THE USE OF BIBLIOMETRICS AT THE WATERLOO INSTITUTE FOR NANOTECHNOLOGY

Lisa Pokrajac[1], Sushanta Mitra[1], Laura Bredahl[2], Shannon Gordon[3]
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Waterloo Institute for Nanotechnology[1]
University of Waterloo [2]
Bibliometrics & Research Community Impact[3]

Overview

1. **Bibliometrics at Research Institutes**: An important tool for benchmarking, reporting, decisions

2. **Methodology:** How we gather and process the data

3. **Future Analyses:** Key takeaways on honing the analysis process

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WHAT IS "WIN"?

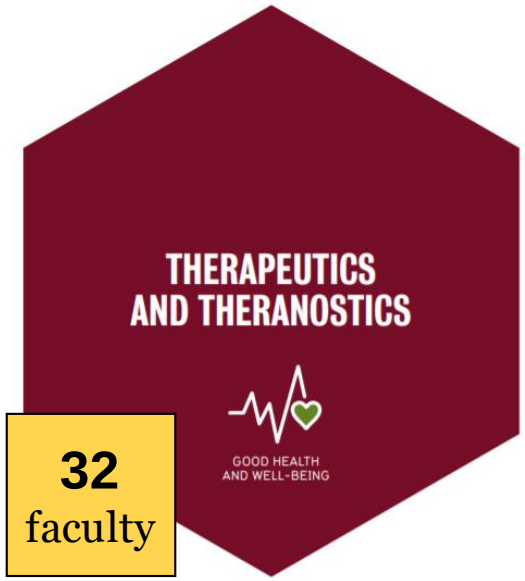
- Largest Nanotechnology Research Centre in Canada est. 2008
- 101 Faculty Members across 11 departments
- 200+ graduate students on-site; 500+ Undergraduate students
- Founding member of the international Network for Sustainable Nanotechnology

KEY THEME RESEARCH AREAS AT WIN:

65 faculty

40 faculty

33 faculty



32 faculty

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Research Impact of Theme Groups: 2015-20

Group (2015-2020)	Total Publications	Total Citations	FWCI	Output in top 10% Citation Percentile	Collab: Nat'l	Collab: Int'l	Collab: Industry
WIN Members (total)	3,780	72,437	1.60	27.5%	11.4%	50.3%	4.2 %
Smart & Functional Materials	2,332	45,829	1.57	27.0%	10.0%	49.4%	3.6%
Connected Devices	1,617	20,222	1.21	20.1%	11.8%	45.7%	4.3%
Next Generation Energy Systems	1,334	39,127	2.14	36.6%	8.9%	50.5%	5.0%
Therapeutics & Theranostics	1,509	26,169	1.48	30.1%	12.7%	50.7%	2.6%

Source: SciVal Field-Weighted Citation Impact (FWCI) calculation

Date of data collection: April 2021

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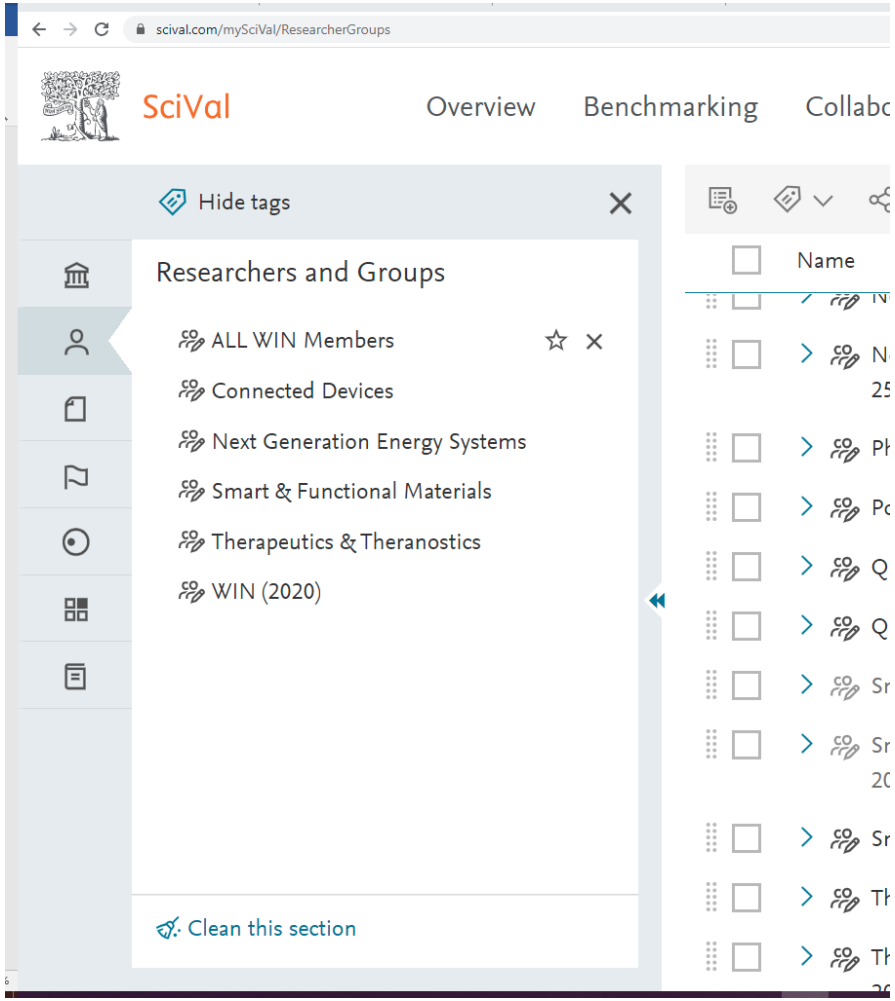
SCIVAL DATA COLLECTION



Modules:

1. Overview
2. Benchmarking

Research and Groups:

- Membership List created by theme areas
- 5 groups created for analysis
- Library generated User Groups
- Data exported

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THEMATIC AREAS & KEYWORDS

Smart & Functional Materials:
Characterization, quantum materials, carbon nanomaterials, natural products

Connected Devices:
Sensors, MEMS/NEMS, ICT, flexible electronics/displays

Next Generation Energy Systems:
Batteries, fuel cells, catalysis, solar, environmental and clean-tech

Therapeutics & Theranostics:
Drug delivery/pharmaceuticals, diagnostic devices/medical imaging

SciVal data collection:
All publications from 2015-2020
Using ALL WIN MEMBERS list

Export data: ~48 parameters including:

- Author affiliations/country
- Citations
- FWCI
- ***Topic Cluster***
- ***Topic Name***

Topic Cluster (TC) & Topic Name (TN) new in 2019:

- TC – high level (~1,500 topics), pulled from aggregation of relevant topics
- TN – granular analysis (100,000^{+} topics), based on citation linkages

TOPIC CLUSTERS vs TOPIC NAME

For WIN's full publication list from 2015-2020 we have
Topic Cluster Name (1,193 entities) vs Topic Name (1,293 entities): Which to use?

Manual Input

Topic Cluster	Scholarly Output	Publication share (%)	FWCI	Prominence percentile	WIN Topic
Advanced Glycosylation End Products; HMGB1 Protein; Pyruvaldehyde	6	0.08	0.45	69.143	Biomaterials
Thermoelectricity; Thermoelectric Equipment; Thermal Conductivity	31	0.21	1.35	88.019	Clean Energy
Secondary Batteries; Electric Batteries; Lithium Alloys	425	0.32	4.13	100	Batteries
Block Co-polymers; Micelles; Polymers	72	0.26	0.96	96.252	Polymers
Quantum Chemistry; Density Functional Theory; Molecular Orbitals	6	0.03	0.24	89.157	Quantum Materials
…etc…					

Manual Input

Topic Name	Scholarly Output	Publication share (%)	FWCI	Prominence percentile	WIN Topic
Accelerator Mass Spectrometry; 14C; Drug Development	2	1.24	0.51	72.519	Characterization Tools
Carbon Quantum Dots; Nanodots; Carbon Nanoparticles	8	0.11	1.5	99.977	Quantum Materials
Anion-exchange Membranes; Alkaline Fuel Cells; Poly(2,6-Dimethyl-1,4-Phenylene Oxide)	5	0.34	5.05	99.777	Fuel Cells
Zinc Air Batteries; Electrocatalysts; Chemical Reduction	60	0.79	4.28	99.991	Batteries
Cantilever; Micro-Electrical-Mechanical Systems; Resonators	9	1.03	1.31	92.935	MEMS
…etc…					

COMPARISON of RESULTS

	Topic Cluster		Topic Name		Control	
	FWCI	#	*FWCI*	#	*FWCI*	#
Characterization	1.37	297	1.83	277	1.36	256
Nanomaterials	1.34	444	1.03	98	0.93	276
Quantum Materials	1.16	163	1.35	142	1.47	248
Polymers	1.07	262	1.5	222	1.22	222

"Reasonable" Match

	Topic Cluster		Topic Name		Control	
	FWCI	#	*FWCI*	#	*FWCI*	#
Sensors & Actuators	0.78	29	1.09	77	0.81	109
Displays/Flex	0.9	127	0.96	173	0.93	186
Info/Comms	1.7	56	1.03	31	1.75	120
Electronics/devices	1.38	115	1.65	223	1.2	140

"Reasonable" Match

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COMPARISON of RESULTS

	Topic Cluster		Topic Name		Control	
	FWCI	*# Pubs*	*FWCI*	*# Pubs*	*FWCI*	*# Pubs*
Batteries	4.1	431	4.21	382	4.04	436
Fuel Cells	1.78	106	2.02	108	1.08	111
Clean Energy	1.12	186	1.51	172	1.25	255
Solar	1.14	156	1.75	59	1.35	71

"Reasonable" Match

	Topic Cluster		Topic Name		Control	
	FWCI	*# Pubs*	*FWCI*	*# Pubs*	*FWCI*	*# Pubs*
Drug delivery/ biomaterials	1.26	499	1.14	333	1.25	553
Diagnostic devices/ imaging	1.86	240	1.69	80	1.96	194

Topic Cluster and Control have a reasonable match

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CONSIDERATIONS & FUTURE STEPS

Preliminary results: first experiments on using Topic Clusters and Names for deeper analyses

To ***optimize method*** to match Clusters/Names with WIN-related research categories
- Publication Title + Author + Topic Cluster + Topic Name + any other info available
- Ideally authors to assign categories (but may get low compliance)

Challenges:
- Cross-disciplinary research spans many categories
- Very time-consuming to sort all data consistently (for database)

Future steps:
- Generate standard database for mapping TC and TN to WIN-related research topics
- Create an automated system for assigning topic categories to publication sets

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KEY TAKEAWAYS

In-depth study of research impact at the granular level for **University Centres/Research Institutes**

Considerations going forward:

1. Is there a 1 to 1 relationship of documents and topics?
2. Is there an acceptable error rate?
3. Research Areas function in SciVal?

Bibliometric tools:

- Can provide better understanding of research themes within WIN's 4 thematic areas
- Identify strengths, weaknesses and opportunities
- Promote research excellence, potential partnerships, help guide decisions, allocation of resources

Questions?

Thank you!

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