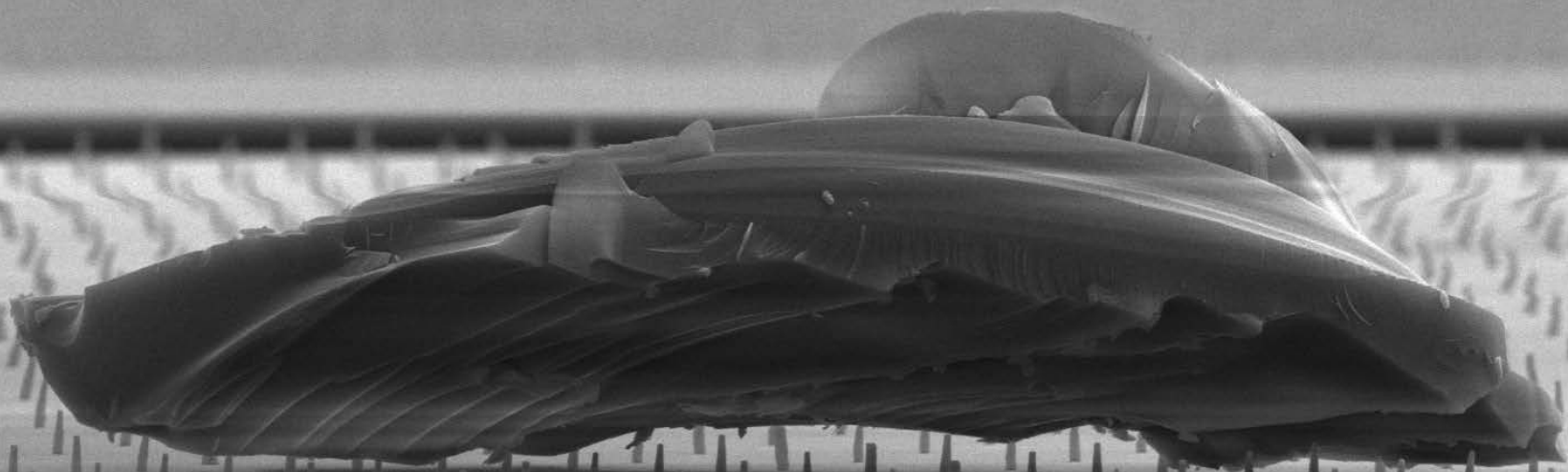


NTNU NanoLab
Leiestedsmodellen



Ida Noddeland
Lableder NTNU NanoLab

Vad är NTNU NanoLab?

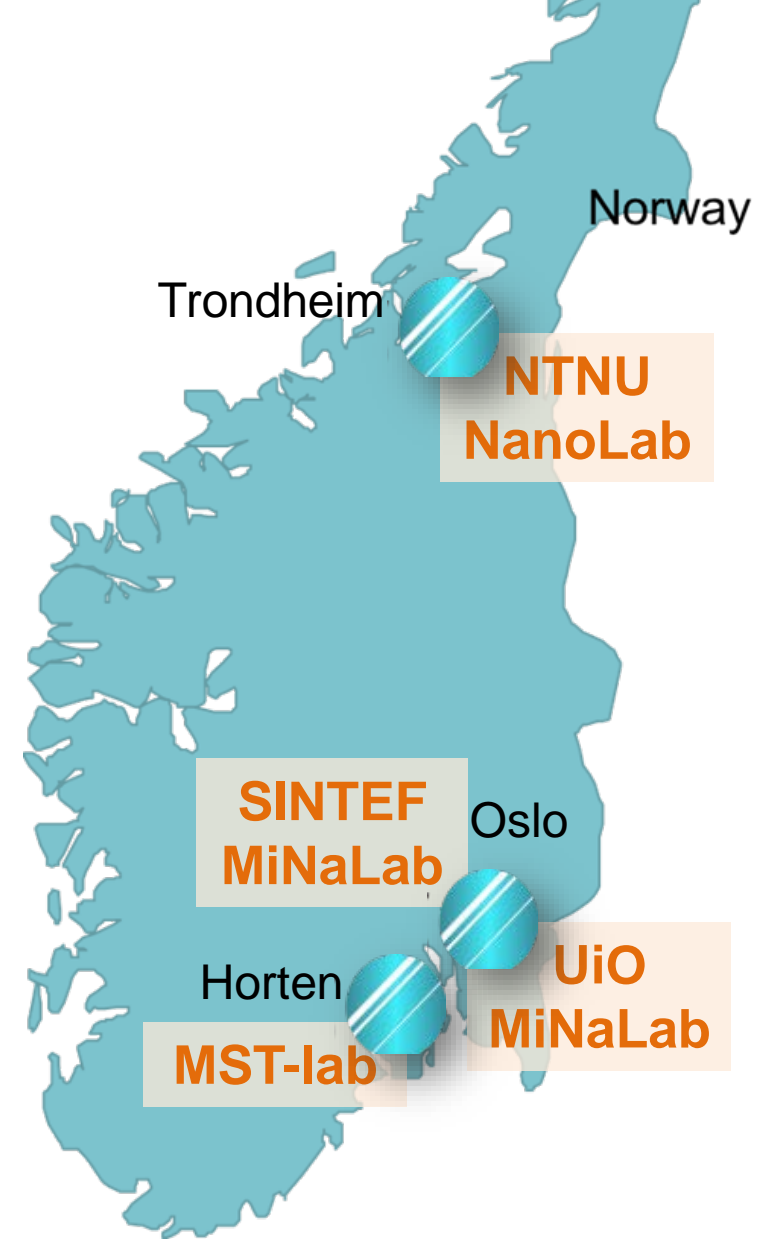
- 700 m² renrum
- Dyr infrastruktur
- Öppen infrastruktur, hands on modell
- Del av NorFab



Vad är NorFab?

- Nationell infrastruktur för μ - och 10^{-9} teknologi
- 4 «noder» (3 UH, 1 SINTEF), 4 leiested
- Olika kostnads- og finansieringsmodeller
- Én infrastruktur – ett pris oavsett tillhörighet

- Godt samarbeid og spleiselag
- Svært høye drifts og investeringskostnader
 - 100 MNOK investering og drift per år
 - 40% dekkes av egenandel fra eierne
 - 25% dekkes av NFR
 - Resterende dekkes av brukerbetaling
- Betydelig egeninnsats fra eierinstitusjonene
- Nationellt program för forskningsinfrastruktur





Technologies



The technologies offered at NorFab are divided in the following nine categories:

Thermal processes

Lab Facilities



NorFab provides access to state-of-the-art laboratories for Norwegian researchers, independent of their academic, institute or company affiliation. The laboratories include the

News

Official opening of NTNU NanoLab's new FIB and SEM



The acquisition of a new FIB combined with a SEM at NTNU NanoLab was officially marked with an opening on June 16, 2017.

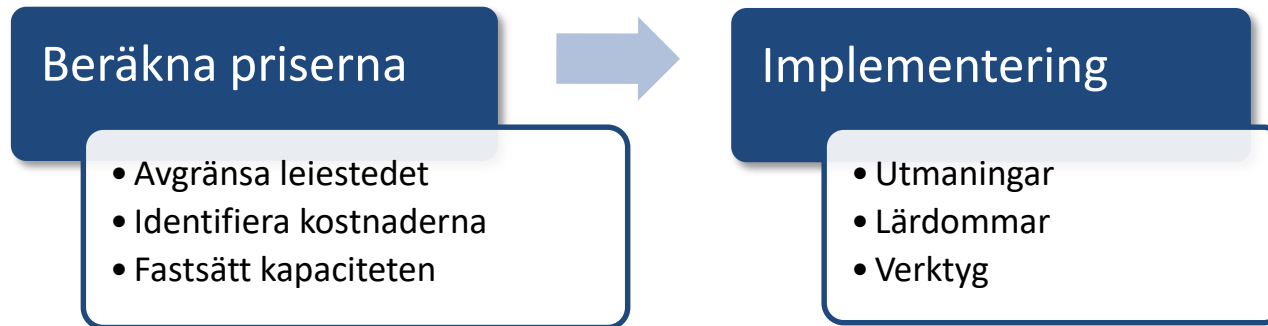
ENRIS and NNUM 2017



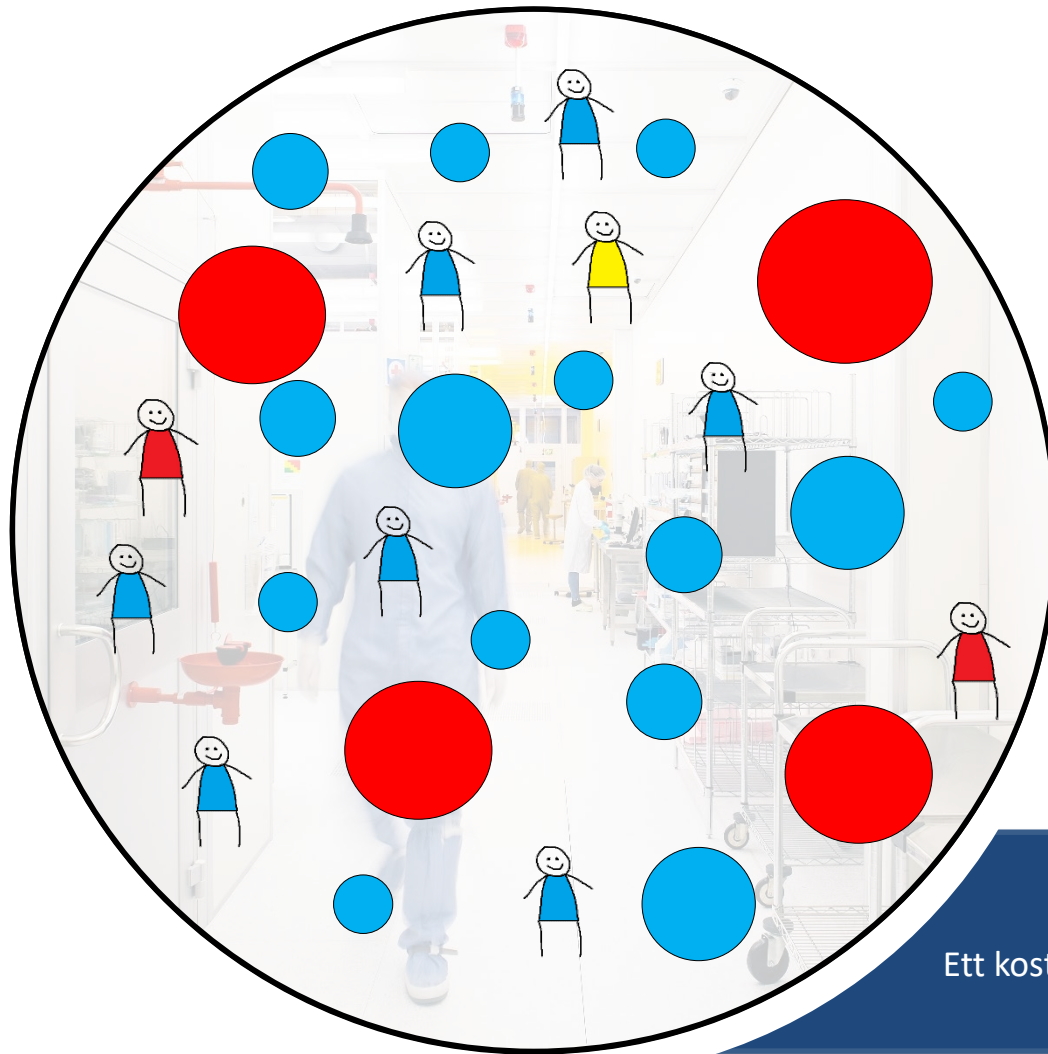
The conferences ENRIS and NNUM were arranged in Trondheim 8-10 May, hosted by NorFab.

NorFabs prispolitik

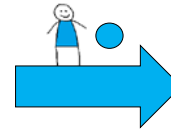
- NorFab – gemensam prispolitik från 2011
- NTNU NanoLab – implementering av leiestedsmodellen i 2014
 - ✓ Förenkling
 - ✓ Förankrade i verkligheten



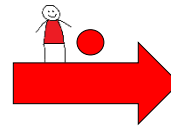
Avgränsning av leiestedet



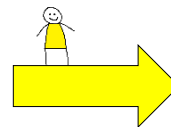
700 m²
Ett kostnadssted



Inngang - Klargjøring till forskning
Renhet, standardkemikalier,
standardgas, träning, vedlikehold,
brukerstøtte. 80 instrument



Tilläggspris for bruk
20 instrument i 2 prisgrupper
Extra støtte og vedlikehold,
extra driftskostnad



Tilläggspris for teknisk bistand
Operatørstjånst

Identifiera kostnaderna



NanoLabs driftsmodell

Kostnadsmodell

Lønn

Drift

Husleie

Investeringer

27 MNOK

Finansieringsmodell

NTNU:

Grunnfinansiering Rektor

Grunnfinansiering Fakulteter

Husleie

AVIT

NFR:

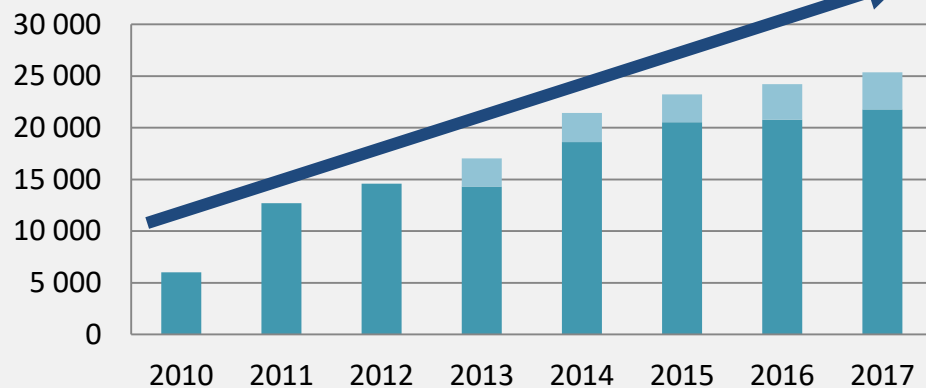
NorFab

Brukere:

Brukerbetaling

22000 renrumstimmar

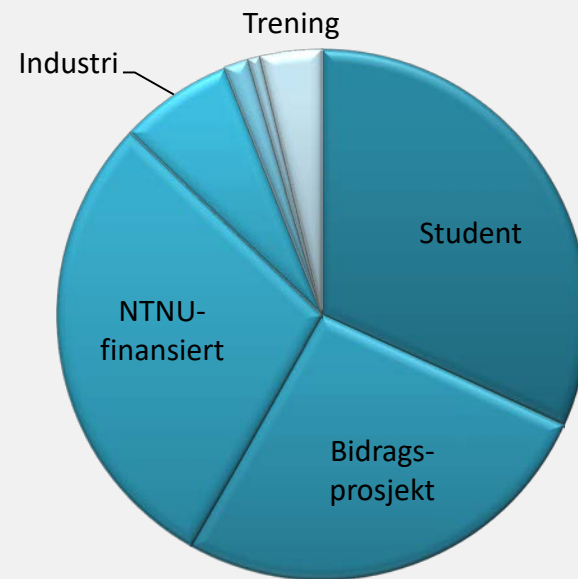
User Hours NTNU NanoLab



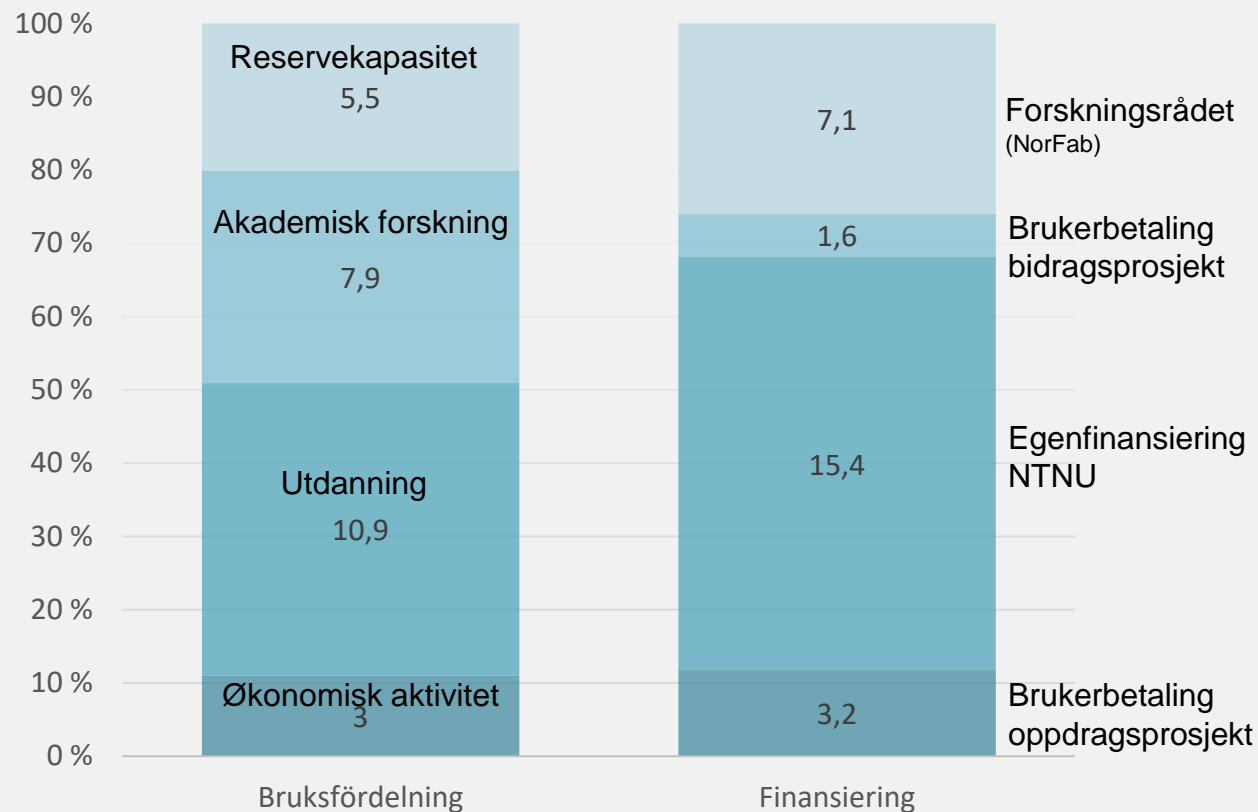
■ User hours ■ Training hours

Kapasitet (h/år)	25 000
Driftskostnader (MNOK/år)	17
Totalkostnader (MNOK/år)	27

User hours by user category



Kostnadsfordeling



Finn kostnader – instrument A

Type Pricing	Post				Total	%	Total SUM
Teknisk støtte		# hours/ month	hours/ year	hourly rate			
	NanoLab Engineers	27,64	331,62963	371	122 996		kr 122 996
	Service contract/visit				0		kr -
	SUM						kr 122 996
Driftskostnader							
	Targets				288 258		kr 288 258
	Gas				0		kr -
	Consumables and other costs				134 970		kr 134 970
	SUM						kr 423 228
Husleie							
	Building rent					# kvm	
	SUM						kr -
Avskrivning				Years			
	Upgrades					x	kr -
	Purchasing price				12	2 600 000	
	Purchasing price NTNU				12	100 000	kr 8 333
	Purchasing price NFR				12	2 500 000	kr 208 333
	Installation costs, hardware						kr -
	Installation costs, engineer hours						kr -
	SUM						kr 216 667
	Annual costs Academia (Bidragsprosjekt)						kr 554 558
	Annual costs Industry (Oppdragsprosjekt)						kr 762 891

Finn kostnader - renrum

				total sum		Total sum
Teknisk støtte		timer / måned	timer/år	timelønn		
	Direktør og koordinator		1628,00	1 015	kr	1 653 200
	Lableder		1628,00	397	kr	646 100
	Ingeniør 1	104,47	1253,66	361	kr	453 181
	Ingeniør 2	155,77	1869,19	371	kr	693 252
	Ingeniør 3	59,46	713,51	376	kr	268 003
Drift	Renroms-spesifikke utgifter	80370140	N20352	332 253	kr	332 253
	Generelt labrekvisita	80370140	N20351	600 906	kr	600 906
	Infrastruktur	80370140	N20356	666 259	kr	666 259
	Gas	80370140	N20354	27796	kr	27 796
	Oppgraderinger	80370090	-		kr	-
	Instrumentkostnader	80370140	N20355	518970	kr	518 970
	Kjemikalier	80370140	N20353	134 220	kr	134 220
Husleie (tekniske rom)		m2	pris /m2			
		1716,063	2302	3 950 377	kr	3 950 377
Avskrivningar						
	Alle små instrumenter			9 000 000	12 kr	750 000
Årlig kostnad Akademia (Bidragsprosjekt)					kr	10 694 517
Årlig kostnad Industri (Oppdragsprosjekt)					kr	10 694 517

NanoLabs investeringsplan

all numbers in MNOK				pre NorFab		NorFab I					NorFab II					NorFab III					NorFab IV					Totalt			
Technology area	Equipment	Invest Year	purchase price / MNOK	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028		2029		
Dry etch	CAIBE	2014	5,3																			4,0	2,0				6,0		
	ICP-RIE (F) / cryo	2009	5,0																5,0								5,0		
	ICP-RIE (Cl)	2009	5,0														4,0										4,0		
	SOA Tørrrets (f.eks. DRIE)																		5,0								5,0		
Thin film/ Deposition	PECVD	2008	3,0													5,0											5,0		
	CVD (Graphen)	2013	1,0																								0,0		
	Sputter coater & evaporator	2012	2,8																			3,0					3,0		
	E-beam evaporator	2005	2,0																								3,8		
	Black magic (Graphene)																										4,0		
	MVD (Anti-sticking layer Nanoimprint)		1,7												1,7											4,0	5,7		
	SOA Deponering (3D printing)																						5,0				5,0		
Furnaces	RTP Si	2007	1,0																								0,0		
	RTP (no gold)		1,3																								1,3		
	RTP (gold)		1,3																								1,3		
Lithography	EBL	2015	14,0									14,0													10,0	10,0	34,0		
	Mask aligner EVG m/ Nanoimprint	2008	3,6																								0,0		
	Mask aligner Suss m/ Nanoimprint	2013	3,6																			4,0					4,0		
	Maskless Aligner MLA	2017	3,6												3,6										4,0	7,6			
	SOA Lithografi (3D Lithografi)																					3,0	3,0				6,0		
Characterisation	FIB	2009	9,8																			6,0	6,0				12,0		
	FIB II	2017	13,0										12,9	1,0										6,0	6,0		25,9		
	HR-S(T)EM	2009	5,5																								7,0		
	AFM	2008	2,5													2,5											5,0		
	Process characterisation SEM	2017	4,6										4,0	1,3											6,0	11,3			
	Micro Raman	2014	2,0																					2,0			2,0		
	Ellipsometer																						2,0				2,0		
	Electrical probe station		1,3																								1,3		
	Optical profiler		1,1																								1,5	3,4	
	SOA Characterisation (e.g. He mikroskop)																						5,0	5,0			10,0		
	Sum Investeringer/utstyr			94,0									0,0	0,0	14,0	16,9	9,5	10,2	5,0	9,0	12,0	16,0	5,0	10,0	14,0	15,0	20,0	11,5	12,5
																												73,0	
																												55,6	
																												52,0	
																												50	
																												10,4	

installed
 under purchasing/installation
 planned new investment

under depreciation, state-of-the-art
 depreciated, should be reinvested
 replacement urgent

Budget 52,0
 Average per year 11,1

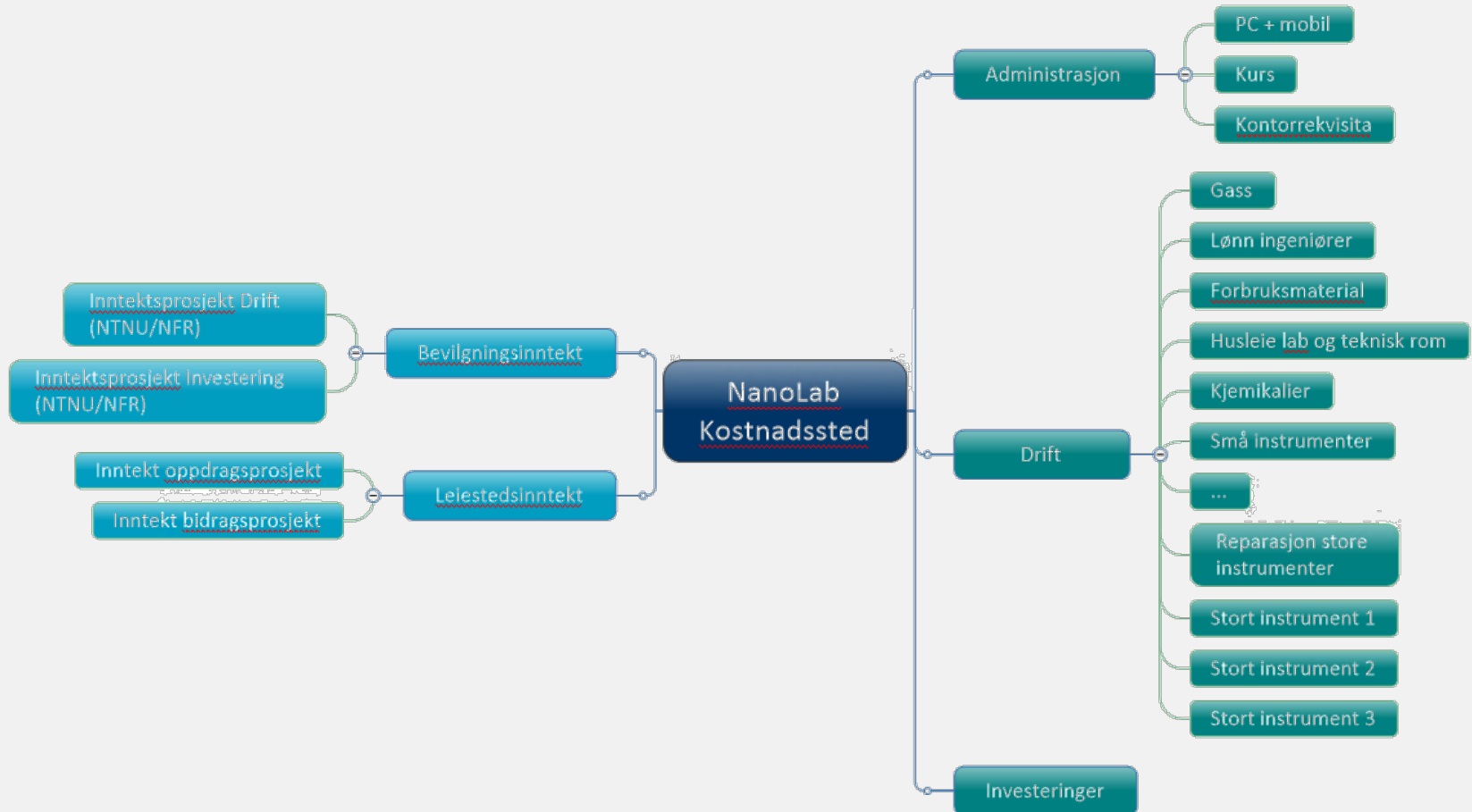
NanoLabs investeringsplan (förenklad)

Utstyr	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Totalt
ICP-RIE (F) / cryo								5,0								10,0
ICP-RIE (CI)						4,0										9,0
FIB							6,0	6,0								21,8
HR-S(T)EM						5,0	2,0									12,5
Sputter coater										3,0						5,8
CVD (Graphen)									5,3							1,0
Mask aligner										4,0						7,6
CAIBE											4,0	2,0				5,3
Micro Raman											2,0					2,0
FIB II		13,0	0,9									8,0	6,0			13,9
MVD			2,4										4,0			2,4
Optical profiler			1,9											1,5		1,9
RTP (no gold)				6,6										6		12,6
PECVD II					8,2										8,7	8,7
Sum Investeringer/utstyr	0,0	13,0	5,2	6,6	8,2	9,0	8,0	11,0	5,3	7,0	6,0	10,0	10,0	7,5	8,7	120,1

Finn kostnader - renrum

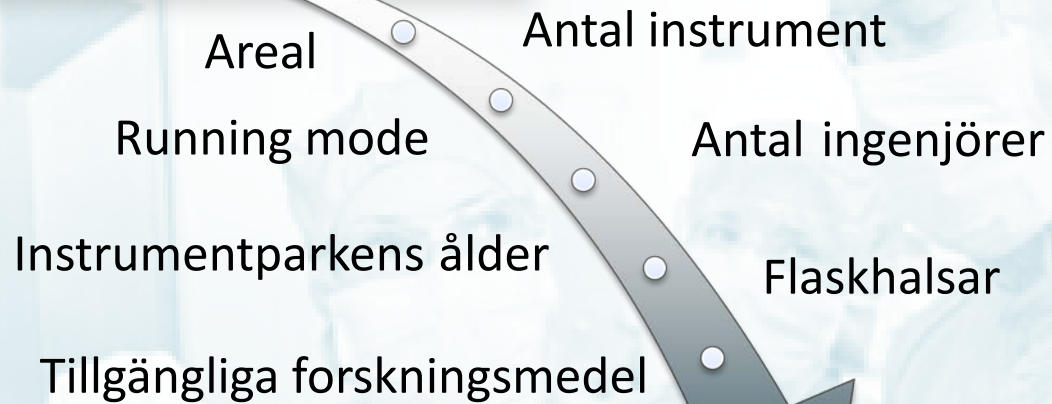
				total sum		Total sum
Teknisk støtte		timer / måned	timer/år	timelønn		
	Direktør og koordinator		1628,00	1 015	kr	1 653 200
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Årlig kostnad Akademia (Bidragsprosjekt)					kr	10 694 517
Årlig kostnad Industri (Oppdragsprosjekt)					kr	10 694 517

Kostnadssted - struktur



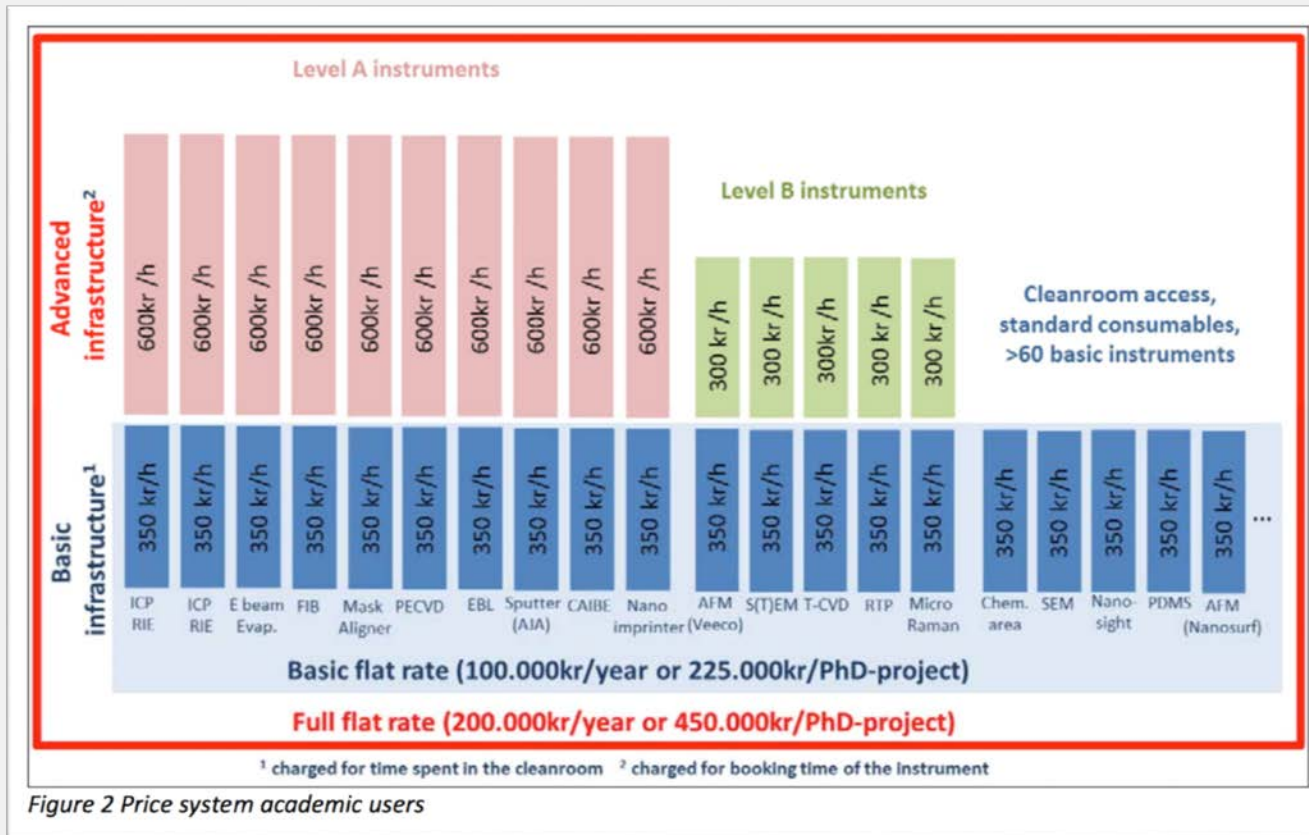
Fastsätt kapaciteten

1 instrument:	8000 timmar
100 instrument:	800 000 timmar



Renrum:	25 000 t
Instrument:	500-2650 t

NanoLabs prispolitikk



$$\text{Price} = \frac{\text{Cost}}{\text{Capacity}}$$

Figure 2 Price system academic users

Utmaningar

- Holdningsändring – enda infrastrukturen på NTNU som fakturerade
- Statstøtteregelverket (forståelse)
- Tidsbruk
- Smutthull i prispolitiken



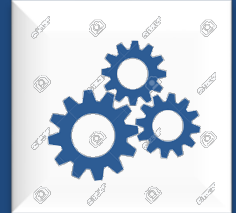
- Kulturändring – övertyga projektledare om att söka driftsmedel
- Identifisere og separere kostnadene
- Drift av ett litet leiested (smørkrise)
- EU-priser



Vad har fungerat?

Samarbete

- Gott samarbete med NFR og NTNU
- God stötte från NTNU sentralt i hela processen
- Blåkopi av myFab



Holdningsskapende arbeid

- Informasjon til prosjektledere (kontinuerlig process)
- Avertering
- Fokus på effektiv drift



Goda verktug

- LIMS – Lab Information Management System
- Finansieringsplan
- Genomtänkt struktur på Kostnadssted



KISS! (keep it simple, stupid)

- Enkel prismodell och flatrates
- Se innsatsen som en god start och jobba vidare





Mer verdiskapning
för innsatsen

Nöjdare kunder

Bättre infrastruktur

Mer bevilgning

Bättre kapacitets-
utnyttjande

Fler projekt

Nöjda kunder

Bra infrastruktur

Långsiktig planering

Effektiv drift

Bra verktyg

Grundfinansiering

Bra storlek
på leisted

Tack!



Forskningsrådet



NTNU

NORWEGIAN MICRO- AND NANOFABRICATION FACILITY

NorFab



Hvilken priskategori?

