State of the Workflow 2023 – USERS AND DEMOGRAPHICS

nextflow | **nf-core**

WHO IS USING NEXTFLOW?

Role	%
Bioinformaticians	66.5%
Principal Investigators	9.2%
Software Engineers	8.4%
Data Scientists	7.4%
HPC Sysadmin	1.6%
Others	7.0%

Most Nextflow users are **Bioinformaticians**

NEXTFLOW USERS ARE GLOBAL

🇺🇸	31.1%	🇸🇪	4.0%	🇧🇷	2.0%	🇮🇳	1.4%
🇬🇧	14.7%	🇨🇭	3.0%	🇳🇱	1.6%	🇧🇪	1.4%
🇩🇪	10.2%	🇦🇺	2.8%	🇫🇷	1.6%	🇩🇰	1.2%
🇪🇸	8.0%	🇮🇹	2.6%	🇦🇹	1.6%	🇷🇸	1.0%

USERS BY INDUSTRY

Industry	%
ACADEMIA	36.9%
BIOTECH STARTUP	20.72%
RESEARCH	19.7%
HEALTH/CLINICAL	8.6%
PHARMA	5.2%
GOVERNMENT	3.6%

RAPID ADOPTION

Experience	%
< 1 year	42.4%
1-3 years	34.3%
3-6 years	19.7%
6-10 years	3.6%
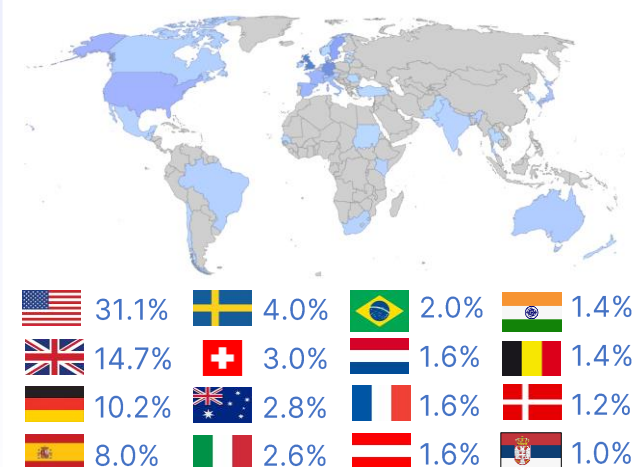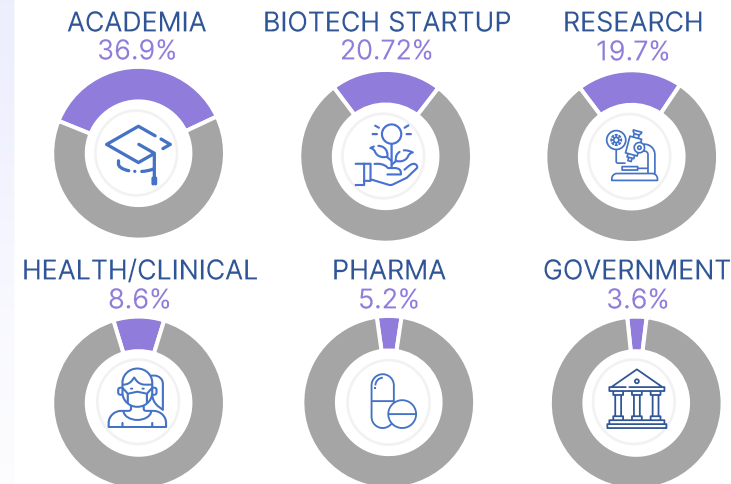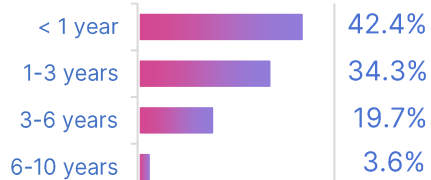
42% of Nextflow users are new in the last year

LANGUAGES SPOKEN

Language	%
Spanish	15.6%
German	14.9%
French	9.6%
Italian	7.0%
Hindi	5.6%
Portugese	5.4%
Mandarin	3.6%
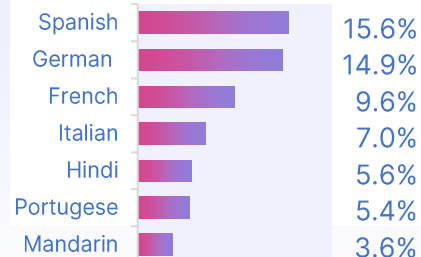
In addition to English

AGE OF NEXTFLOW USERS

(Age groups: 20-30, 31-40, 41-50, 51-60, 60+)
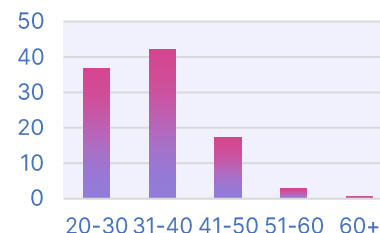
79% of Nextflow users are between 20 and 40 years old

GENDER

73%
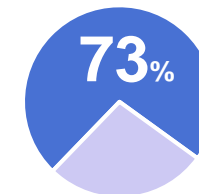
Most Nextflow users are male

HAPPY USERS

99% user satisfaction rate

- Delighted
- Very Satisfied
- Satisfied
- Not Satisfied

94% would recommend Nextflow to a colleague

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State of the Workflow 2023 – CLUSTER & CLOUD EXECUTION

WHERE DO YOU RUN NEXTFLOW?

- On-Premises Cluster — 62.8%
- Public Cloud — 43.0%
- Single Computer — 42.4%
- Private Cloud — 6.2%
- Other — 3.8%

On-premises HPC clusters remain the dominant runtime platform for Nextflow

SLURM RULES THE *HPC ROOST*

75% Use an HPC workload manager

Legend: Slurm, Grid Engine, IBM Spectrum LSF, PBS

Slurm is used to manage **66%** of all on-premises Nextflow clusters

WORKLOADS SHIFT TO THE CLOUD

43% Use public cloud today → **70%** Plan to migrate to the cloud

Among Nextflow users, the use of public cloud is up **20%** since 2022[1]

NEXTFLOW USERS ALSO RUN:

- Snakemake **35.9%**
- Galaxy Project **14.3%**
- Cromwell/WDL **10.0%**

Other tools used by Nextflow users include CWL, Airflow, and Prefect
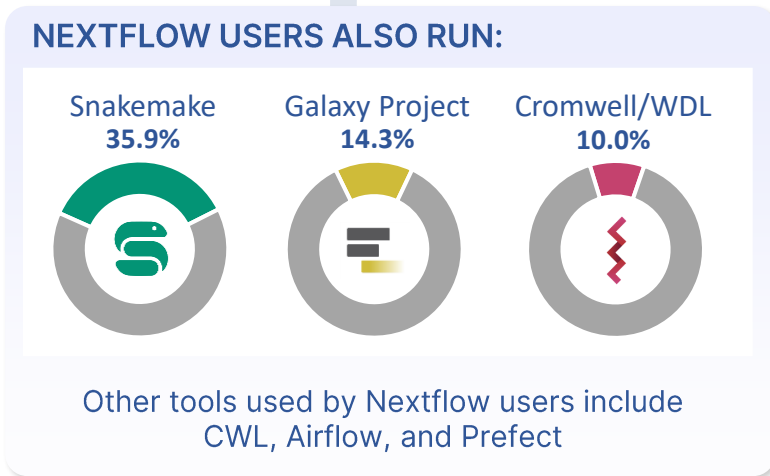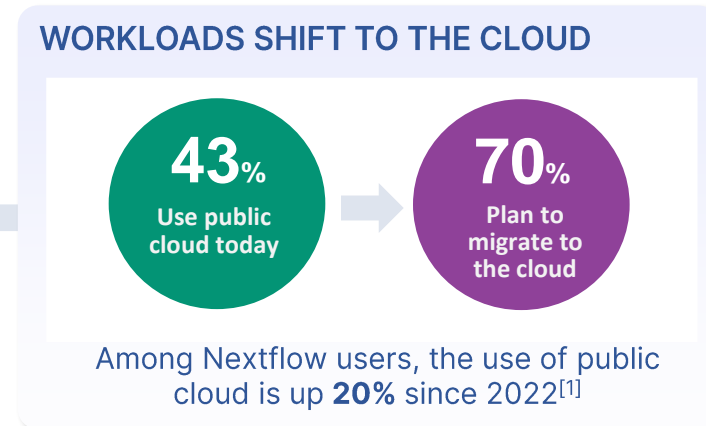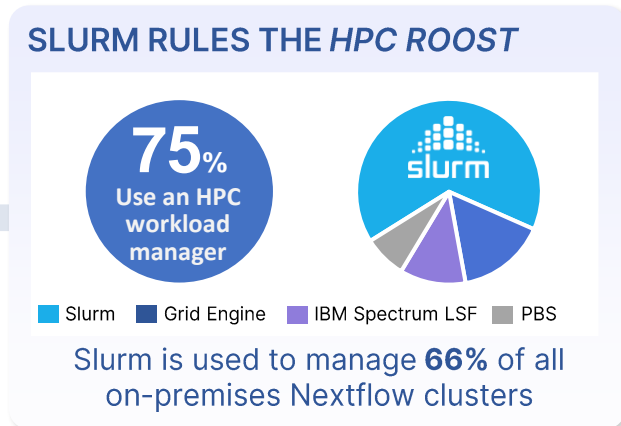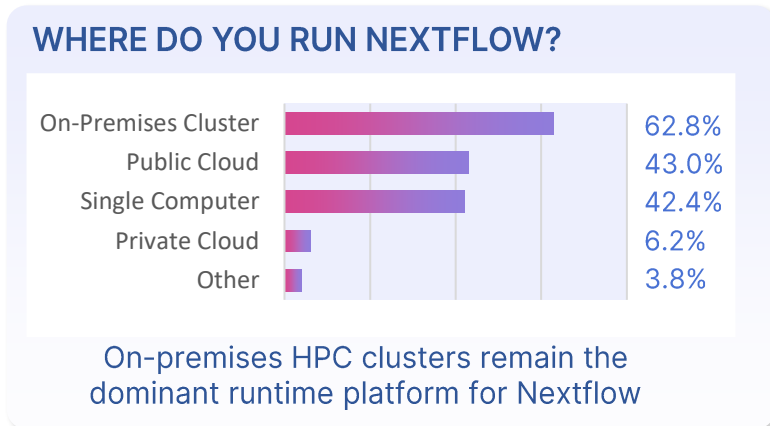
LIMITED KUBERNETES ADOPTION

Kubernetes **6.2%**

K8s adoption as a compute environment is unchanged from 2021

Amazon EKS, Google GKE, Azure AKS, OpenShift, Rancher, etc.

PREFERRED CLOUDS

Among users planning a move to the cloud within 2 years, most plan to use AWS

- Amazon — 49.1%
- Google Cloud — 12.3%
- Microsoft Azure — 7.7%
- Oracle Cloud — 0.8%
- No plans/other — 30.1%

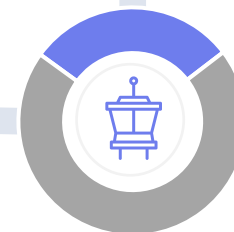Public cloud adoption is higher in the private sector where **80%** use public cloud[2]

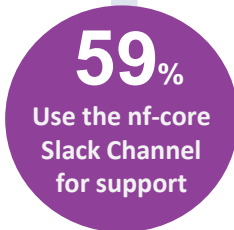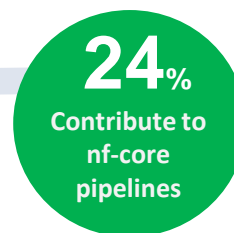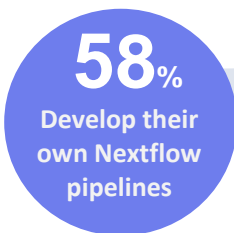[1] In March 2022, 35.7% of 384 survey respondents indicated they were using the public cloud. In March 2023, 502 respondents, 43% are using public cloud – a 20% increase
[2] Includes 170 of 401 respondents who self-identified as being in Biotech startups, Pharmaceutical companies, or healthcare/diagnostics/clinical care. Of these, 136 use public cloud.
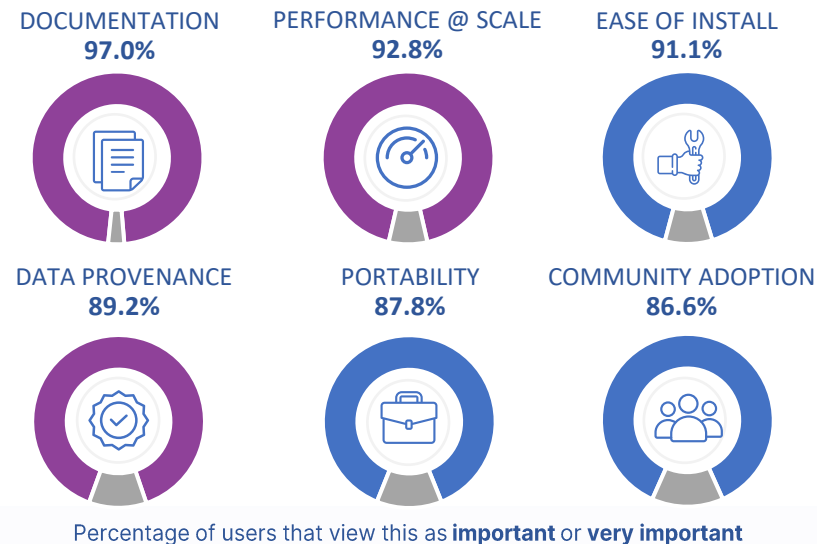
Bioinformatics community survey – March 2023 - sample size n=502

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State of the Workflow 2023 – COMMUNITY & NF-CORE

WHAT TYPES OF WORKFLOWS DO YOU USE?

nf-core workflows	61.8%
Custom - written by me	60.8%
Custom - by my group	36.9%
Other open source	19.1%
Commercial workflows	3.4%
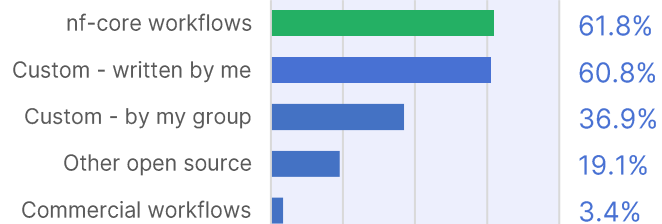
nf-core pipelines are used by **61.8%** of respondents

WHAT MATERIALS ARE MOST USEFUL?

Nextflow reference doc.	89.0%
nf-core website	73.6%
Implementation patterns	61.5%
Seqera nf tutorials	53.7%
Seqera & Nextflow blogs	45.8%
nf-core #bytesize	41.5%

Percentage of respondents viewing materials as *very useful*

HANDS-ON, COMMUNITY-MINDED

58% Develop their own Nextflow pipelines

24% Contribute to nf-core pipelines

59% Use the nf-core Slack Channel for support

49% Use the Nextflow GitHub Repo

79% launch Nextflow from the command line

30% use Tower sometimes or often

WHAT IS IMPORTANT IN A WORKFLOW MGR?

DOCUMENTATION
97.0%

PERFORMANCE @ SCALE
92.8%

EASE OF INSTALL
91.1%

DATA PROVENANCE
89.2%

PORTABILITY
87.8%

COMMUNITY ADOPTION
86.6%

Percentage of users that view this as **important** or **very important**

MOST VALUED NEXTFLOW TOWER FEATURES

WEB UI TO MONITOR FLOWS
72.4%

RECOMMENDATIONS TO REDUCE COST
72.1%

CONTROL VIA CLI OR API
71.1%

Percentage of users that view this as **important** or **very important**

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State of the Workflow 2023 – IMPORTANT FEATURES
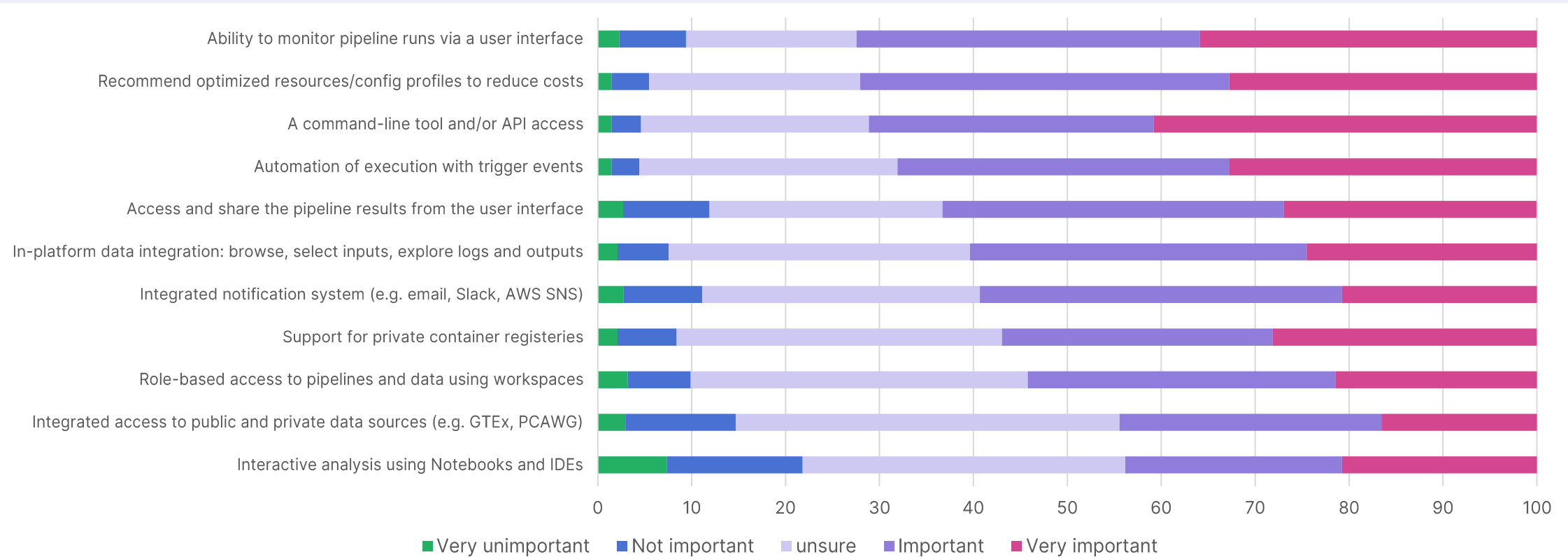
WHAT INTEGRATIONS AND TECHNOLOGIES ARE MOST IMPORTANT?

Bioinformatics community survey – March 2023 - sample size n=502