Myfab Annual Report 2024

Summary

During its 5th operating period 2020–2024, Myfab has developed in several ways: through extensive investments in new equipment, strengthened user support through recruitments and development of manufacturing processes. The ambition Myfab had and as described in the application to VR, and facilitated by the grant for investments and operation, has been essentially fulfilled and even exceeded in some respects. The table below gives an overview of some of the key numbers.

Myfab Infrastructure Overview			
5 165 m2	750	88 (corresp. to 55,4 FTE)	877
Cleanroom area	Bookable Tools	Expert Staff	Active Users
Myfab Research			
469	3496	47	251
Publications 2024	Publ. 2020–2024	Ph.Ds. 2024	Ph.Ds. 2020–2024

This corresponds roughly to about one PhD thesis per week and two peer-reviewed publications per day during the whole five-year period.

Popular Science Description

Myfab (https://myfab.se/)is Sweden's open-access micro- and nanotechnology research infrastructure, with cleanroom laboratories at Chalmers, KTH Royal Institute of Technology, Lund University and Uppsala University. The infrastructure provides an outstanding environment for the development and fabrication of materials and device structures for advanced research in physics, materials science, nanoscience, chemistry, life sciences, nanoelectronics and semiconductors. The user community, including a large number of top international researchers and holders of ERC and KAW grants (24 respectively 30 in 2023) produce about two peer-reviewed publications/day and about one Ph.D. student/week emanate from the environment each year. Myfab also provides an innovation platform for industry and deep-tech start-ups, with more than 120 active companies. Myfab is a dynamic environment, where about 1/3 of our 850+ users are replaced every year. We anticipate a growing demand from researchers in new and expanding areas targeting the global challenges and the UN Sustainable Development Goals.

Description of activities

The support from the Swedish Research Council (VR) for the Myfab fifth activity period 2020-2024 (two grants, Dnr. 2019-00207 Myfab period 5 and Dnr. 2021–00278 Myfab utrustning för nanotillverkning) has primarily been for investments replacing aging equipment in the laboratories, for renewing capabilities and as a contribution to operational costs. In total, 16 instruments/platforms have been procured, installed, tested and made available to Myfab's users. We have managed to implement everything within our timeframes; only one instrument was delayed 3 months. The investments funded by Dnr. 2019-00207 during the Myfab period 5 are listed in annex "A4. Myfab tools financed by VR during period 5.docx". In addition to the two investment grants from VR, the Myfab laboratories have been successful in attracting funds for further investments.

Report from Myfab's cleanroom laboratories

Myfab have cleanroom laboratories at four universities, with a total area of 5 165 m^2 and a staff of 88 which corresponds to 55,4 full-time equivalents. All labs have a broad set of generic tools and processes, combined with expert profiles, illustrated in brief below:

Myfab Chalmers	Myfab KTH	Myfab Lund	Myfab Uppsala
			
Microwave and Photonic process line Nano and Quantum Technology process line	Si CMOS process line MEMS process line SiC process line Materials and devices for photonics integration Nanoscience based on new active nano and quantum materials	III-V compound semiconductor epitaxy and nanowires ALD Talbot Displacement Lithography Wide band gap materials for power	Materials Science Thin Film Tech. and Surface Science Biomedical Eng. Power Generation and Storage Si Nanoelectronics

Myfab Lund is planning a new NanoLab at Science Village (NLSV). Following the selection of a new landlord in 2024, a design project was launched in November. A full cost evaluation for construction and operation will be completed within two years, guiding the decision on moving forward with the facility. In Myfab Lund, a new SEM, PECVD, XRD and Automatic Resist processing station have been installed. Myfab Chalmers are replacing all ULPA filters, refurbishing the wet benches, installing redundancy for our CDA, installing a new gas alarm system and commissioned a new facility control system that enable to implement further energy savings in the infrastructure, and in addition to the VR-funded instruments, 11 new instruments have been installed. At Myfab KTH a fully automatic chemical process tool, decreasing chemical consumption, was procured, a direct write lithography tool was installed. The reactive ion etch station, equipped with two separate etch chambers for silicon and silicon carbide, was validated and is now available for all users. During 2024 a major upgrade of Myfab Uppsala was initiated, including new ventilation and DIW production. The installation of gas flow meters to monitor the distribution of N2 consumption enabled us to accurately invoice for the user's consumption, which decreased the cost by 500 kSEK/y. The number of active users is also higher than the year before, and the ratio between new and active users is 38%.

The Myfab laboratories in Lund, KTH and Chalmers, together with Linköping University have been commissioned to be part of the European WBG pilot line 4 from the EU Chips Joint Undertaking, with the main goal of fabricating silicon carbide power devices for the European power electronics community. All four Myfab laboratories have in addition received grants from *Tillväxtverket* for a four-year (2025-2028) project to improve accessibility and relevance for industrial users. The project will improve our level of user support and bring some new tools to our lithography, etch and backend processing, and for a project on semi-automatic chemical processing that will increase the reproducibility of the processes, reduce the chemical consumption, and increase the working environment safety.

International networking, user meetings and expert groups

The Nordic Nanolab Network (NNN, http://nordicnanolab.net/) is an established collective of research infrastructures across the Nordic Countries[1]. The 12 Nordic laboratories collaborate on the management, expert and user levels. NNN's Nordic Nanolab User Meetings (NNUM) is arranged every 2nd year. The latest NNUM was arranged by NorFab (http://nordicnanolab.se/NordicNanolabNetwork/NNUM2024.aspx) 3–4 June 2024 in Oslo

[1] NorFab Norway, DTU Nanolab Denmark, OtaNano/Aalto University and VTT Finland, and the University of Iceland.

with 300 participants. Two NNN management meetings were held during 2024: 21–22 May in Fredensborg Denmark and 22–23 October in Horten, Norway. Myfab's technology expert staff actively participate in five different thematic groups in Nordic Nanolab Expert Network (NNEN). These NNEN groups are responsible for planning and executing parallel tutorial sessions, the core part of NNUM, where various fabrication techniques available to the users are presented and discussed.

EuroNanoLab and European Nanofabrication Research Infrastructure Symposium. Myfab is a member of and contributed historically to the formation of EuroNanoLab[2] (ENL, https://euronanolab.eu/). ENL is, very much like NNN, inspired by the modus operandi and the user-fee based open access that Myfab has developed. Essential parts of the collaboration are the ENL expert groups and the arrangement of the biennial European Nanofabrication Research Infrastructure Symposium (ENRIS, https://enris2025.org/), which will be arranged next time in Bologna 13–15 May 2025. Thomas Swahn acts as chairman for the ENRIS 2025 program committee.

Organizational Changes

Myfab's Steering Group has a new chairperson since 1 November 2024 as Professor Anne Borg, NTNU, succeeds Professor Mikael Östling, KTH, who also resigned from the steering group. Professor Jane Hvolbaek Nielsen, DTU, resigned from the steering group meeting early September. Eva Hellberg, Myfab's Outreach and Support Systems Officer (50%) started on 1 September. At Myfab Chalmers five new staff members are hired, where two are retirement replacements. With the coming EU Chips pilot-line at least one additional staff member will be hired. At Myfab KTH two retirements took place followed by the appointment of one new Director at the Electrum laboratory on 1 September and one new technical staff at the Electrum Laboratory and one at Albanova Nanolab. At Myfab Lund one staff member has been hired and two have left the organisation. At Myfab Uppsala the organization was essentially stable during 2024.

Steering Committee's Work

The Steering Groups actively oversees the development of Myfab, provide strategic guidance and take decisions on, e.g., budget. During 2024, the Steering Group has among other things addressed issues related to the VR evaluation, the participation in the pilot line within the European Chips Act, strategic recruitments and investments, as well as Myfab's relationship with local labs in Sweden. Myfab's steering committee has conducted four meetings during 2024: 22–23 January in Gothenburg, an electronic meeting 12 June, a meeting in Uppsala 16–17 September and an electronic meeting 11 November, the first meeting after Professor Anne Borg started to act as chairman.

Financial Outcomes

The Myfab steering group decides on the distribution of funds from the VR grant for operations and investments (grant Dnr. 2019-00207). For a complete financial report from the laboratories, we refer to the auditors' reports. Myfab's account "Common", used for management and organizational has had costs in 2024 of 3 845 344 SEK and the Myfab Access program 40,876 SEK. As there were unspent funds on Common and Myfab Access from previous years, 1 458 025 SEK has been reallocated to operating funds for 2024. In total, over five years, Myfab Common has used 13 925

[2] Current members of ENL, in addition to Myfab, are: RENATECH France, NorFab Norway, NanoLab NL the Netherlands, CEITEC the Czech Republic, NCNR Italy, INL Portugal and Spain, DTU Nanolab in Denmark and KU Leuven Belgium.

142 SEK, Myfab Access 162 833 SEK and Myfab LIMS 3 940 000 SEK. The table below represents the full-year 2024 for Myfab's four laboratories [kSEK].

	Myfab Chalmers	Myfab KTH	Myfab Lund	Myfab Uppsala	Myfab all labs
Faculty grants	36 918	17 686	22 499	11 708	88 811
Fees, academic	16 335	19 427	4 079	7 927	47 768
Fees comp. incl. RISE	22 761	36 614	3 912	4 010	67 297
Myfab VR grant	4 434	4 384	4 314	4 334	17 983
Financed depr.	8 444	9 301	5 096	4 756	27 527
Projects SSF, EU	1 056	6 242	0	0	7 298
Services	201	0	1 956	299	2 209
Income Total	90 149	93 654	41 856	33 034	258 893
Personnel	21 248	12 024	9 598	8 445	51 315
Rent premises	19 187	36 630	8 508	12 466	76 791
Operation	21 077	39 245	8 706	7 410	76 438
Overhead	6 412	3 681	3 708	2 199	16 000
Financed depr.	8 444	9 301	5 096	4 756	27 527
Depreciations	6 876	5 233	4 080	0	16 258
Costs Total	83 244	106 114	39 696	35 276	264 329
Result	6 905	-12 460	2 160	-2 242	-5 436

Risk Analysis

Below we summarize the main risks identified for Myfab in a tabular form.

Risk	*Module*	*Risk description*	*Prob.*	*Cons.*	*Value*	*Risk owner*
1	2,3	Insufficient staffing	2	3	6	Myfab, Universities, VR
2	1,2,3	Loss of key competence	2	3	6	Myfab, Universities, VR
3	5	Inadequate renewal of equipment	1	3	3	Myfab, Universities, VR, other sources
4	2,5	Cost increase	3	2	6	Myfab, Universities, VR
5	2,3,5	Insuff. research project funding	2	3	6	VR, VINNOVA, SSF, KAW
6	1,2,3,4,5	Shift in university priorities	1	3	3	Universities
7	2,3	Discont. renewal Myfab Lund	2	2	4	Lund University
Low risk 1-2		**Medium risk 3-4**		**High risk 6-9**		

Educational Initiatives, Outreach, and User Support

Each year, the labs host courses for around 500 students in subjects related to semiconductor fabrication and technology, many of them completing diploma theses and 47 receiving Ph.D. Thesis. In 2024, about 268 new users received introduction training, highlighting the crucial role of skilled staff. A communication network with university representatives was established for consistent messaging. A communication strategy, content plan, and annual wheel were developed. Profile materials and channels were managed, new photographs collected, and a new user-friendly homepage was initiated in December. Myfab LIMS development includes a

new improved electronic logbook for the tools. This couples to the ongoing development of the process manager module. Now we are ready for the third part of the process manager, the run sheet documentation. In addition, we have developed a ticket system for fault reports and to do lists. We have also finally found what seems to be a long-term solution on how to send e-mails from the system with reduced risk of being sorted out by junk mail filters.

Gender Equality Plan

Myfab is committed to fostering an inclusive and equitable environment where all individuals, regardless of gender, can thrive and contribute to our mission. All Myfab's staff are either employed at one of Myfab's host universities or at Chalmers Industriteknik, and it is their respective gender equality plans that apply to Myfab's staff. In line with these policies, Myfab ensures equal opportunities for all staff, career development, and leadership roles. Currently, a gender equality plan specifically for Myfab does not exist but will be developed and reported to VR by 31 October 2025.

Comments on Key Figures

Myfab has access to excellent statistics through its Myfab LIMS system. In addition to data in the compulsory Key Numbers form (Annex A1), we have accumulated data in a standardised report (Annex A2) since more than a decade and a half. For 2024 we see an increase in most usage related number: number of users +57 to 877 (almost perfectly gender-balanced: +28 female and +29 male), number of booked hours +11,8% (to 161195 hours). The increase in the number of hours should be seen in the light of the fact that during Myfab's 5th period we have invested in more efficient equipment, which reduces the time spent in the lab while enabling better quality.

Comments on Publication list

In contrast to the increased number of users and booked hours, we see a decrease in the number of peer-reviewed publications as compared to earlier in the period. Thers is of course a delay between when the work was carried out and when the work is published. So even though we don't know why this is happening, we speculate that it reflects to some extent the cleanroom activities over the last 1-2 years and that if so, it could mean that the number of publications will increase in the coming years. Maybe the decreased activity (-14%) during the pandemic is reflected in fewer publications as well. Currently, the process to find and report publications is a manual process. We have discussed, and the steering group might decide to introduce a new and mandatory process for users to continuously report their publications to a Myfab database for this purpose. This would facilitate the annual reporting and ensure that it is done in a more comparable way each year as the human factor is partly eliminated.

Other

Myfab was evaluated by VR during 2023–2024 (Annex A). Some quotes from the summary of the evaluation were that "Myfab works very well, it lives up to the demands that can be placed on a national, distributed research infrastructure, and that it fulfils an important function from a national perspective (there is an important added value in coordinating the distributed national nodes in a common mission to a national, distributed research infrastructure)." Some shortcomings were also identified, and valuable recommendations are given.

Annexes

Key Numbers, "A1. Myfab 5 – Key Numbers 2024.xlsx".
Myfab LIMS Statistics 2024 and 2023, in "A2. LIMS statistics 2024 and 2023.pdf".
Publications and Doctoral Thesis, in "A3. Myfab Publications and Doctoral Thesis 2024".
Strategic Investments, in:" A4. Myfab tools financed by VR during period 5.pdf"
Evaluation report, in "A5. Evaluation report Myfab Nov 2024.pdf"

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3D printing of hierarchical structures made of inorganic silicon-rich glass featuring self-forming nanog
Transparent Programmable Luminescent Tags Enabled by Spiro [fluorene-9, 9′-xanthene]-Based Hol
Ultrafast Metal-Free Microsupercapacitor Arrays Directly Store Instantaneous High-Voltage Electricity
Monolithic Fabrication of Metal-Free On-Paper Self-Charging Power Systems
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A Novel Frequency-Sweeping Scanning Notch Beam Radar at 238-248 GHz
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A swirl nozzle and methods of fabricating the same
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Bolaget ska bedriva utveckling, tillverkning och försäljning av produkter och teknologi inom hudvård, l
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essen, Germany
SUSTech, Shenzhen, PR China
uit Technology ICSICT, Oct 22-25, 2024, Zuhai, PR China

ISBN 978-91-8040-916-2, TRITA-EECS-AVL-2024:41
ISBN 978-91-8040-847-9, TRITA-EECS-AVL-2024:18
ISBN: 978-91-8040-973-5, TRITA-EECS-AVL-2024:57
ISBN: 978-91-8040-911-7, TRITA-EECS-AVL-2024:37
ISBN: 978-91-8040-964-3
ISBN: 978-91-8040-842-4
ISBN: 978-91-8106-130-7
ISBN: 978-91-8040-810-3

ISBN: 978-91-8040-797-7
ISBN: 978-91-8040-885-1
ISBN: 978-91-8040-841-7
ISBN: 978-91-8040-830-1

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Myfab Uppsala – Scientific Output 2024

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