster organisations for specific sectors), and international level (Euresearch) for projects with foreign participation. These intermediaries organize multiple brokerage events, innovation workshops, industry days, Hackathons, conferences, or lab tours, which are also challenging to track and keep an eye on for companies and non-academics in general. For instance, through the Innosuisse Innovation Mentoring companies may obtain an initial assessment of a project idea and support in the initiation phase of an innovation project (https://www.innosuisse.admin.ch/en/innovation-mentoring). A different existing tool, the Innovation Boosters, convene researchers, companies and other stakeholder in a topic area to explore problems and develop and test new innovation ideas using the Design Thinking approach – in a recent evaluation the instrument was found to trigger radical innovation, support diverse networks, and help the participants to learn about innovation processes (Peter & Bernhard, 2025). Such activities are crucial for bringing people and organisations together and a functioning CRIS could become a platform for disseminating information about network events and opportunities for individual information and communication.

7. Article 15 RIPA extension

In the 2025-28 funding period SERI supports 35 research institutions of national importance according to Article 15 of the Federal Act on the Promotion of Research and Innovation (RIPA). These institutions are 16 research infrastructures, 9 research institutions, and 10 technology competence centers (https://www.sbfi.admin.ch/de/forschungseinrichtungen-vonnationaler-bedeutung). Among the 10 technology competence centers supported according to Art. 15c RIPA,[8] some are closely connected to higher education and research institutions and all provide specific expertise and infrastructure on which companies can draw with their innovation activities. In this respect, they represent an investment in the innovation infrastructure, and provide buildings, laboratories, facilities, equipment, and specialised hardware and software that can benefit companies in joint projects. Such benefits from facilities and equipment were also discussed with companies under the heading of CAPEX grants for R&D.

While some of these Art. 15c organisations have been set up within the last 6 years, e.g. within the Advanced Manufacturing Technology Transfer Centers (AM-TTC, https://www.am-ttc.ch/) initiative by the ETH Board,[9] others have a long history and many years of experience. The oldest technology competence center, the Swiss Center for Electronics and Microtechnology (*Centre suisse d'électronique et de microtechnique, CSEM,* https://www.csem.ch), was set up in 1984 in Neuchâtel. The 2023 impact analysis found that CSEM creates value for its customers, above all by means of industrial projects which serve to transfer knowledge and technology to companies (Rieder et al., 2023). Positive effects on the innovation outcome of companies have also been documented for inspire, another Art. 15c RIPA technology competence center (see Foray & Woerter, 2020). The Art. 15c organisations focus more on application-oriented research and are less academically oriented than universities and the ETH domain. Other than universities of applied sciences (UAS), they also cover lower TRLs and technology and process development. The positive impacts of the existing technology competence centers justify on the one hand the continuation of their funding. On the other hand, it should also be evaluated whether the instrument could be extended to other sectors. CSEM and inspire might serve as role models for new Art. 15c organisations and the AM-TTC initiative as an example how such an extension could be organised.

8. National data strategy

According to the experts, Switzerland continues to lag behind other advanced economies in several areas of digitalisation, partly because existing systems remain highly efficient. However, this functional appropriateness reduces the perceived urgency of digitalization and could, over time, weaken the international competitiveness of Swiss companies in more digitally advanced markets.

Sectoral data hubs for Innovation. To strengthen Switzerland's position in the global digital economy, a coherent national data strategy is needed. Such a strategy should address technical, legal, economic and social dimensions of data management and provision:

- *Technical*: Establish standards for data interoperability, anonymisation, and secure exchange to ensure compatibility and seamless data flows across sectors.
- *Legal*: Align data regulation with EU norms concerning data ownership, sovereignty, and protection, while maintaining high standards of privacy and trust.
- *Economic*: Create incentives for data sharing, as data collection and curation can be very costly for individual organisations. For example, anonymised electronic patient records or digital financial data would have high added value and drive research, development and testing of new digital (and analogue) products in these sectors.

[8] Analytics With Neutrons And X-Rays For Advanced Manufacturing (Anaxam), Campus Biotech Geneva Foundation (FCBG), Swiss Center for Technological Innovation (CSEM), Inspire AG (Inspire), Time Arts (MTTA), Rhine Valley Research and Innovation Center (RhySearch), Swiss Center of Manufacturing Technologies for Medical Applications (m4m), Swiss Cobotics Competence Center (S3C), Swiss Center for Design and Health (SCDH), & Swiss Photonics Integration Center (Swiss PIC).

[9] ANAXAM, m4m, S3C, and Swiss PIC are the four Art. 15c RIPA technology centers that belong to the AM-TTC.

- *Social*: Informing and educating the public about the responsible use and benefits of data, strengthening data literacy, reducing fears about data misuse.

A key institutional component of this strategy could be the establishment of sectoral data hubs in areas such as healthcare, finance, consumer markets, and energy and transport. These hubs would facilitate access to high-quality datasets for R&D, support regulatory compliance, and promote collaboration between public and private actors.

Strengthening digital capabilities and skills. A second pillar of the proposed strategy would address education and skills development across all levels of the education system. This initiative should:

- Integrate digital and data literacy into curricula from primary to tertiary education,
- Expand opportunities for continuous training, particularly for mid-career professionals, to maintain and further develop a digitally skilled workforce,
- Encourage special programmes on emerging digital technologies such as artificial intelligence (AI) to boost their adoption and application in practice.

To support these efforts, corporate tax incentives could be adjusted to treat the costs of further education and digital upskilling as eligible R&D expenditures, with the possibility of introducing super-deductions at the cantonal level. In order to alleviate the shortage of skilled workers, consideration could also be given to increasing incentives for graduates of selected STEM programmes to remain in Switzerland.

Data regulation for innovation. As the regulatory environment plays a critical role in fostering digital innovation, its adjustment and optimisation would be the third pillar of the strategy. Firms in the financial, ICT, and medical technology sectors have identified data protection as both a necessary safeguard and a key regulatory challenge. To balance protection with innovation, Switzerland could introduce regulatory sandboxes that permit controlled experimentation with new digital products and services under real-market conditions and with the consent of participating customers.

9. Fast-track procedure for work permits for highly qualified professionals

Finally, the availability of qualified personnel remains a central challenge. Switzerland's capacity for innovation depends on timely access to international talent. The lengthy and complex procedures for granting work permits to non-EU citizens make it difficult to recruit highly qualified professionals, especially younger ones. The problem lies less in quota restrictions than in procedural delays and resource-intensive approval processes.

Introducing an accelerated procedure for work permits for certain highly qualified individuals would improve access to the Swiss labour market and strengthen the domestic talent pool. This measure would align with Postulate 25.4048, “Talentstrategie Schweiz – Momentum nutzen!”, which calls for a national talent strategy. International studies demonstrate that facilitating the immigration of skilled workers is positively related with innovation activities (Akcigit et al. 2017, Barabuffi et al. 2025). In fact, it is one of the most effective measures (Bloom et al., 2019).

References

Aghion, P., Dechezleprêtre, A., Hémous, D., Martin, R., & Van Reenen, J. (2016). Carbon Taxes, Path Dependency, and Directed Technical Change: Evidence from the Auto Industry. *Journal of Political Economy*, *124*(1), 1–51. https://doi.org/10.1086/684581

An Assessment of ARPA-E (with National Academies of Sciences, Engineering, and Medicine). (2017). National Academies Press. https://doi.org/10.17226/24811

Akcigit, U., Grigsby, J., & Nicholas, T. (2017). Immigration and the rise of American ingenuity. *American Economic Review*, *107*(5), 327–331.

Asset Management Association Switzerland, WTW (2025). Risikofähigkeit und Anlagerisiken von Schweizer Pensionskassen.

Azoulay, P., Fuchs, E., Goldstein, A. P., & Kearney, M. (2019). Funding Breakthrough Research: Promises and Challenges of the "ARPA Model". *Innovation Policy and the Economy, 19*, 69–96. https://doi.org/10.1086/699933

Barabuffi, S., Costantini, V., Leone Sciabolazza, V., & Paglialunga, E. (2025). Knowledge spillovers through high-skilled migration network: evidence from OECD countries. *Industry and Innovation, 32*(8), 884–914. https://doi.org/10.1080/13662716.2025.2451398

Barjak, F., Foray, D., & Wörter, M. (2023). *Mastering multiple complexities – a rising challenge for Swiss innovation models*. State Secretariat for Education, Research and Innovation SERI. https://www.sbfi.admin.ch/dam/sbfi/de/dokumente/webshop/2023/report_innovation_models.pdf.download.pdf/report_innovation_models_de.pdf

Bloom, N., Van Reenen, J., & Williams, H. (2019). A toolkit of policies to promote innovation. *Journal of Economic Perspectives, 33*(3), 163–184.

Braun-Dubler, N., Kaderli, T., Roth, F., & Birrer, T. (2022). *Prüfauftrag zur Einführung eines Schweizer Innovationsfonds*. Seco. https://www.newsd.admin.ch/newsd/message/attachments/72184.pdf

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, *35*, 128–152.

Colatat, P. (2015). An organizational perspective to funding science: Collaborator novelty at DARPA. *Research Policy, 44*(4), 874–887. https://doi.org/10.1016/j.respol.2015.01.005

David, P. (2012). The innovation fetish among the Economoi. in Josh Lerner and Scott Stern (ed.) The direction of inventive activity revisited, NBER, Chicago University Press.

European Commission: Joint Research Centre, Nindl, E., Napolitano, L., Confraria, H., Rentocchini, F., Fako, P., Gavigan, J. & Tübke, A. (2024). *2024 EU industrial R&D investment scoreboard*. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/0775231

Foray, D. (2019). On sector-non-neutral innovation policy: Towards new design principles. *Journal of Evolutionary Economics*, *29*(5), 1379–1397. https://doi.org/10.1007/s00191-018-0599-8

Foray, D., Mowery, D. C., & Nelson, R. R. (2012). Public R&D and social challenges: What lessons from mission R&D programs? *Research Policy*, *41*(10), Article 10. http://dx.doi.org/10.1016/j.respol.2012.07.011

Foray, D., & Woerter, M. (2020). The formation of Coasean institutions to provide university knowledge for innovation: A case study and econometric evidence for Switzerland. *The Journal of Technology Transfer*. https://doi.org/10.1007/s10961-020-09828-z

Goldstein, A., & Kearney, M. (2024). *Uncertainty and individual discretion in allocating research funds*. NBER Working Paper 32033. http://www.nber.org/papers/w32033.

Hulfeld, F., Spescha, A., & Wörter, M. (2024). *Funding R&D Cooperation Between Firms and Universities—The Effectiveness of the Innosuisse Model* (No. 522; KOF Working Papers). KOF Swiss Economic Institute, ETH Zurich. https://doi.org/10.3929/ethz-b-000708831

Jensen, M. B., Johnson, B., Lorenz, E., & Lundvall, B.-Å. (2007). Forms of knowledge and modes of innovation. *Research Policy*, *36*(5), Article 5. http://dx.doi.org/10.1016/j.respol.2007.01.006

König, M., Spescha, A., Wörter, M., Daubelaere, S. (2022). *What makes Firms Stop Doing R&D in Switzerland?* KOF-Studies, No. 169, April, Zürich. https://doi.org/https://doi.org/10.3929/ethz-b-000541754

Lee, Y.-N., & Walsh, J. P. (2016). Inventing while you work: Knowledge, non-R&D learning and innovation. *Research Policy*, *45*(1), 345–359. https://doi.org/10.1016/j.respol.2015.09.009

Narver, J. C., Slater, S. F., & MacLachlan, D. L. (2004). Responsive and Proactive Market Orientation and New-Product Success. *Journal of Product Innovation Management*, *21*(5), 334–347. https://doi.org/10.1111/j.0737-6782.2004.00086.x

OECD. (2009). *Sustainable manufacturing and eco-innovation. Framework, practices and measurement. Synthesis report.* (No. DSTI-IND(2009)5). OECD. https://one.oecd.org/document/DSTI/IND(2009)5/en/pdf

OECD. (2015). *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities*. OECD Publishing. http://www.oecd-ilibrary.org/science-and-technology/frascati-manual-2015_9789264239012-en

OECD. (2021). *Effective policies to foster high-risk/high-reward research* (OECD Science, Technology and Industry Policy Papers). OECD. https://www.oecd.org/en/publications/effective-policies-to-foster-high-risk-high-reward-research_06913b3b-en.html

OECD & Eurostat. (2018). *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation*. OECD Publishing, Eurostat. http://www.oecd.org/sti/oslo-manual-2018-9789264304604-en.htm

Rieder, S., Grosjean, N., Peter, C., Büchler, C., Föhn, Z., & Wagenbach, M. (2023). *Evaluation des «Centre suisse d'électronique et de microtechnique» (CSEM)*. SBFI. https://www.sbfi.admin.ch/dam/en/sd-web/NrQcvPtERrV2/evaluation_csem_de.pdf

Schneider, Y., Zenhäusern, P., Saurer, G., Hettich, P., & Pietzonka, A. (2022). *Prüfauftrag zu Regulatory Sandboxes*. SECO. https://www.seco.admin.ch/seco/de/home/Publikationen_Dienstleistungen/Publikationen_und_Formulare/Regulierung/VereinfachungvonRegulierung/pruefauftrag_regulatory_sandboxes.html

Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, *47*(9), 1554–1567. https://doi.org/10.1016/j.respol.2018.08.011

Spescha, A., Tran, S., & Wörter, M. (2025). Innovation und Digitalisierung in der Schweizer Privatwirtschaft – Ergebnisse der Innovationserhebung 2023. In *KOF Studies* (Vol. 182) [Report]. ETH Zurich. https://doi.org/10.3929/ethz-b-000717329

Spescha, A., & Wörter, M. (2022). Innovation und Digitalisierung in der Schweizer Privatwirtschaft – Ergebnisse der Innovationserhebung 2020. In *KOF Studies* (Vol. 172) [Report]. ETH Zurich. https://doi.org/10.3929/ethz-b-000583885

Swisscanto (2025). Schweizer Pensionskassenstudie 2025. Zürcher Kantonalbank. https://www.swisscanto.com/ch/de/private/vorsorge/pensionskassenstudie.html

Trinkner, U., Mattmann, M., Finger, M., Bruhin, L., Grichnik, D., & Greger, M. (2022). *Grundlagen zur Einführung eines Schweizer Innovationsfonds*. Seco. https://www.seco.admin.ch/dam/seco/de/dokumente/Standortfoerderung/KMU-Politik/Finanzierung%20der%20KMU/grundlagen_zur_einfuehrung_eines_schweizer_innovationsfonds.pdf.download.pdf/Beilage%2002%20Schlussbericht%20Swiss%20Economics%20SE%20DE%20zu%20AsP%20WBF.pdf

Vancauwenbergh, S., De Leenheer, P., & Van Grootel, G. (2016). On research information and classification governance in an inter-organizational context: The Flanders Research Information Space. *Scientometrics*, *108*(1), 425–439. https://doi.org/10.1007/s11192-016-1912-7

Weber, K. M., & Rohracher, H. (2012). Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. *Research Policy*, *41*(6), Article 6. https://doi.org/10.1016/j.respol.2011.10.015

Wörter, M., & Spescha, A. (2020). Konzentration von Forschungs- und Entwicklungsausgaben. *Die Volkswirtschaft*, *6*, 53–55.

Appendix

Appendix 1. Responses by industry association

	Res-ponse	Rejec-tion	Non-response	Not reached (by email)	Population total	Outside of po-pulation
Swiss Medtech	36.3%	3.9%	58.8%	1.0%	510	3
Interpharma	57.1%	3.6%	32.1%	7.1%	28	0
Science industries	32.6%	2.2%	59.8%	5.4%	184	1
SBVg, SFTI	53.7%	0.0%	43.9%	2.4%	41	2
SVV	53.5%	4.7%	41.9%	0.0%	43	0
SWICO	31.6%	2.9%	60.0%	5.4%	478	5
No industry association	24.5%	3.9%	64.2%	7.4%	5,322	103
All data sources	26.5%	3.8%	63.1%	6.7%	6,578	114

Appendix 2. Companies by economic sectors

Sector	n	%
Chemicals, pharmaceuticals & biotechnology	113	9.5%
Information and communication technologies (ICT)	240	20.2%
Medical technologies	136	11.4%
Metals, electronics, machines (MEM)	232	19.5%
Food and beverages	141	11.9%
Finance (banking, insurance, financial services)	212	17.8%
Other manufacturing	45	3.8%
Other services	69	5.8%
Total	**1,188**	**100%**

Appendix 3. Companies by global/Swiss employees and size classes (full-time equivalents FTEs)

Size class	1-9		10-49		50-249		250+		Total
	n	%	n	%	n	%	n	%	
Global employment	356	30.4%	371	31.7%	278	23.7%	166	14.2%	1,171
Employment in Swit-zerland	380	32.5%	384	32.8%	281	24%	125	10.7%	1,170

Appendix 4. Companies by economic sectors and size classes (full-time equivalents FTEs)

Size class	1-9		10-49		50-249		250+		Total
	n	%	n	%	n	%	n	%	
Chemicals, pharma & biotech	27.7	25%	40.2	36.3%	22.2	20%	20.7	18.7%	110.8
ICT	76.0	32.1%	72.8	30.7%	51.8	21.9%	36.2	15.3%	236.8
Medtech	60.5	44.9%	50.1	37.2%	12.2	9.1%	12.0	8.9%	134.8
Metals, electronics, machines	43.0	18.5%	69.7	30%	78.2	33.7%	41.2	17.8%	232.1
Food	58.4	41.6%	46.0	32.8%	29.7	21.2%	6.2	4.4%	140.3
Finance	51.8	25.5%	54.0	26.6%	55.8	27.5%	41.5	20.4%	203.1
Other manufacturing	11.0	24.7%	14.8	33.2%	14.8	33.2%	4.0	9%	44.6
Other services	27.5	40.1%	23.4	34.1%	13.5	19.7%	4.2	6.1%	68.6
Total	**355.9**	**30.4%**	**371**	**31.7%**	**278.2**	**23.8%**	**166**	**14.2%**	**1,171.1**

Appendix 5. Innovators in % of all companies by size class, 2021-23

Variable / size class	1-9	10-49	50-249	250+	Total
Product innovations					
New to the market and not previously offered by any of your competitors (radical innovation)	32.1%	38.7%	40.3%	48.3%	38.7%
New for the enterprise, identical or very similar products were already offered by your competitors (incremental innovation)	76%	77.7%	75.7%	84.6%	77.8%
Process innovations					
New or improved processes	48.9%	53.3%	70.8%	79.8%	59.8%

Appendix 6. Current importance 2021-23 of public support measures by sector

Sector	Current importance 2021-23 of public support measures		Total
	Unimportant	Important	
Chemicals, pharmaceuticals & biotechnology	59.8%	40.2%	104.8
ICT	71.1%	28.9%	223.1
Medical technologies	73.3%	26.7%	124.8
Metals, electronics, machines	63%	37%	212
Food	82.9%	17.1%	135.2
Finance	88.3%	11.7%	193.6
All sectors	73.1%	26.9%	1,101

Appendix 7. Assessment of the competitive environment in % of responses

Competitive environment	Disagree	Neutral	Agree	Total
There are many competitors in our main markets.	20.9%	9.7%	69.4%	1,157
There are powerful competitors in our main markets.	10.7%	8.7%	80.6%	1,167
There is intense price competition in our main markets.	15.9%	12.1%	72%	1,163
There is a high level of non-price competition.	29.9%	22.6%	47.5%	1,167
Many competitors enter and/or leave our main markets.	49.4%	26.9%	23.7%	1,163

Appendix 8. Assessment of technological change in % of responses

Technological change	Disagree	Neutral	Agree	Total
Technology in our industry is changing rapidly.	27.5%	18.2%	54.4%	1,168
Technological change offers great opportunities for our industry.	15.8%	18.3%	65.9%	1,170
It is very difficult to predict what technological level our industry will reach in the next five years.	31.4%	24.4%	44.2%	1,169
Numerous new products in our industry have been made possible by technological breakthroughs.	35.5%	20.1%	44.4%	1,172
Technological change is creating major challenges and risks for our industry.	30.2%	24.6%	45.2%	1,164

Appendix 9. Assessment of the customer dynamics in % of responses

Customer dynamics	Disagree	Neutral	Agree	Total
In our markets, customer needs change from year to year.	53.8%	19%	27.2%	1,173
Customers in our markets are very receptive to new product ideas.	28.7%	27.8%	43.5%	1,176
New customers often have different product-related needs than existing customers.	40.2%	25.4%	34.4%	1,178
Our customer base has been quite stable over time.	13.4%	13.8%	72.9%	1,176

Appendix 10. Mapping of policy suggestions on intervention mechanisms and policy aims

Policy aim Mechanisms	Radical (new to the market)	Digital	Sustainable	Enabling, capacity-enhancing for all innovation types
Regulation	Regulatory sandboxes	Regulatory sandboxes National data strategy (ownership, sovereignty, protection) E-government services (e.g. eIDs, stablecoins)	Address trade-offs Address admin. & compliance burden (e.g. ESG reporting) Regulatory sandboxes	Harmonisation of regulations Regulation dialogue
Funding	Mobilising start-up funding Targeted support for R&D investments (ARPA, grants) Funding for scaling innovation	National data strategy (adoption support)	Tax incentives Adoption subsidies Targeted support for transformative and sustainable innovation	Innosuisse operational improvements (feedback, templates, coaching, monitoring, internat. scope, B2B collaboration)
Collaboration	ARPA Matchmaking platforms Art. 15 RIPA extension	National data strategy (sharing) Digital ecosystems	Matchmaking platforms	Matchmaking platforms Art. 15 RIPA extension
S		National data strategy (digital/data skills)	Sustainable skills initiative	Fast-track work permits Adapt STEM education STEM retention obligation Further education incentives Entrepreneurship education

Appendix 11. Questionnaire

New innovation models in Switzerland

Thank you very much for your willingness to participate in this survey on the innovation activities of companies in Switzerland. It helps to identify obstacles to innovation and supports the further development of innovation policy and funding.

The survey is being conducted on behalf of the Swiss Federal Government (State Secretariat for Research, Education and Innovation SERI). It is supported and funded by Innosuisse – the Swiss Innovation Agency, SwissBanking, Swiss Fintech Innovations, the Swiss Insurance Association, Swiss Medtech, Interpharma, and swico. The School of Business of the University of Applied Sciences Northwestern Switzerland (FHNW), the University of St. Gallen (HSG) and the Swiss Federal Institute of Technology (ETHZ) are conducting the research.

Completing the survey takes no more than 30 minutes and is easier if you have your organisation's annual report at hand. Your responses are automatically saved, allowing you to resume the survey at any time from the last unanswered page. The survey link can be shared within your organisation, enabling collaboration on specific questions. Alternatively, you can request a printable version by sending an email to innomod.business@fhnw.ch. The survey will remain open until January 31, 2025.

Data protection

The survey complies with the Federal Act on Data Protection. All responses will be evaluated and presented in an anonymised and aggregated form. No data identifying individual organisations will be made public.

Please note: all your answers should refer to «u_company» («uid») and, unless otherwise stated, to the location Switzerland!

Module A: Information on «u_company» and the market environment

1. **Please, indicate the industries in which «u_company» is active.**

This question must be completed to ensure the appropriate set of subsequent questions is displayed. The codes of the Swiss industry classification "NOGA" are provided below. If you need further help, please read the help text in the box. Multiple answers are possible.

*If you need help with identifying the correct industry: use the **KUBB tool** from the Swiss Federal Statistical Office (https://www.kubb-tool.bfs.admin.ch/en/search). Perform a full-text search for relevant products or services on KUBB. Go to the "NOGA Explanatory Notes" or "Keywords" tab in the results for the best match. The search produces 6-digit NOGA classes, of which the first 2 digits are relevant. If the first two 2 digits from KUBB are not included in any of the listed options, select one of the "Other" categories.*

Industry Options (NOGA Classification)

- ☐ 10-12 Manufacture of food products, beverages, or tobacco products
- ☐ 19-20 Manufacture of coke and refined petroleum products, chemicals and chemical products
- ☐ 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations
- ☐ 24-25 Manufacture of basic metals or fabricated metal products (except machinery and equipment)
- ☐ 26 Manufacture of computer, electronic and optical products
- ☐ 27 Manufacture of electrical equipment
- ☐ 28 Manufacture of machinery and equipment not elsewhere classified
- ☐ 325 Manufacture of medical and dental instruments and supplies (à Question 3)
- ☐ 33 Repair and installation of machinery and equipment
- ☐ 53 Postal and courier activities
- ☐ 61 Telecommunications
- ☐ 62 Computer programming, consultancy and related activities (software)
- ☐ 63 Information service activities
- ☐ 64 Financial service activities (except insurance and pension funding) (→ Question 2)

- ☐ 65 Insurance, reinsurance and pension funding (→ Question 2)
- ☐ 66 Activities auxiliary to financial services and insurance activities (→ Question 2)
- ☐ 7211 Research and experimental development on biotechnology
- ☐ 7219 Other research and experimental development on natural sciences and engineering
- ☐ Other manufacturing not elsewhere classified
- ☐ Other services not elsewhere classified
- ☐ Other industry not elsewhere classified, please specify: ______________________________

→ Only answer question 2 if NOGA 64-66 applies.

2. In which market segments was «u_company» active in 2021-23?

Multiple answers are possible.

- ☐ Provider of IT/software solutions
- ☐ Retail banking
- ☐ Corporate investment banking
- ☐ Brokerage services
- ☐ Insurance
- ☐ Wealth & asset management
- ☐ Re-insurance
- ☐ Other, please specify: ____________________

____

→ Only answer question 3 if NOGA 325 applies

3. Into which risk classes for medical devices do your main products (goods or services) from 2021-23 fall?

Risk classes are based on the European Medical Device Regulation. Main products are those with the biggest contribution to the sales of «u_company».
Multiple answers are possible.

- ☐ Risk classes do not apply for our main products.
- ☐ Low risk (Class I) (e.g. dressing material, simple surgical instruments)
- ☐ Medium risk (class IIa) (e.g. dental fillings, hearing aids)
- ☐ Higher risk (class IIb) (e.g. infusion pumps, anaesthesia equipment)
- ☐ Highest risk (class III) (e.g. pacemakers, implantable defibrillators)
- ☐ Other, please specify: ____________________

____

4. In what year did «u_company» start doing business in Switzerland?

Please provide your answer as a four-digit year, (e.g., 2004).

____ (year)

→ Only answer question 5 if answer to question 4 is 2015 or younger.

5. Is «u_company» a start-up company?

<u>Start-ups</u> are young companies focused on innovation and growth.
<u>Spin-off</u> companies are start-ups that are based on research conducted at a university or research institution, have a licence, option or assignment agreement for intellectual property (copyright, know-how, patents, trademarks, etc.) from this institution and have at least one (co-)founder with an affiliation to this institution (employee, student, alumnus).
<u>Split-off</u> companies originate from another business enterprise, have an agreement with the parent company and at least one founder is affiliated with it.

- ☐ Yes, «u_company» is a <u>spin-off</u> from a university or public research organisation.
- ☐ Yes, «u_company» is a <u>split-off</u> from another business enterprise (also enterprise spin-off, spin-out).
- ☐ Yes, «u_company» is an independent <u>start-up</u> company.
- ☐ No, «u_company» is not a start-up.

6. How many employees worked at «u_company» globally and in Switzerland at the end of 2023?

Include apprentices and self-employed persons/assisting family members. Convert part-time employees to full-time equivalents (FTEs). Provide a number, for example, "18".

____ FTEs (global)

____ FTEs (in Switzerland)

7. What percentage of all employees at «u_company» held a tertiary education degree in 2023?

<u>Tertiary education</u> includes universities, universities of applied sciences, the ETH domain, higher technical colleges etc.
Provide a rough estimate.

____ % of all FTEs

8. What was the total global <u>turnover</u> of the Swiss locations of «u_company» in 2023?

<u>Turnover</u> refers to the market sales of goods and services, including all taxes except VAT.

Please indicate the turnover generated by Swiss locations, using the following guidelines:
<u>Banks</u>: include income from interest, trading and commission/services business.

Insurance companies: include gross premiums minus gross payments for insurance claims, plus net income from investments;
Consultancy firms and similar businesses: include gross fee income
Examples to include:

- *Sale of a machine by the Swiss entity to a foreign subsidiary of the same company group,*
- *sale of software by the Swiss entity developed with the contribution of developers located abroad but employed by the Swiss entity.*

Examples to exclude:

- *A machine or software produced and sold by a foreign subsidiary of the Swiss entity,*
- *Venture capital raised by a start-up.*

(Estimated turnover in CHF, 2023)

9. What percentage of the turnover came from exports in 2023?

Exports include goods and services provided to foreign customers that are purchased in Switzerland. This includes transactions such as interest income from foreign clients.
Exports as percentage of total turnover

☐ 0 to below 10%
☐ 10-39%
☐ 40-79%
☐ 80% or more

10. What was the estimated expenditure on intermediate goods and services in 2023?

Expenditure refers to spending on intermediate inputs used in the production process, excluding VAT.
Intermediate goods include materials, intermediate products, energy, water, etc.
Intermediate services include financing, insurance, IT, rent and leasing, etc.
Exclude spending on capital goods.

(estimated expenditure in CHF 2023

or – please answer according to availability –
in % of sales 2023)

11. Market competition: How much do you agree with the following statements?

	Disagree	Rather dis-agree	Neutral	Rather agree	Agree
There are many competitors in our main markets.	☐	☐	☐	☐	☐
There are powerful competitors in our main markets.	☐	☐	☐	☐	☐
There is intense price competition in our main markets.	☐	☐	☐	☐	☐
There is a high level of non-price competition (e.g. product differentiation, quality, frequent introduction of new products).	☐	☐	☐	☐	☐
Many competitors enter and/or leave our main markets.	☐	☐	☐	☐	☐

12. Technological change: How much do you agree with the following statements?

	Disagree	Rather disagree	Neutral	Rather agree	Agree
Technology in our industry is changing rapidly.	☐	☐	☐	☐	☐
Technological change offers great opportunities for our industry.	☐	☐	☐	☐	☐
It is very difficult to predict what technological level our industry will reach in the next five years.	☐	☐	☐	☐	☐
Numerous new products in our industry have been made possible by technological breakthroughs.	☐	☐	☐	☐	☐
Technological change is creating major challenges and risks for our industry.	☐	☐	☐	☐	☐

13. Customer dynamics: How much do you agree with the following statements?

	Disagree	Rather dis-agree	Neutral	Rather agree	Agree
In our markets, customer needs change from year to year.	☐	☐	☐	☐	☐
Customers in our markets are very open to new product ideas.	☐	☐	☐	☐	☐
New customers often have different product-related needs than existing customers.	☐	☐	☐	☐	☐
Our customer base has been quite stable over time.	☐	☐	☐	☐	☐

14. Did «u_company» introduce any product innovations in the period 2021-23 or earlier?

A product innovation is a new or improved good or service that differs significantly from the company's previous offerings and has been introduced to the market.
Include significant changes to the design of a product, digital goods or services.
Exclude simple resale of new goods and purely aesthetic changes.
Please only indicate innovations that were developed at your Swiss locations or were launched in markets that are served from Switzerland.
Definitions:
Products: goods or services produced through economic activities that can be traded, consumed, or invested in.
Goods: tangible items for which ownership rights can be established and transferred through market transactions. Examples include machines, software and physical products.
Services: outputs of activities that facilitate changes in the conditions for users or the exchange of goods (e.g. financial services). Services cannot be traded separately from their production and are delivered upon completion of production.

	Current (2021-23)	before 2021
New or improved goods (incl. software, financial products)	☐	☐
New or improved services	☐	☐

15. Were these new or improved products (goods or services) introduced in 2021 to 2023 new to the market and/or new to «u_company»?

Multiple answers allowed.

☐ New to the market and not previously offered by any of your competitors (radical innovation).
☐ New for the enterprise, identical or very similar products were already offered by your competitors (incremental innovation)

16. Did «u_company» introduce any process innovations at its Swiss sites in 2021-23 or before?

Process innovations refer to the first-time use of technically new or significantly improved production/process technologies for your company to produce goods or provide services for people or objects. Although the product may also change, the focus is on increasing efficiency. Newly developed production processes that you sell to other companies are product innovations.

	Current (2021-23)	before 2021
New or improved processes	☐	☐

→ Only answer question 17 if no innovations occurred during 2021-23.

17. How important were the following reasons for not innovating in 2021-23 for «u_company»?

Meaning	Unimportant	Rather unimportant	Rather important	Important
Lack of expertise in relevant areas and technologies (e.g., digitalisation)	☐	☐	☐	☐
The competitors are too far ahead technologically.	☐	☐	☐	☐
High technical risk of innovations	☐	☐	☐	☐
High costs of innovation, lack of financing	☐	☐	☐	☐
High market risk or poor ROI for innovations	☐	☐	☐	☐
Uncertainty or high volatility in the markets (e.g. due to COVID)	☐	☐	☐	☐
Regulatory barriers (laws, ordinances).	☐	☐	☐	☐
Lack of collaboration partners for innovation projects	☐	☐	☐	☐
«u_company» has other strategic priorities.	☐	☐	☐	☐
We don't innovate continuously, but only when an opportunity arises.	☐	☐	☐	☐

18. Did «u_company» engage in any research and development (R&D) activities in 2021-23 or earlier?

Definition: R&D involves creative and systematic work aimed at increasing knowledge, including knowledge of humanity, culture and society, and applying this knowledge to new uses.
Exclude market research from R&D.

For software development:
A project qualifies as R&D if it involves scientific and/or technological advancements or resolves uncertainties systematically.
Routine upgrades or adaptations do not qualify unless they result in significant advancements in knowledge or technology. Using software for a new application or purpose alone does not constitute R&D.
Examples of R&D in banking and insurance:
- *mathematical research for financial risk analysis*
- *development of risk models for credit policy*
- *experimental development of home banking software*

- *development of techniques to analyse consumer behaviour to create new types of accounts and banking services*
- *research on new risks or risk characteristics for insurance contracts*
- *research on social phenomena influencing new insurance types (health, retirement, etc.), such as on insurance cover for non-smokers*
- *R&D for electronic banking, insurance, or e-commerce applications*
- *R&D related to innovative financial services (new account types, loans, savings instruments).*

	Current (2021-23)	before 2021
Performed in-house R&D conducted directly by «u_company» to create new knowledge or solve scientific / technical problems	☐	☐
R&D contracted out «u_company» has outsourced R&D to other enterprises (including enterprises in your own group) or research organisations (including Innosuisse projects).	☐	☐

19. How much did «u_company» spend on R&D in 2023?

Please include the following:
In-house R&D: current expenditure (e.g. labour costs) and capital expenditure on R&D-specific buildings or equipment
Outsourced R&D: Expenditure for R&D carried out by other organisations.
The answers should reflect R&D activities at your Swiss locations.
Please exclude costs for market research, patents, licenses or after-sales services

Either provide

Estimated R&D expenditure (in CHF) ____________

or

R&D expenditure in % of turnover ____________

20. How has your R&D expenditure changed in 2021-23 compared to before 2021?

☐ Strong decrease
☐ Decrease
☐ More or less stable
☐ Increase
☐ Strong increase

21. How important were non-R&D expenditures for innovation in 2021-2023?

Meaning	Unimportant	Rather unimportant	Rather important	Important
Acquisition of new facilities, machinery and equipment, software, services, etc.	☐	☐	☐	☐
Acquisition of external knowledge (e.g. patents, licences etc.)	☐	☐	☐	☐
Acquisition of data and information	☐	☐	☐	☐
Staff training	☐	☐	☐	☐
Certification or regulatory approvals	☐	☐	☐	☐
Market research	☐	☐	☐	☐
Innovation labs	☐	☐	☐	☐

22. Innovation support: Did «u_company» in Switzerland receive public support for innovation projects from national or international organisations in the period 2021-2023?

☐ No, in Switzerland we did not receive public support for innovation projects.

Yes, from …

☐ Innosuisse
☐ Other Swiss funding organisations
☐ Cantonal or regional funding agencies
☐ EU programmes
☐ Other international agencies

→ Only answer question 23 if you obtained Innosuisse funding 2021-23.

23. How do you evaluate public support by Innosuisse in the following areas?

Degree of consent	Disagree	Rather disagree	Neutral	Rather agree	Agree
Enabled us to take on projects with high technological risks and uncertainties.	☐	☐	☐	☐	☐
Contributed to the success of our R&D activities.	☐	☐	☐	☐	☐
Helped us to address a shortfall of qualified specialists in-house (e.g. through collaboration).	☐	☐	☐	☐	☐
Provided flexibility to adjust project scope during execution.	☐	☐	☐	☐	☐

→ Only answer question 24 if you obtained any public innovation support 2021-23.

24. How do you evaluate the impact of the public innovation funding (by Innosuisse, cantonal or European funding organisations, etc.)?

Degree of consent	Disagree	Rather disagree	Neutral	Rather agree	Agree
Helped us to drive digitalisation forward through innovation.	☐	☐	☐	☐	☐
Supported the development of sustainability innovations.	☐	☐	☐	☐	☐
Assisted in meeting the regulatory requirements for innovations.	☐	☐	☐	☐	☐
Helped us to successfully collaborate with other organisations.	☐	☐	☐	☐	☐

25. How important are public funding measures (e.g. from Innosuisse, cantonal or European funding bodies, etc.) for your company and how has their importance changed?

Current importance (period 2021-23)

- ☐ Unimportant
- ☐ Rather unimportant
- ☐ Rather important
- ☐ Important

Change in importance compared to before 2021

- ☐ Less important today
- ☐ About the same
- ☐ More important today

Module B: Digitalisation and artificial intelligence (AI)

26. How important were the following <u>digital data sources</u> for the innovation activities of «u_company» in 2021-23?

#	Importance	Unimportant	Rather unimportant	Rather important	Important
(1)	Customer data (e.g. transaction data, internal data from the CRM, purchase histories)	☐	☐	☐	☐
(2)	Operational / performance data (e.g. sensor data, logs, performance metrics)	☐	☐	☐	☐
(3)	Digital platforms and online sources (e.g. social media, automated web scraping, APIs)	☐	☐	☐	☐
(4)	Specialised data providers, data/analytics companies	☐	☐	☐	☐
(5)	Science publications / databases	☐	☐	☐	☐
(6)	Intellectual Property databases (e.g. patents)	☐	☐	☐	☐
	→ The following items are only for NOGA 19-21, 325, 7211 (pharmaceutical and medtech sector)				
(7)	Clinical trials (e.g. treatment success, side effects, lab test results)	☐	☐	☐	☐
(8)	Hospitals, doctors, patients (e.g. patient health / treatment data, wearables)	☐	☐	☐	☐
(9)	Data libraries, including preclinical data	☐	☐	☐	☐

27. Which digital data sources have gained or lost importance for the innovation activities of «u_company» compared to before 2021?

Please enter the numbers from question 26 (column 1).

__________ (more important today)

__________ (no change in importance)

__________ (less important today)

28. How important were the following advances in <u>digital technologies</u> for the innovation activities of «u_company» in 2021-23?

Importance	Unimportant	Rather unimportant	Rather important	Important
Big data analyses (for pattern recognition, predictive modelling etc.)	☐	☐	☐	☐
Artificial intelligence (e.g. machine learning, neural networks etc. for natural language processing, image recognition, decision support)	☐	☐	☐	☐
Platform as a Service (PaaS), Computing as a Service (CaaS), Software as a Service (SaaS)	☐	☐	☐	☐

Digital twins (virtual model of a physical device, process or system)	☐	☐	☐	☐
Blockchain, distributed ledger technology (not as a service)	☐	☐	☐	☐
Increased hardware performance (e.g., chips, devices, sensors etc.)	☐	☐	☐	☐

29. What barriers have reduced or prevented the (more extensive) use of data in innovation activities in «u_company» in 2021-23?

- ☐ Limited data access (e.g. non-existent, not available)
- ☐ Data processing not allowed or impossible (e.g. due to regulation, risk of data breaches)
- ☐ Poor data structure, data quality or formats (e.g. missing structure or standards)
- ☐ Lack of data infrastructure or tools (e.g. for storage, analysis)
- ☐ Insufficient personnel or expertise
- ☐ High costs compared to the expected benefits
- ☐ Internal resistance within the company
- ☐ No need for additional data usage
- ☐ Other priorities in innovation activities
- ☐ Other barriers, please explain:

____
____

Module C: Sustainability innovations

30. Did «u_company» introduce any of the following sustainability innovations in 2021-2023?

A <u>sustainability innovation</u> refers to a new or significantly improved product (good or service), process, organisational/management method or marketing method that creates environmental, social or governance-related benefits compared to existing alternatives.

	Current (2021-23)	before 2021
Innovations that create or enable <u>environmental</u> benefits (e.g. increased sustainability of energy / material use, reduced emissions, green mortgages, etc.)	☐	☐
Innovations that create or enable <u>social</u> benefits (e.g. improvements in occupational safety, human rights, diversity)	☐	☐
Innovations for <u>ethical corporate governance</u> (e.g. improvements in accounting, auditing, compliance or corruption management)	☐	☐
Other sustainability innovation	☐	☐

31. How have these sustainability innovations benefited the environment, society or corporate governance?

- ☐ Incremental change to existing products, processes, methods or organisational structures
- ☐ Significant redesign of existing products, processes, methods or structures
- ☐ Introduction of alternatives/substitutes for existing products, processes, etc.
- ☐ Creation of entirely new products, processes, methods, structures or organisations.
- ☐ Extension of the product life cycle
- ☐ Other mechanism, please explain: __________

____

32. What barriers reduced or prevented the introduction or use of sustainability innovations in «u_company» in the years 2021-2023?

- ☐ Existing or expected regulations
- ☐ High costs (development, scaling, etc.) or financial constraints
- ☐ Lack of sustainability-related data or impact measurements
- ☐ High technological or operational risks (e.g. complex technology, contamination risks from multiple use of products)
- ☐ Conflict with our business model
- ☐ Conflict with customer demands/requirements
- ☐ Lack of knowledge and experience with sustainability innovations in our company
- ☐ Difficulties implementing innovations within the supply chain
- ☐ Lack of cooperation partners for sustainability innovations
- ☐ Other innovation priorities
- ☐ No need for additional sustainability innovations
- ☐ Internal resistance within the company
- ☐ Other barriers, please explain:

____
____

Module D: Regulation and innovation

33. How important were the following regulatory aspects for the innovation activities of «u_company» in 2021-23?

#	Importance	Unimportant	Rather unimportant	Rather important	Important
(1)	Product-related (e.g. CE, pre-market requirements, product components, functionalities, consumer/patient safety, etc.)	☐	☐	☐	☐
(2)	Intellectual property rights	☐	☐	☐	☐
(3)	Data protection	☐	☐	☐	☐
(4)	Market-related (e.g. pricing, antitrust, licence to operate, capitalisation, liability)	☐	☐	☐	☐
(5)	Process-related (e.g. audits, QM, supply chains, R&D, risk management, compliance, reporting, etc.)	☐	☐	☐	☐
(6)	Employee safety, ethics and security	☐	☐	☐	☐
(7)	Labour market-related (e.g. migration)	☐	☐	☐	☐
(8)	Environmental protection	☐	☐	☐	☐
	à The following items are only for NOGA 64-66 (financial sector)				
(9)	Banking secrecy	☐	☐	☐	☐
(10)	Know your customer (KYC), anti-money laundering (AML)	☐	☐	☐	☐

34. How have the aspects of regulation listed in question 33 changed in importance for the innovation activities of «u_company» compared to before 2021?

Please enter the numbers from question 33 (column 1).

(Become more important today) ____________________

(Seen no change in importance) ____________________

(Become less important today) ____________________

35. How have changes in regulations affected the innovation activities of «u_company» in the years 2021-2023?

Degree of consent	Disagree	Rather disagree	Neutral	Rather agree	Agree
We innovate less.	☐	☐	☐	☐	☐
We are making fewer fundamental/radical innovations.	☐	☐	☐	☐	☐
The changes raise innovation costs.	☐	☐	☐	☐	☐
We change the business processes/models.	☐	☐	☐	☐	☐
We have greater planning security for innovations.	☐	☐	☐	☐	☐
We face more uncertainty (technological, market-related).	☐	☐	☐	☐	☐
We need more qualified staff.	☐	☐	☐	☐	☐
We cooperate more with universities, other companies, research institutes, or consultants.	☐	☐	☐	☐	☐
We communicate more with the regulatory authorities.	☐	☐	☐	☐	☐

Module E: Cooperation in innovation activities

36. Has «u_company» collaborated with other companies or organisations (e.g. universities, research institutes) on innovations?

☐ Yes, in the years 2021-2023.
☐ Yes, before 2021.
☐ No, there was never any collaboration in our innovation activities. *à Please skip questions 37-41 and go to question 42.*

37. How important are the following <u>external partners and contributors</u> for the success of the innovation projects of «u_company»?

#	Importance	Unimportant	Rather unimportant	Rather important	Important
(1)	Academic partners (universities, universities of applied sciences, ETH domain, etc.)	☐	☐	☐	☐
(2)	Start-ups, spin-offs	☐	☐	☐	☐
(3)	Established companies	☐	☐	☐	☐
(4)	Service providers and consultants (e.g. technology, analytics, data-related)	☐	☐	☐	☐
(5)	Public administrations or regulatory bodies	☐	☐	☐	☐
	→ The following items are only for NOGA 19-21, 325, 7211 (pharmaceutical and medtech sector)				
(6)	Doctors & medical or technical staff	☐	☐	☐	☐
(7)	Patient organisations	☐	☐	☐	☐

38. Have any of these partner types gained or lost importance for the innovation

activities of «u_company» compared to before 2021?

Please enter the numbers from question 37 (column 1).

(more important today)
___

(no change in importance)
___

(less important today)
___

39. Where are the key innovation partners of «u_company» located?

Multiple selection is possible.

- ☐ Region (neighbourhood, canton, agglomeration)
- ☐ Other regions of Switzerland
- ☐ Europe, EU area
- ☐ North America
- ☐ China
- ☐ Other East Asia
- ☐ Other world region, please specify:

___

→ *Only answer question 40 if your answer to question 37, above, was "rather important" or "important" for one of the items 2, 3, or 4.*

40. What is the nature of the relationship between «u_company» and its key innovation partners?

Multiple selection is possible.

They are …

- ☐ … our customers
- ☐ … our suppliers
- ☐ … our competitors
- ☐ … other partners
- ☐ … other relationship, please specify:

___

41. What significant challenges did «u_company» face during innovation collaborations in 2021-2023?

Multiple answers are possible.

- ☐ Technical, e.g. R&D challenges, system incompatibilities, knowledge gaps
- ☐ Economic, e.g. lack of financial resources, lack of economic collaboration outcomes,
- ☐ Legal, e.g. intellectual property disputes, contract complexities, contract breaches
- ☐ Sociocultural, e.g. communication problems, cultural differences
- ☐ Organisational, e.g. different working styles, time management, capacity constraints
- ☐ Other challenge, please explain:

___

___

→ *Only answer question 42 if you did not engage in innovation collaboration 2021-23.*

42. What obstacles prevented «u_company» from engaging in innovation collaborations during 2021-2023?

- ☐ Technical, e.g. no suitable/capable partners found, incompatible technologies, technical dependencies
- ☐ Economic, e.g. lack of financial resources, lack of benefit from cooperation, high economic risk
- ☐ Legal, e.g. antitrust law, no contractual solution found, uncertainty regarding regulations
- ☐ Sociocultural, e.g. trust issues, communication problems, resistance to cooperation, cultural differences
- ☐ Organisational, e.g. different working styles, time management challenges, capacity constraints
- ☐ Other obstacle, please explain:

___

___

43. Finally, if you were to suggest ideas that would promote innovation in «u_company», what would they be?

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You have now reached the end of the questionnaire.

Please send this document back to innomod.business@fhnw.ch.

Thank you for your participation!

Appendix 12. Interview questions for the Delphi round 1 interviews

Intro: In recent years, the share of R&D-active companies in Switzerland has declined significantly, from approximately 26% in 1999 to around 13% in 2022.

1. Do you observe a similar trend of declining R&D in your sector or field of activity?

If yes, …	**If no**, …
… what do you see as the main reasons for the decline in R&D activity among companies?	… what do you see as the main reasons for the increase in R&D activity among companies?
2. In your opinion, are new policy measures needed to encourage companies to enter or remain in the R&D landscape in Switzerland?	

3. Which types of instruments or reforms would you consider most effective for your company? Does this apply as well for the sector/industry?

Prompts (only mention, if needed for explanation):

- Financial incentives (e.g., direct subsidies, (higher) tax relief)?
- Strengthened public-private collaboration mechanisms? If yes, what would be helpful?
- Sector-specific support measures (please indicate which ones)?
- Regulatory simplification (which regulations are an issue)?
- Access to international research networks?
- Other policies (please describe which ones).

Intro: Based on hearings among more than 50 representatives from companies and organizations there are 4 megatrends that strongly influence the innovation activities of companies.

a) Digitalisation,
b) Sustainability requirements,
c) Regulations,
d) R&D/innovation collaborations.

4. In your view, is any of these factors also significantly shaping the innovation in your company? Yes/no

If yes, please respond to the following questions.

Digitalization

5. How is digitalisation currently an opportunity for innovation in your company?

6. How could Swiss policy support digitalization in your company?

Prompts (only mention, if needed for explanation):

- Training
- Data standards

- Infrastructure

Regulation

7. In your view, which regulations primarily act as a direct obstacle to innovation in your company?

Prompts (only mention if needed): We know from our survey that the following regulatory areas are key for innovation in your sector (just read the relevant sector):

- **Pharma & MEM**: Process-related, employee-safety and security, product-related, & environmental
- **Medtech**: Product and process-related, and data protection,
- **ICT**: Data protection, know-your customer and anti-money laundering, and banking secrecy
- **Finance**: Data protection, know-your customer and anti-money laundering, process-related
- **Food**: Environmental and process-related, employee-safety and security,

8. Why are they obstacles? What could be improved to support innovation?

9. Which regulations drive innovation (e.g., compliance-driven innovation, standard-setting)? Optional Question

Sustainability

10. In your company do you consider sustainability a driver of innovation or more of a constraint?

11. What policy interventions could strengthen sustainable innovation in your sector?

Collaboration

Intro: Collaborating with academic organizations in innovation projects is a key paradigm of Swiss innovation policy.

12. How do you see this for your company: Are the costs/benefits of collaborating with academic organizations different to the costs/benefits of collaborating with other companies?

13. Should innovation policy support innovation collaboration between companies?

14. What could innovation policy do to stimulate both types of innovation collaborations?