Computing Requirements of Sri Lankan Scientific Community

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Contribution

- Sri Lanka's ICT infrastructure has significantly improved over last decade
  - Better ICT → Better access to world-class knowledge, research resources, & collaboration opportunities
- But, overall growth & significance of research findings haven't meaningfully improved
- We attempt to understand current state of research resources, adoption, needs, & challenges
  - Used surveys & interviews
- Also, propose several short & long term solutions to address some of the key challenges

Motivation

- ICT infrastructure in Sri Lanka has improved significantly over the last decade
  - Sri Lanka ranked 76 in 2014 Networked Readiness Index (NRI)
  - Above all of its South Asian neighbors

Rank	Country/Economy	Value	2013 rank (out of 144)
75	Romania	3.95	75
76	Sri Lanka	3.94	69
77	Moldova	3.89	77
78	Philippines	3.89	86
79	Mexico	3.89	63
80	Serbia	3.88	87
81	Ukraine	3.87	73
82	Ecuador	3.85	91
83	India	3.85	68
84	Vietnam	3.84	84
85	Rwanda	3.78	88
86	Jamaica	3.77	85
87	Tunisia	3.77	n/a
88	Guyana	3.77	100
89	Cape Verde	3.73	81
90	Peru	3.73	103
91	Egypt	3.71	80
92	Kenya	3.71	92
93	Dominican Republic	3.69	90
94	Bhutan	3.68	n/a
95	Albania	3.66	83
96	Ghana	3.65	95
97	Lebanon	3.64	94
98	El Salvador	3.63	93
99	Morocco	3.61	89
100	Argentina	3.53	99
101	Guatemala	3.52	102
102	Paraguay	3.47	104
103	Botswana	3.43	96
104	Iran, Islamic Rep.	3.42	101
105	Namibia	3.41	111
106	Venezuela	3.39	108
107	Gambia, The	3.38	98
108	Cambodia	3.36	106
109	Lao PDR	3.34	n/a
110	Zambia	3.34	115
111	Pakistan	3.33	105
112	Nigeria	3.31	113
113	Suriname	3.30	117
114	Senegal	3.30	107
115	Uganda	3.25	110
116	Honduras	3.24	109
117	Zimbabwe	3.24	116
118	Kyrgyz Republic	3.22	118
119	Bangladesh	3.21	114

[1] B. Bilbao-Osorio, S. Dutta, and B. Lanvin, "The global information technology report 2014," World Economic Forum, Geneva, Switzerland, 2014.

Motivation (Cont.)

- In terms of research impact & innovation, Sri Lanka ranks below its South Asian counterparts

	Country	Documents	Citable documents	Citations	Self-Citations	Citations per Document	H index
1	China	3.129.719	3.095.159	14.752.062	8.022.637	6,81	436
2	Japan	1.929.402	1.874.277	23.633.462	6.832.173	13,01	694
3	India	868.719	825.025	5.666.045	1.957.907	8,83	341
4	South Korea	658.602	642.983	5.770.844	1.281.366	11,49	375
5	Taiwan	446.282	434.662	3.993.380	930.383	11,35	300
6	Hong Kong	180.958	172.610	2.448.025	340.370	15,53	325
7	Singapore	171.037	163.153	2.051.237	278.461	14,42	308
8	Malaysia	125.084	121.714	497.646	133.502	8,68	145
9	Thailand	95.690	91.925	790.474	134.626	12,09	190
10	Pakistan	70.208	67.491	328.281	94.655	6,95	130
11	Indonesia	25.481	24.461	185.695	20.750	11,86	126
12	Bangladesh	23.028	22.286	147.791	28.986	9,26	112
13	Viet Nam	20.460	19.854	161.813	23.690	12,89	122
14	Philippines	15.419	14.601	179.820	19.058	15,09	131
15	Sri Lanka	9.637	9.079	76.926	7.582	10,78	96
16	Uzbekistan	8.138	7.975	34.597	6.568	4,41	58
17	Kazakhstan	7.423	7.274	26.836	4.223	5,03	59
18	Nepal	7.007	6.398	53.576	6.853	10,76	80
19	Macao	3.178	3.061	11.515	1.586	6,61	41
20	Mongolia	2.576	2.494	21.967	2.397	14,55	61
21	North Korea	2.235	2.200	30.424	225	12,89	67
22	Cambodia	1.858	1.712	21.412	2.390	14,25	57
23	Brunei Darussalam	1.634	1.423	11.058	1.010	10,38	44

[2] Scimago Lab, "SCImago journal and country ranking," Available: http://www.scimagojr.com/countryrank.php

Motivation (Cont.)

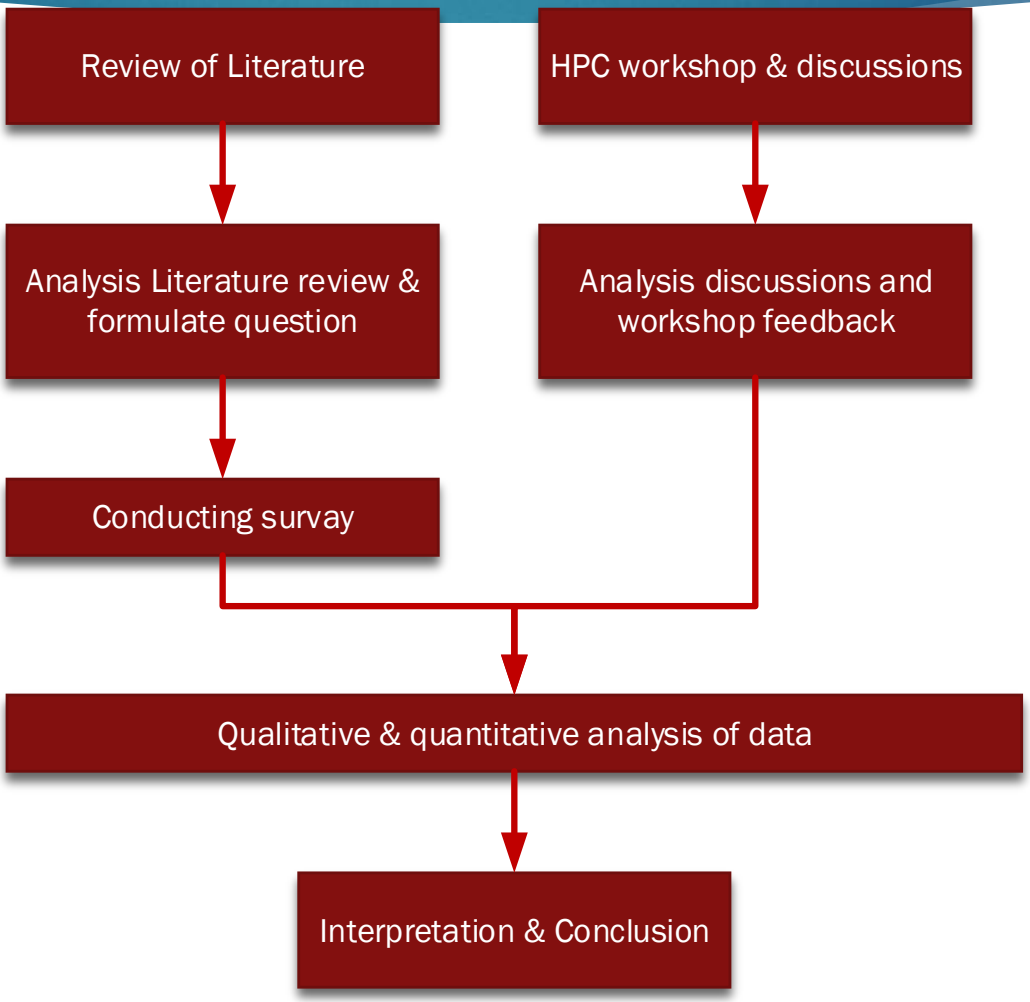
- HPC & cloud computing lead to innovation-driven economies [3]
  - Better ICT infrastructure → Greater research & innovation atmosphere
  - Europe Union (EU) has identified, HPC as one of the key enablers in 21st century research & innovation
  - EU introduced a roadmap prioritizing key areas of development, promote & sustain HPC, & HPC-led research
- Where as Sri Lanka seems to be giving less attention to developing research infrastructure
- While EU guidelines can be applied to us, we need to 1st understand where we stand & our unique needs & priorities

[3] Battelle and R&D Magazine, "2014 global R&D funding forecast," M. Grueber and T. Studt, Dec. 2013.

Research Problem

- In this research, we attempt to answer following questions:
  - What is the current state of computing resources available for research?
  - What are the needs & challenges faced by researchers?
  - What are potential solutions?

Methodology



Methods & Data Collection

- Total population – 2,759
  - 12 state universities
  - 5 private universities
  - 3 research institutes
  - 7 R&D teams from software development companies
- Sampling method – Quota sampling
- Sample Size – 651
  - 23.6% of the total population
- Responses – 147
  - Overall response rate of 22.6%

Demographics

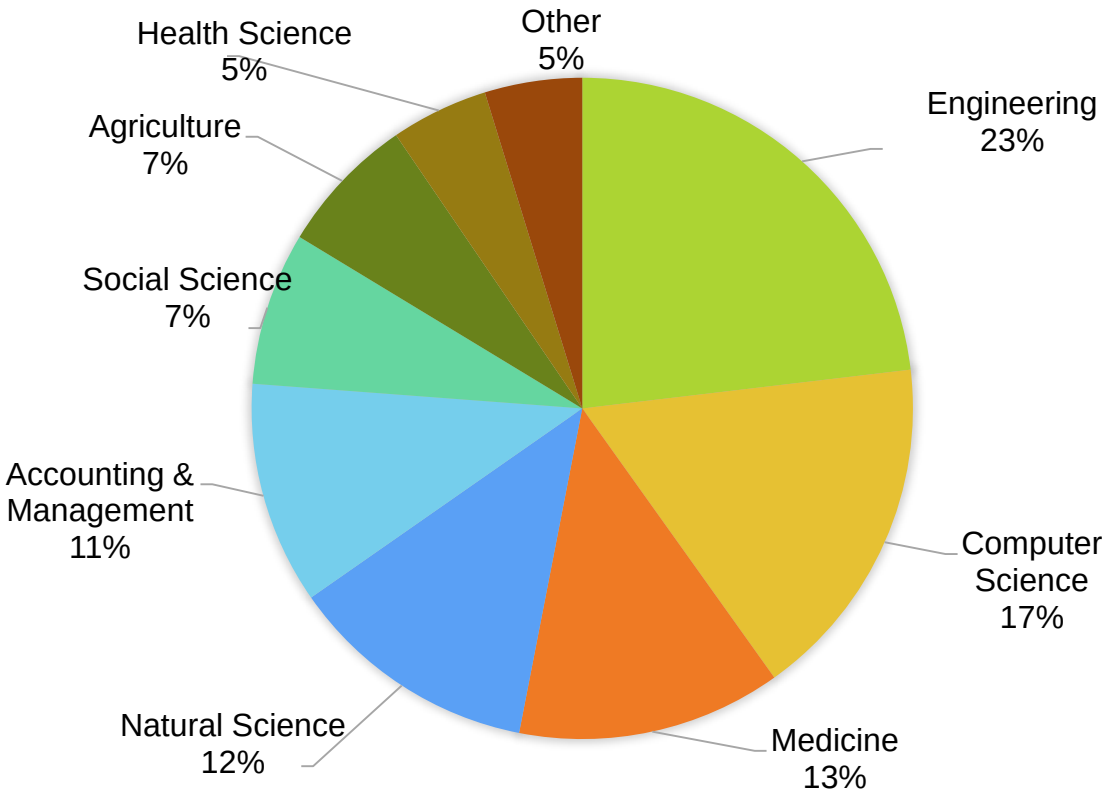
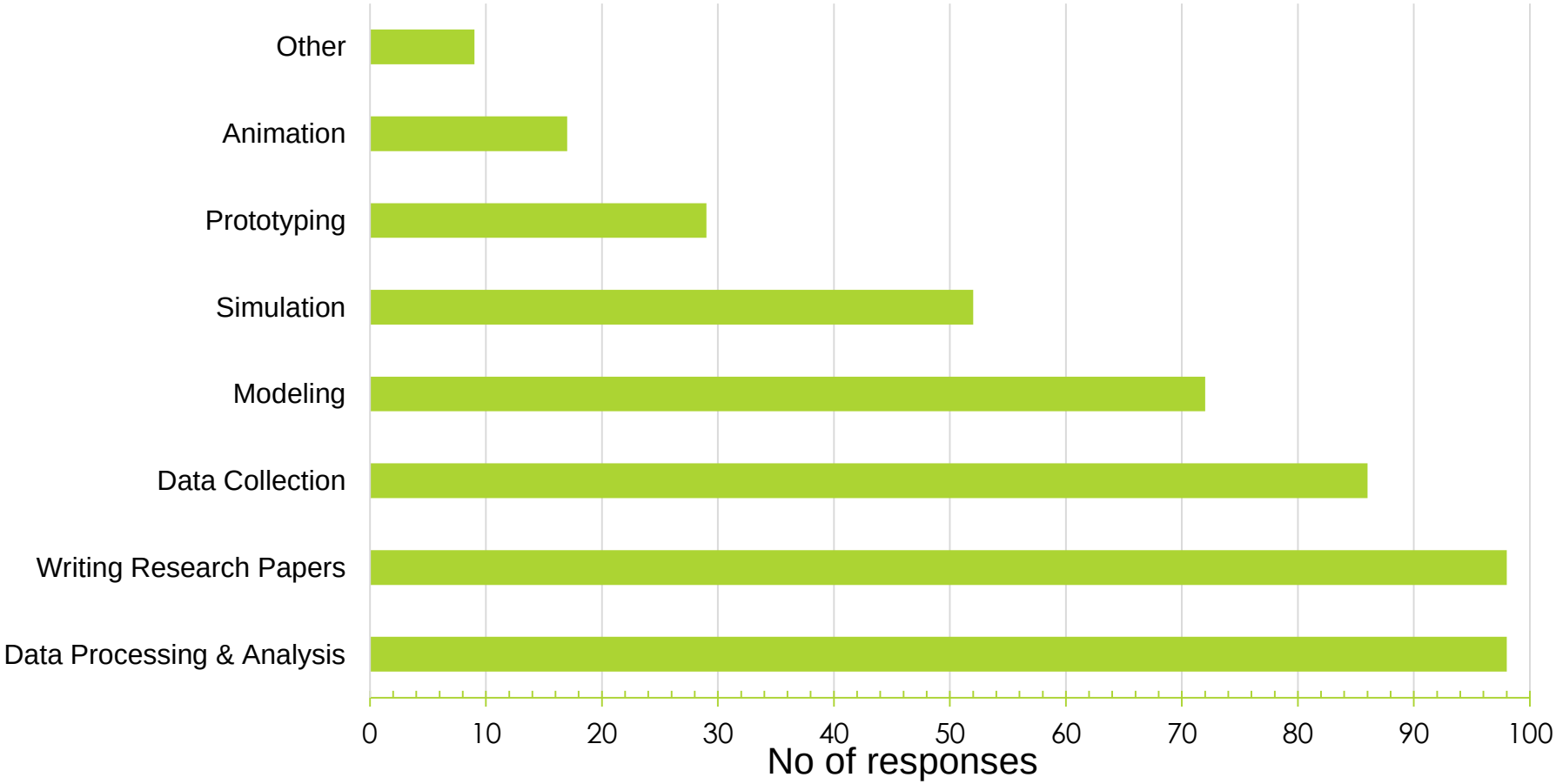


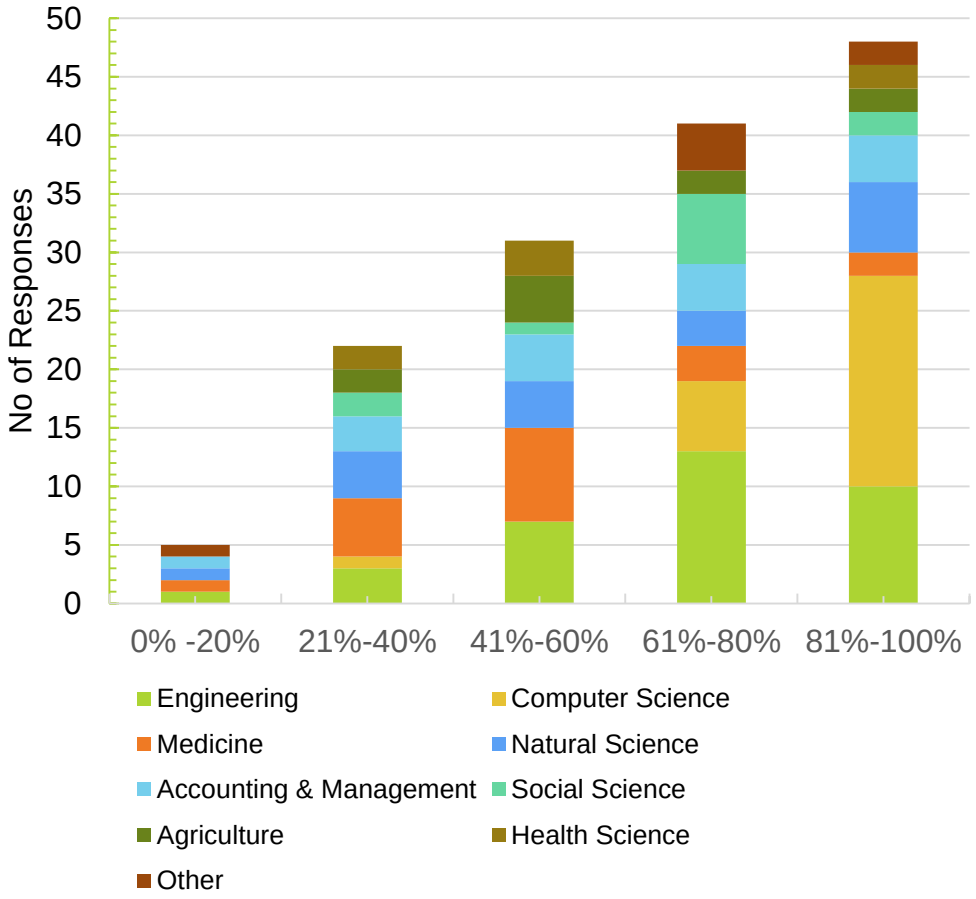
Fig. 1. Distribution of major area of research.

- 79 (53.7%) participants were Senior Lecturer or above
- 37 (25.2%) participants were Lecturers
- Rest include R&D Engineers, Research Assistants, Research Fellow, & Postgraduate Students
- 30 (20.4%) participants were under age 30
- 51 (34.7%) between age 31 - 40, & rest were above age 40

Computing Resources Utilization

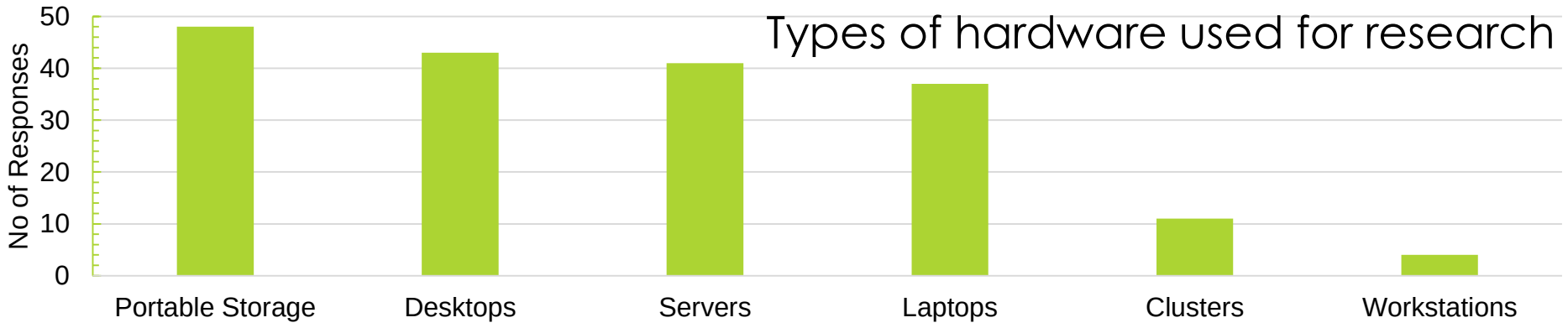


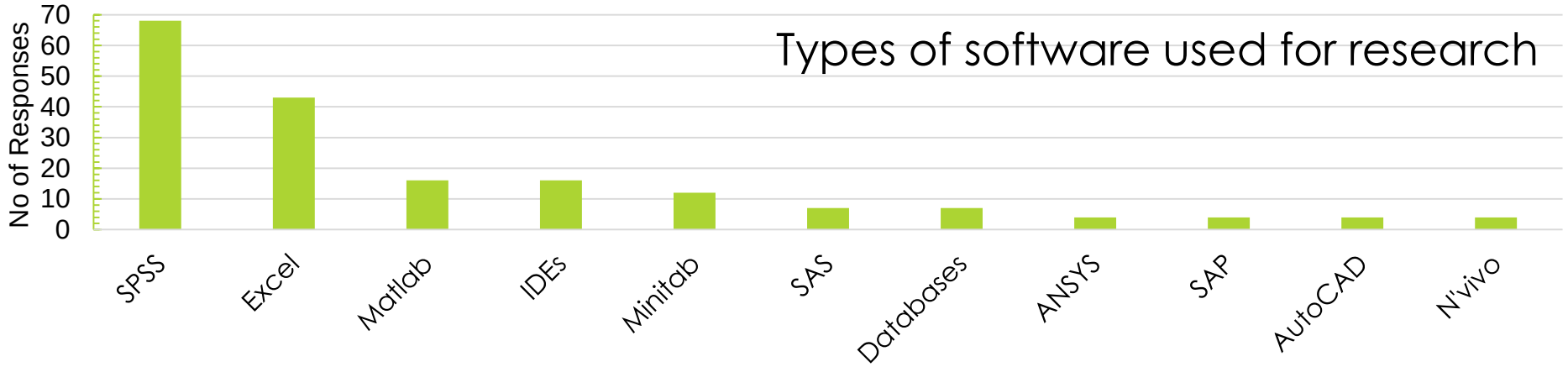
Utilizing of Computing Resources for Research



- ICT adoption was higher among researchers under age of 35
- 60% of survey participants are from none CS & Engineering disciplines
- Findings indicate that use of computers for research is relatively low (except for paper writing)

Current Hardwar & Software Utilization





Software & Hardware Needs

- Prefer proprietary software & willingness to use high-end resources
- 26 participants were quite content with resources they already have access to
- Even though LEARN increased bandwidth of all public universities by 4× in 2013, still bandwidth is insufficient

Challenges

1. Access & funding
   - Majority have access only to primitive resources
   - Researchers have access to 1 -2 servers
   - Unable to secure a stream of follow up funding to expand & maintain resources
   - Limited access to relevant commercial research software
2. Knowledge & skill
   - Lacks awareness about alternative & open source tools
   - Inadequate programming skills to do source code level changes
3. Infrastructure & logistics
   - Reliable access to electricity & Internet
   - Lack of research computing support staff
   - Researchers aren't much aware of resources currently available in the country
   - Constraints while collaborating & sharing resources with each other

Potential Solutions

Short Term	Long Term
Educate researchers on available resources, tools, & right computing platform	Focus more on computational research & curriculum-level changes
Introduce cloud & open source applications	Establish a national research computing facility
Improve infrastructure & remove organizational constraints	Increased funding & budgeting priorities
Promotion of interdisciplinary research, e.g., connect with a CS research group	
Share resources without limiting to organizational boundaries – local & foreign	

Summary

- Even though Sri Lanka has better ICT infrastructure, less focus on developing research infrastructure & related skills
- Through surveys & interviews, we explore current state, needs, & challenges
  - Access & funding
  - Knowledge & skill
  - Infrastructure & logistics
- To strengthen research in the country
  - Improve knowledge, skills, & infrastructure
  - Promote interdisciplinary research
  - Increased funding & lower barriers

Q & A

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Thank You!