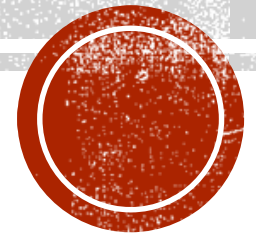


2019 PPAR PAT BENCHMARKING SURVEY*

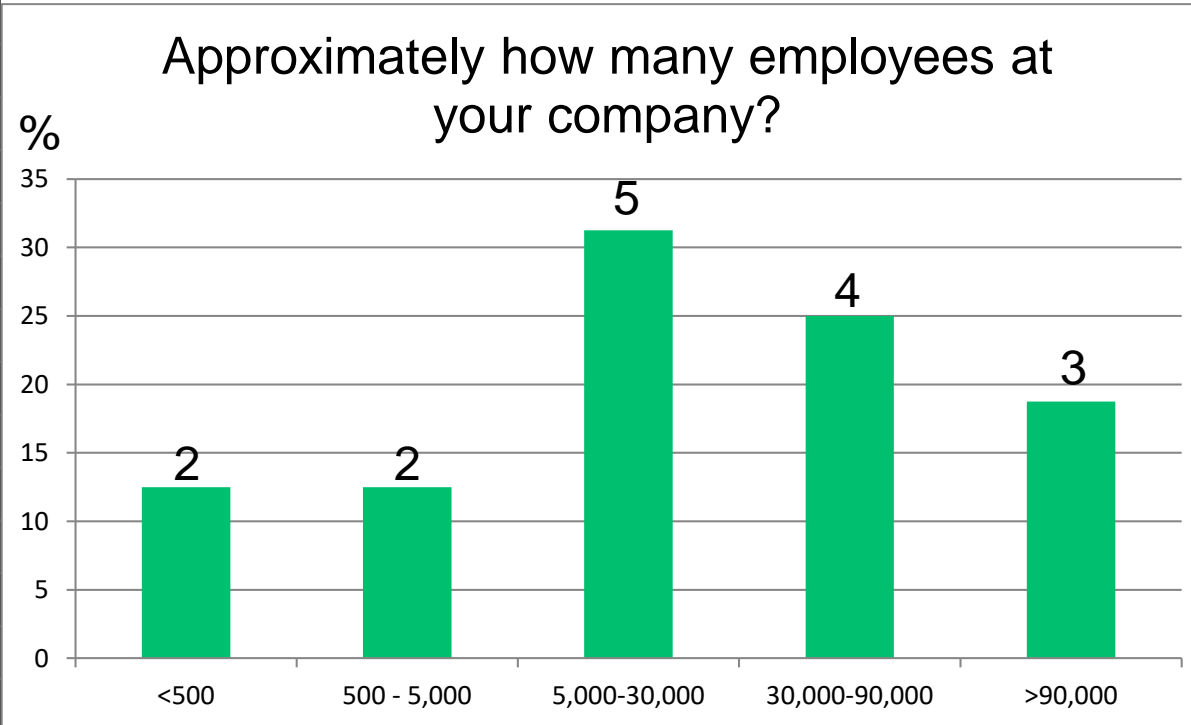


Assembled by:
Rob Guenard – Biogen
Christian Airiau - Sanofi

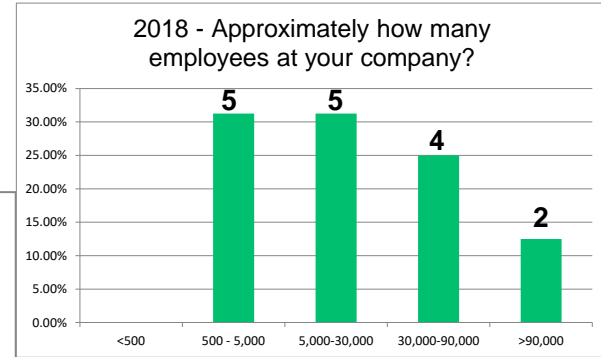
**Content is generated and for the use by members of the PPAR Community during the Annual Meeting Oct 03, 2019.*

SURVEY DEMOGRAPHICS – N=16

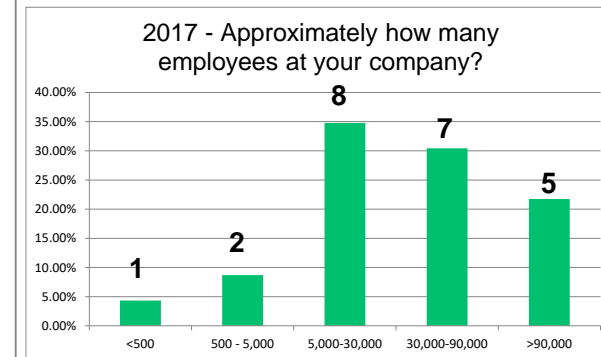
	Company name
1	Bristol-Myers Squibb
2	AbbVie
3	Pfizer
4	Zoetis
5	SANOFI
6	Genentech
7	Merck
8	GlaxoSmithKline
9	Amgen
10	Eli Lilly and Company
11	Biogen
12	Vertex
13	Specere Consulting
14	Hovione
15	thermofisher scientific inc.
16	CPAC



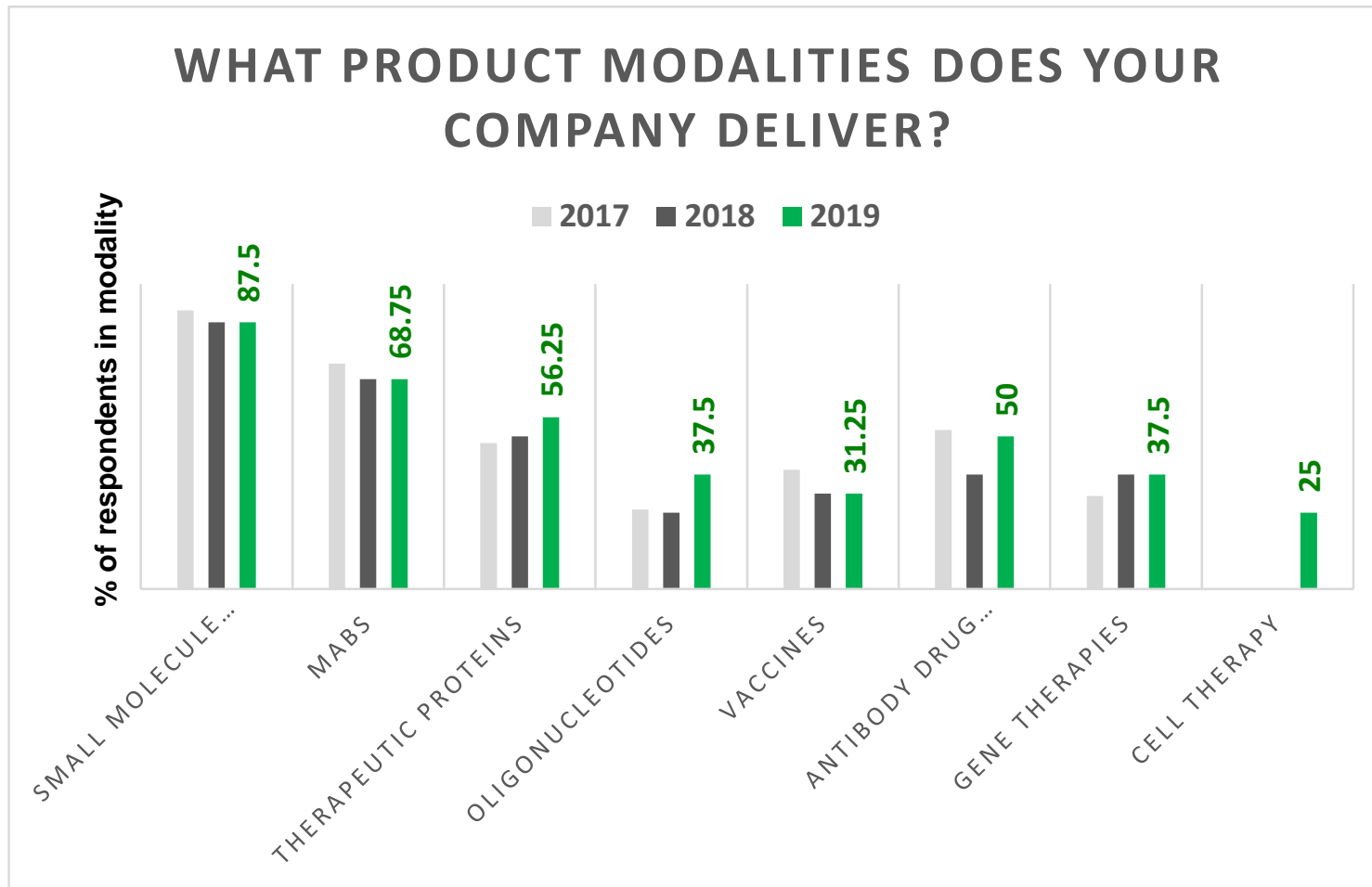
2018: N = 16



2017: N = 23 (17 without repeats)



PRODUCT TYPES



Some evolution

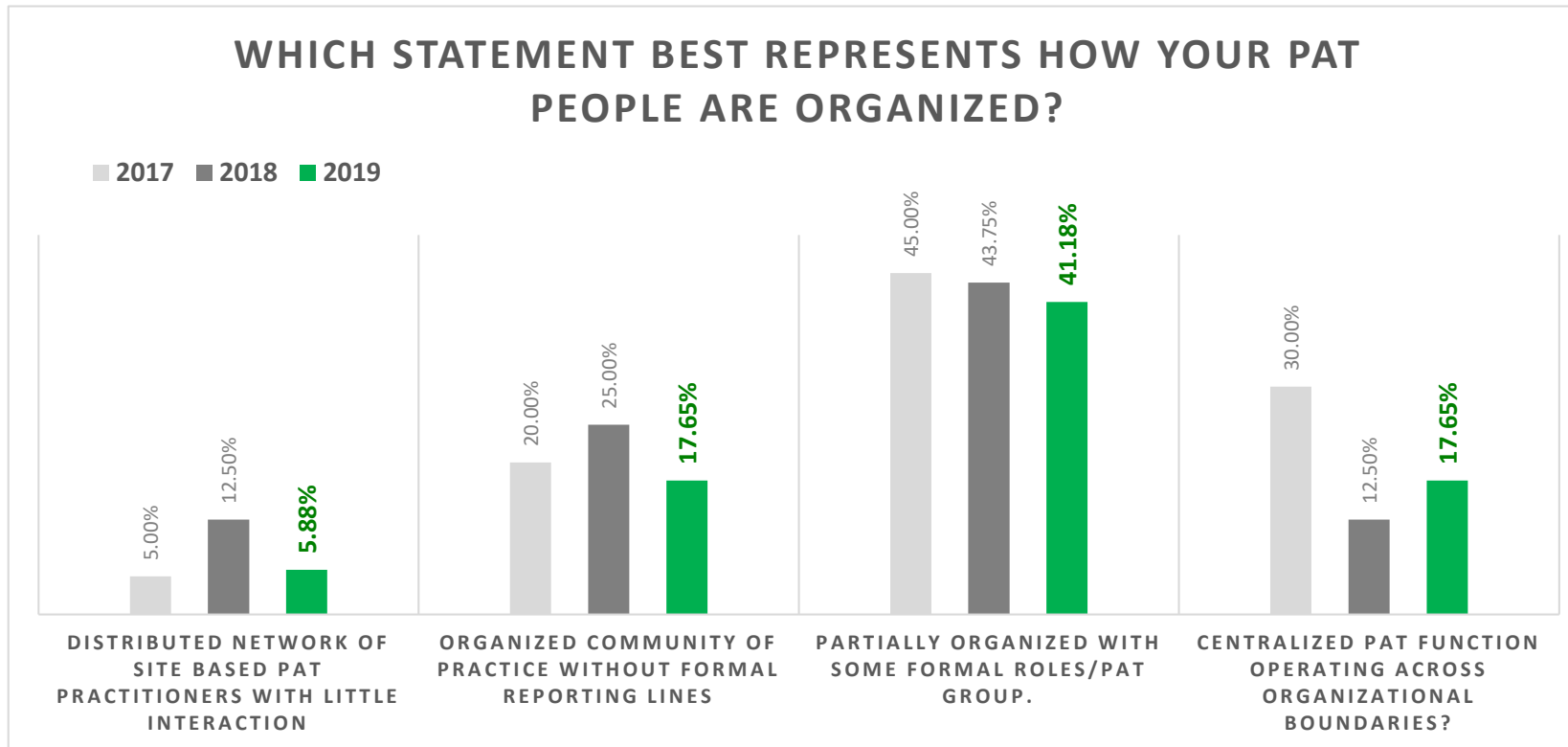
- Therapeutic proteins / Oligonucleotides increasing
- ADC increasing from 2018
- Small molecules constant

Also listed

- Consultancy
- Academic



TEAM ORGANIZATION



Consistent
Mostly “Partially Organized with some formal roles/PAT groups”

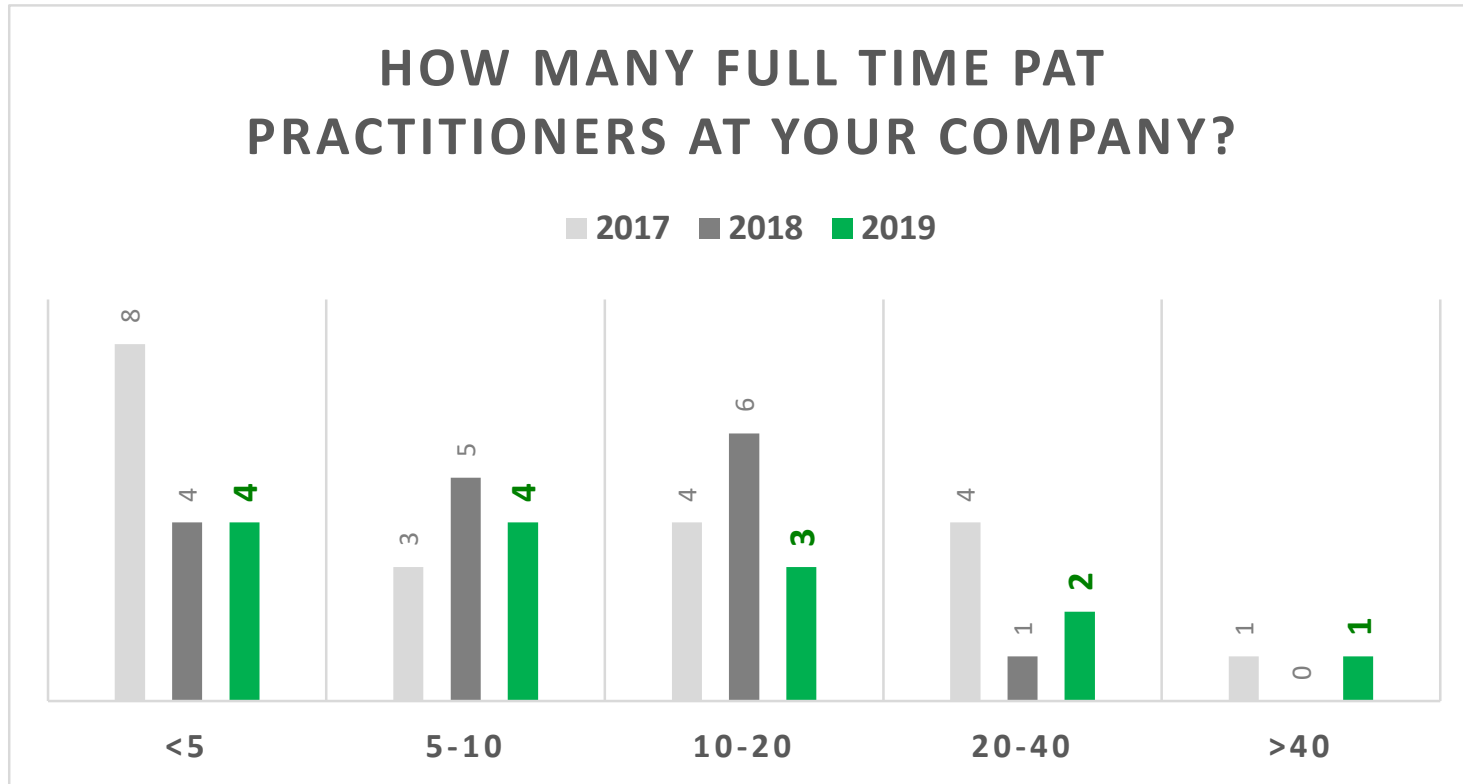
% Reduction of less structured groups from 2018
Increase from 2018 for “Centralized function across organization boundaries” (though 2017 was highest)

Other setup:

- Combination of site based PAT practitioners and centralized support functions
- Two centralized groups - Development and Commercial



TEAM SIZE, FULL TIME



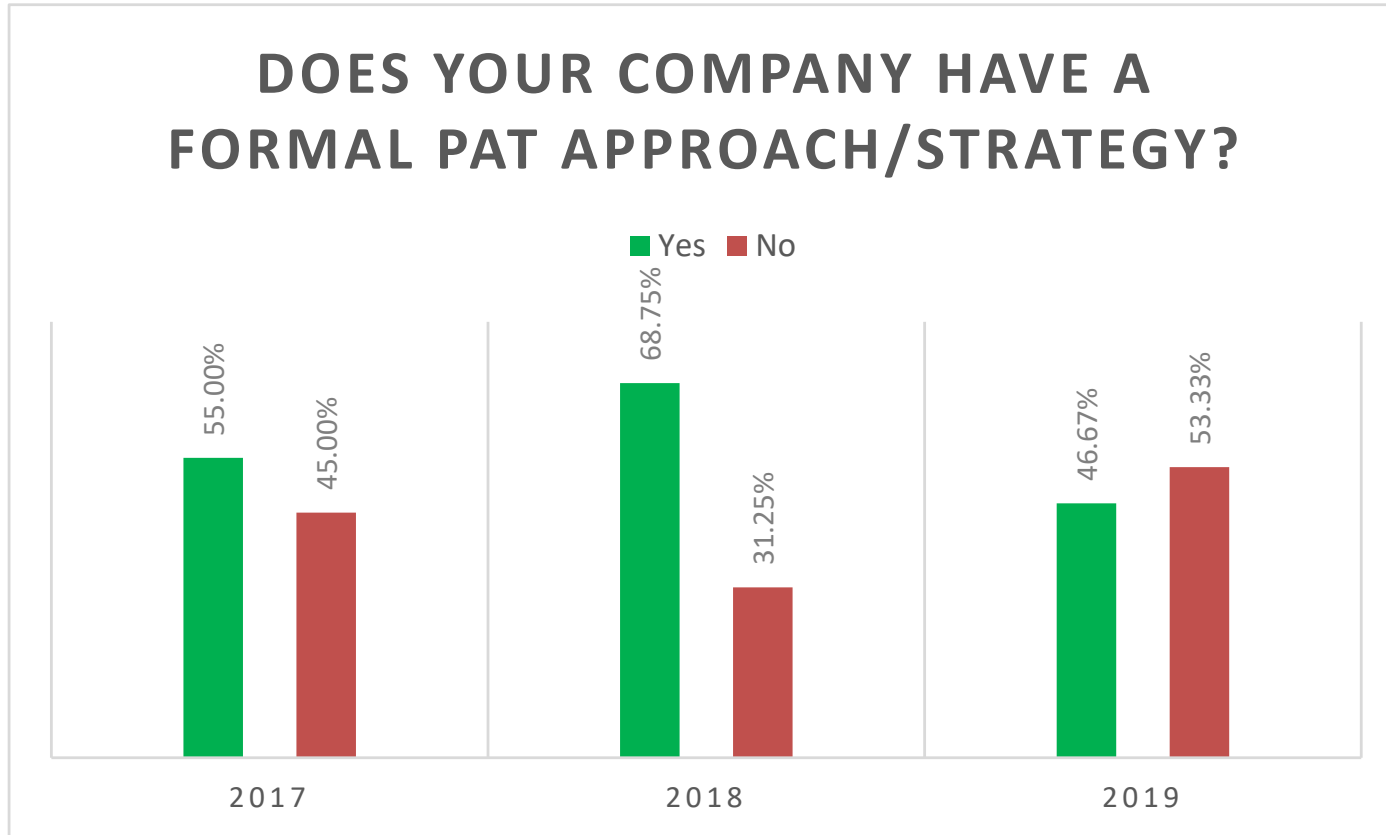
Only 3 companies have >20 full time practitioners
> half (57%) have less than 10 full time practitioners

Note:

- *Removed, Consultant and Academic entries*
- *Removed duplicate responses by same companies*



PAT STRATEGY



Trend is inverted, more companies indicate no formal PAT strategy

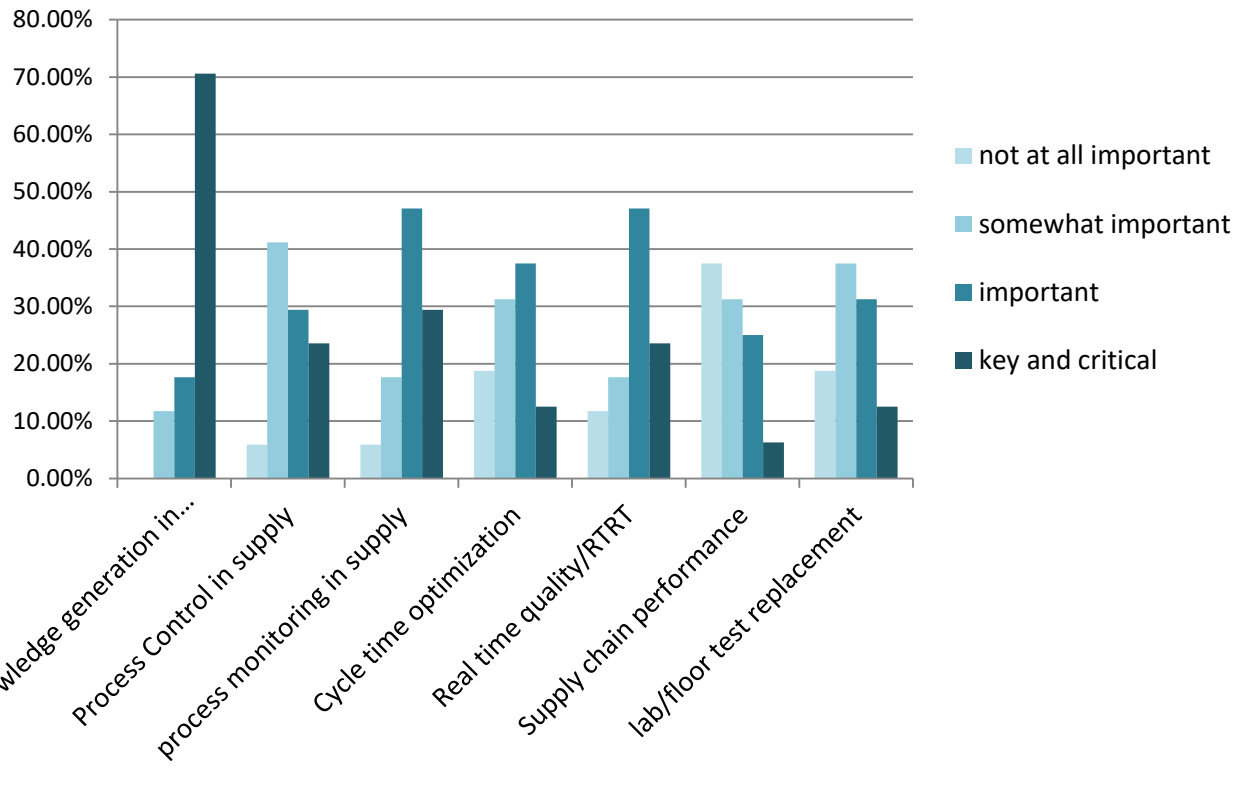
Note:

- *Removed, Consultant and Academic entries*
- *Removed duplicate responses by same companies*
- *7 Yes, 8 No in 2019*



PRIMARY DRIVERS

What are the primary drivers of value proposition for PAT at your company?

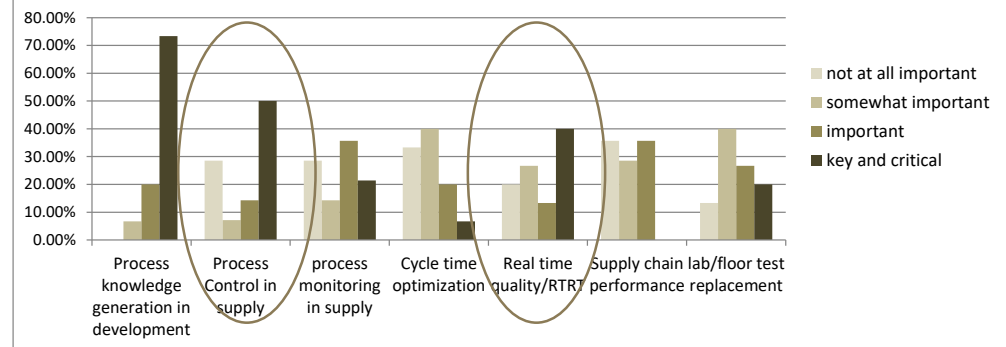


In 2018: Process Control was critical
RTRT was critical (now Important)

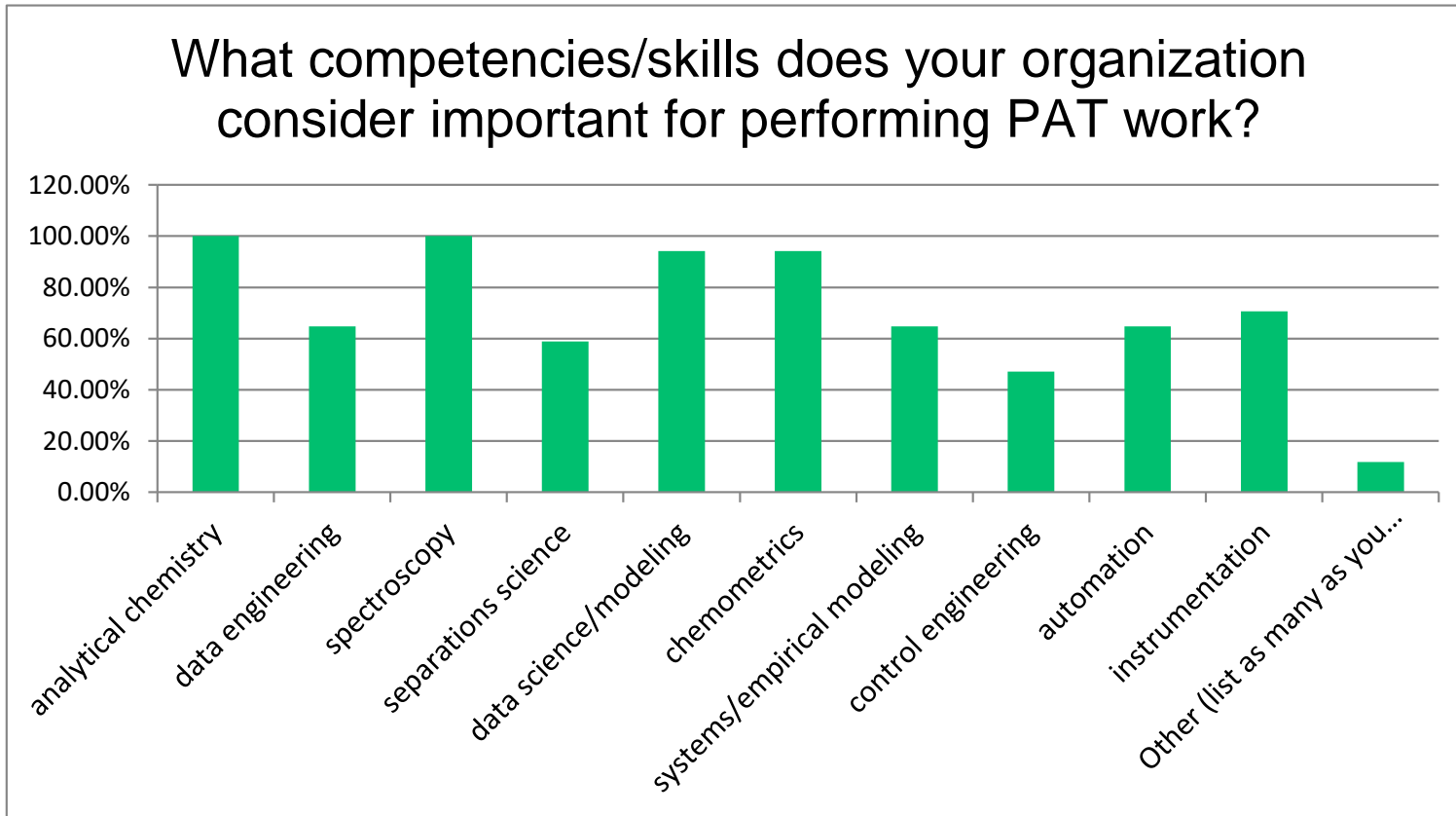
Main drivers:
Process Knowledge, Process Monitoring, RT Quality

Of lesser importance: Supply chain performance / Lab test replacement

2018 - What are the primary drivers of value proposition for PAT at your company?



CORE COMPETENCIES



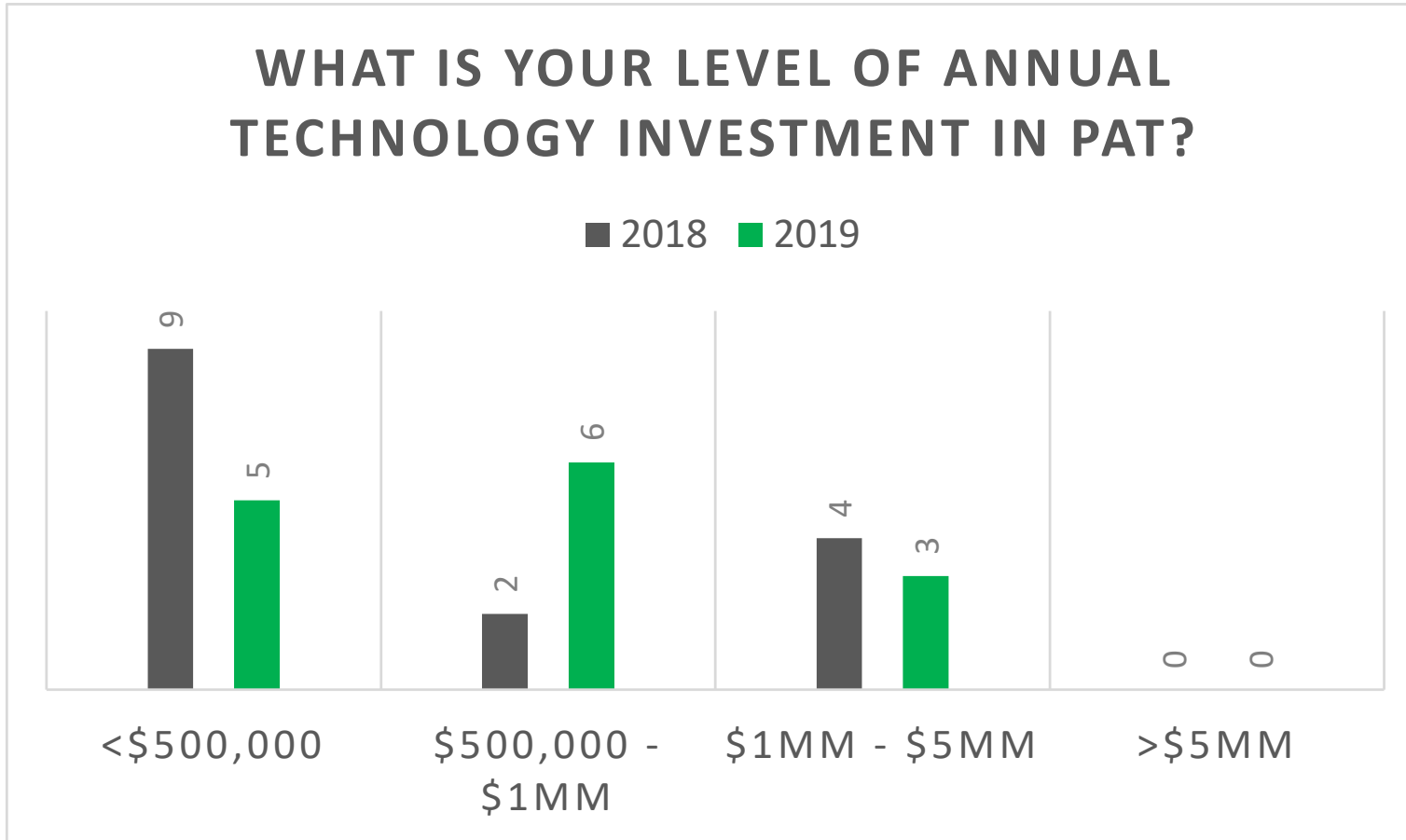
Usual Suspects:
Analytical Sciences
Spectroscopy
Data Science/ chemometrics

Lesser focus:
- Control Engineering/automation
- System modeling
- Separation science

Other:
Attribute focused & value driven innovation
Advanced Process Control



ANNUAL INVESTMENT



Only 3 companies investing \$1MM-\$5MM, down from 4 in 2018

Most companies invest \$0.5MM - \$1MM

In 3 years no company has invested >\$5MM in a year

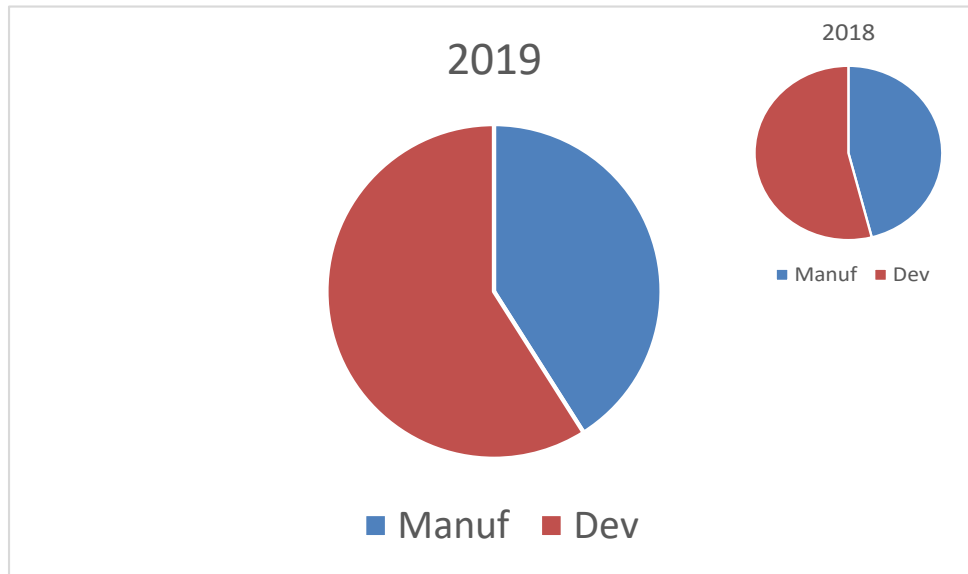
Note:

- 2017 not included due to multiple answers per companies

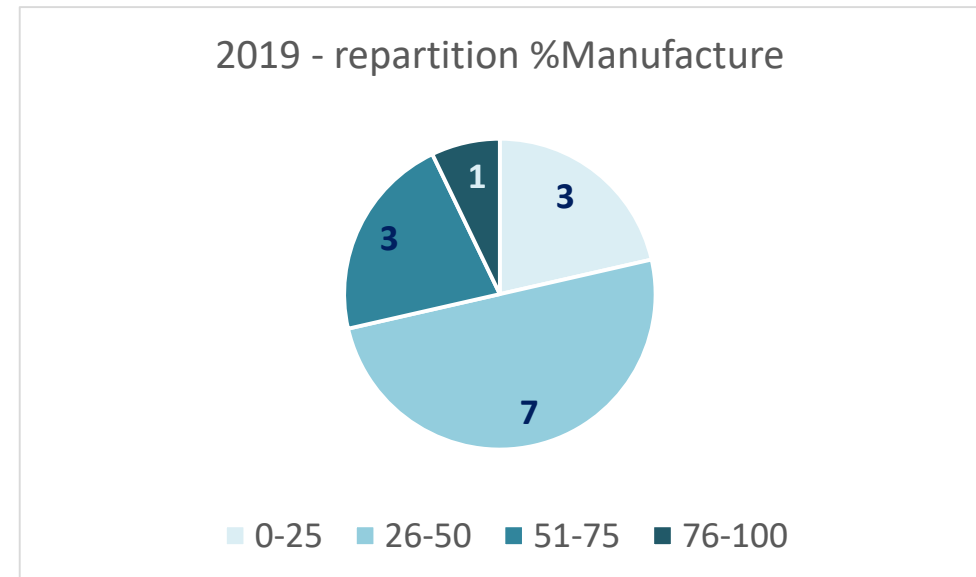


SPLIT BETWEEN MANUFACTURE VS DEVELOPMENT

Wide range: from 0% Manufacture to 80% Manufacture; Heterogeneous landscape



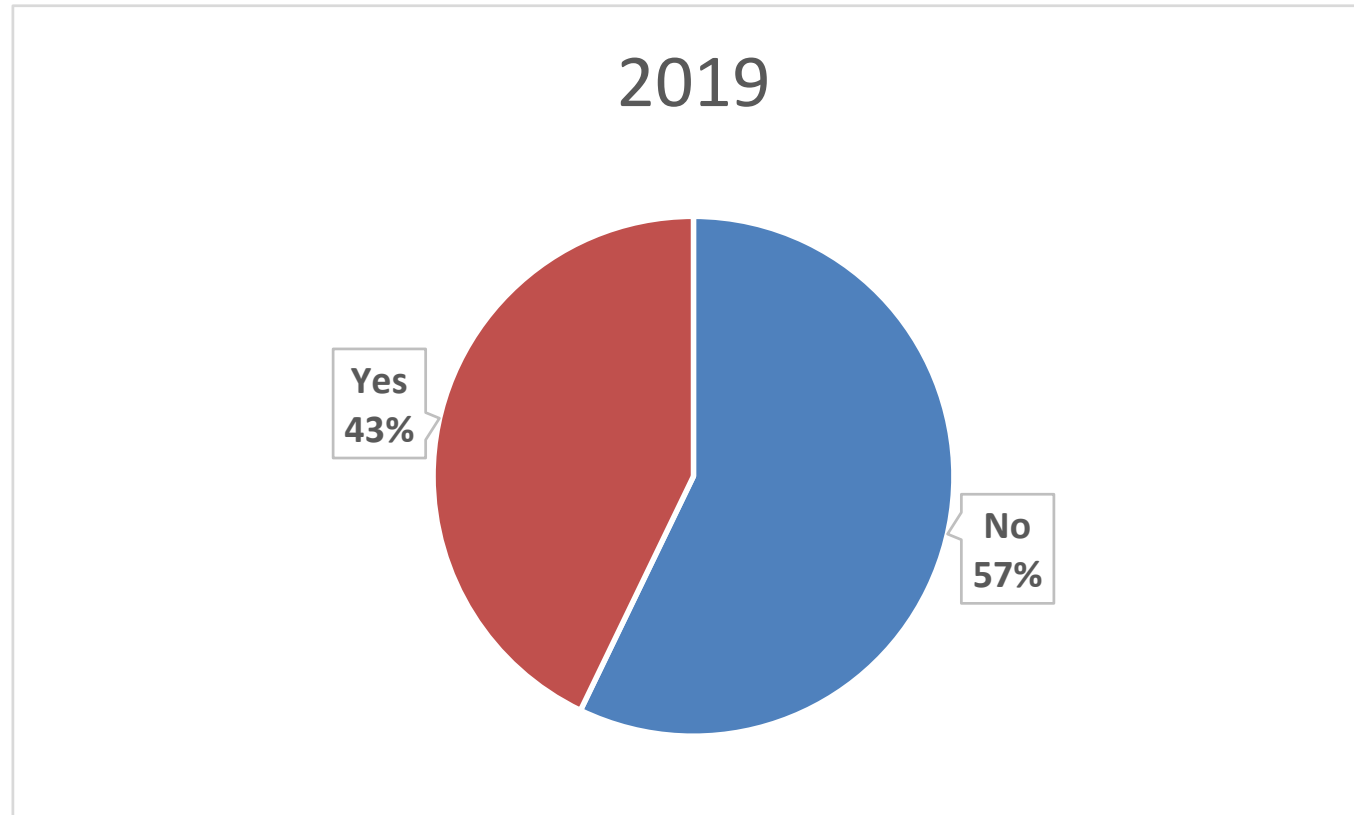
Most deployment (59%) in Development



3 Companies Mostly Dev. (<25% in Mfg)
1 Company Mostly Manuf. (80%)



DO YOU OUTSOURCE ANY/PART OF YOUR PAT ACTIVITIES



Significant increase in outsourcing strategy (6 out of 14)

2018: 0% outsourcing

2017: 25% outsourcing

However, most companies outsource only <20% of their activities

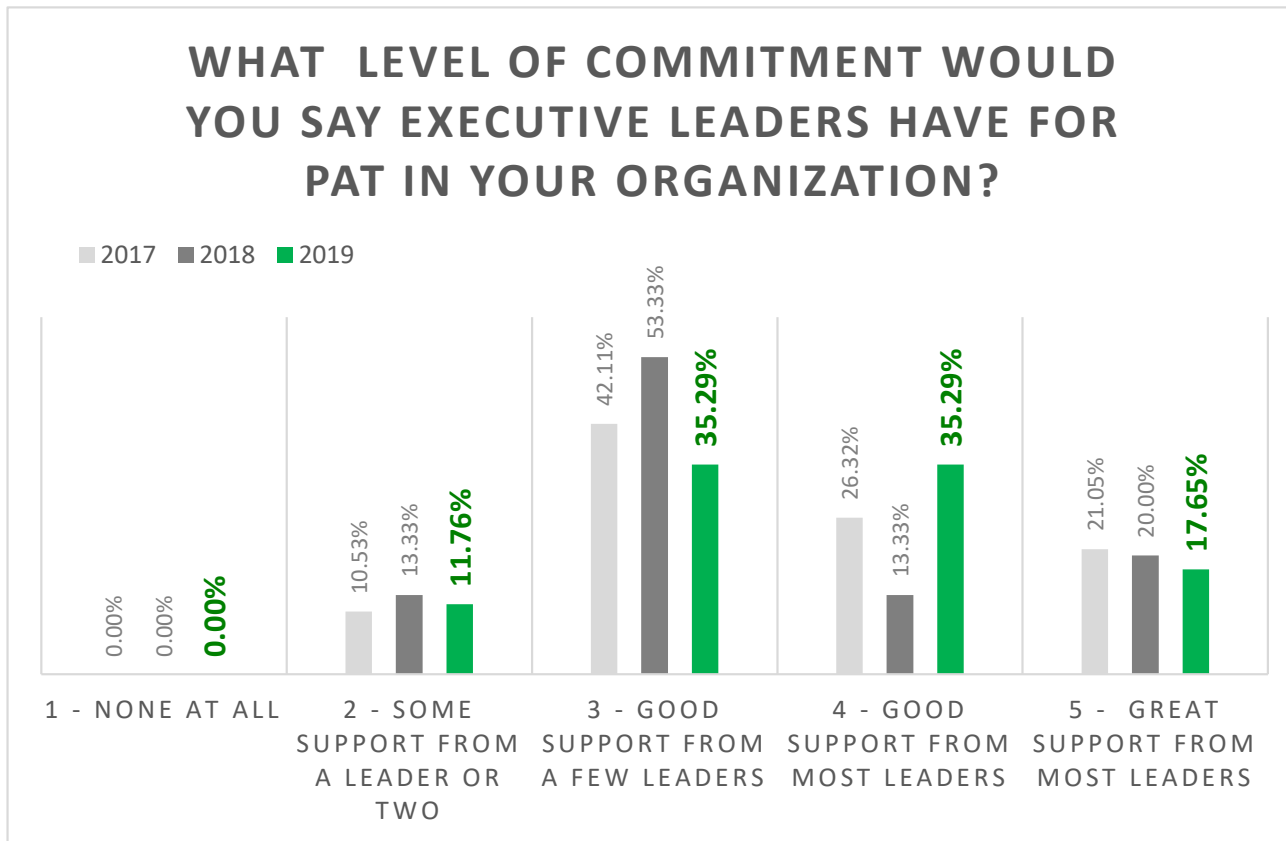
5 Companies (out of 14) request CRO/CMO to implement PAT as part of their core process work

Note:

- *Removed, Consultant and Academic entries*
- *Removed duplicate responses by same companies*
- *7 Yes, 8 No in 2019*



LEADERSHIP COMMITMENT



Strong evolution from

- 3 – Good Support from a few leaders

to

- 4- Good support from most leaders

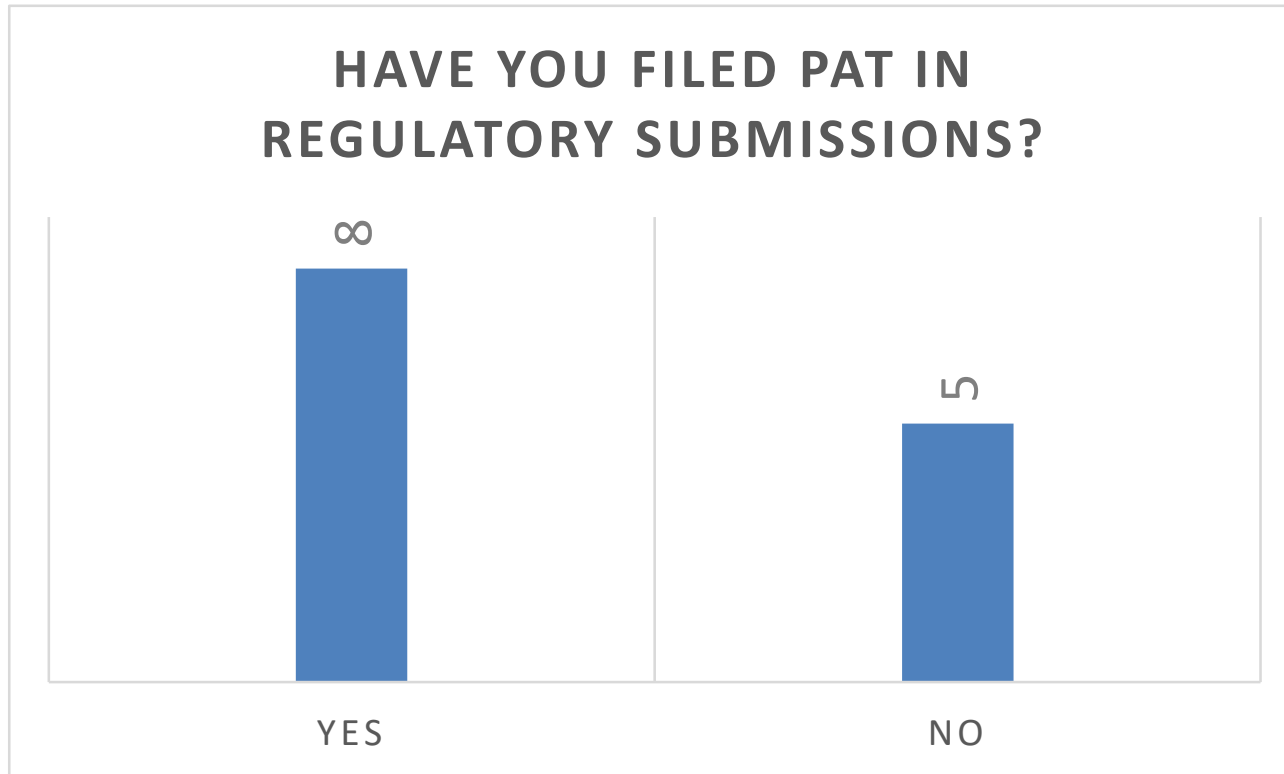
53% of companies are either 4 or 5
“Good or Great support from most
leaders”

2018: 33%

2017 45%



HAVE YOU FILED PAT METHODS IN REGULATORY SUBMISSIONS?

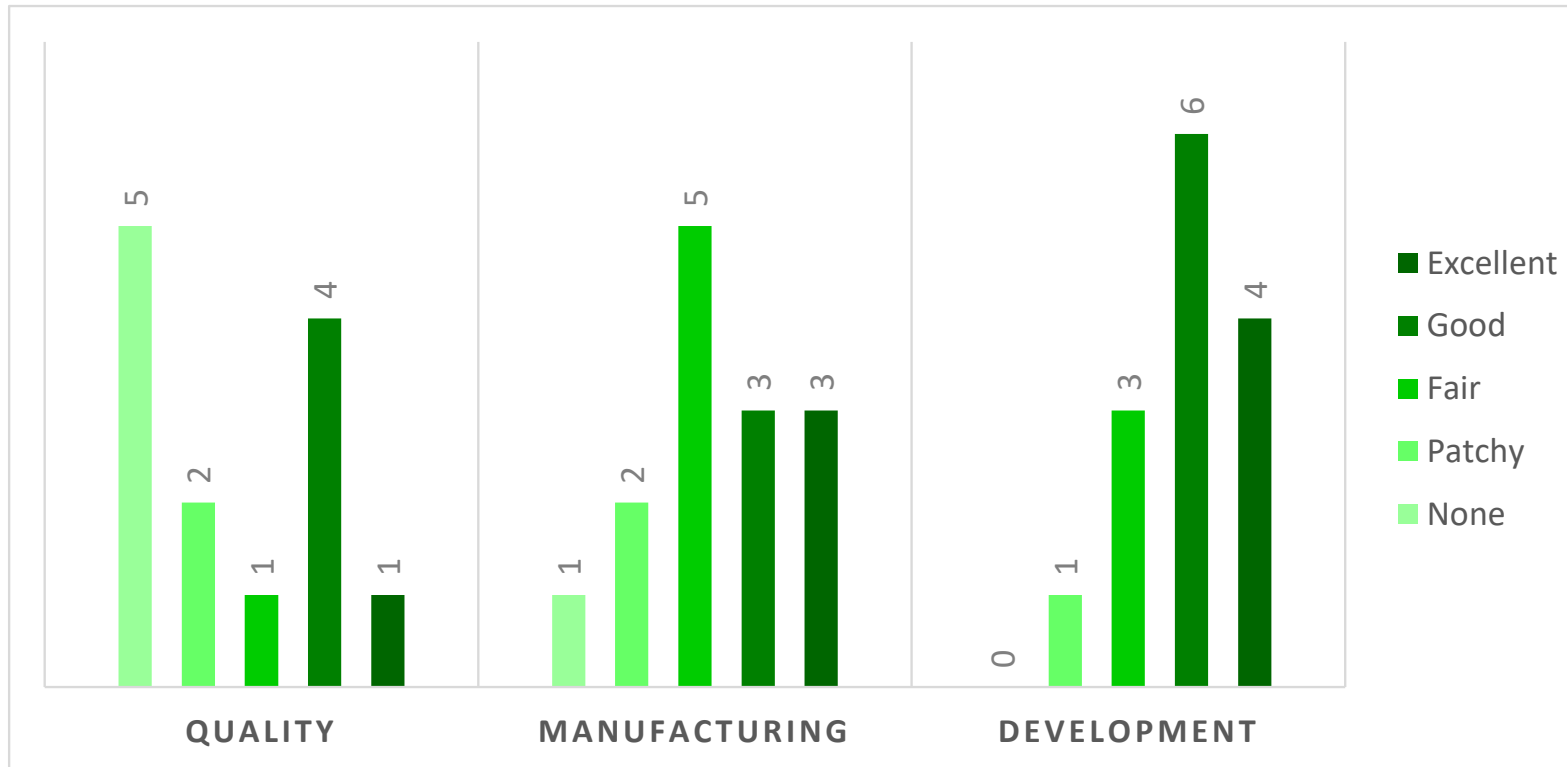


Respondents having file PAT in submissions	Responses
1	2
2	Numerous
3	9
4	5-10
5	2
6	4 approved 1 pending
7	1
8	not disclosed

4 companies have >5 submissions with PAT



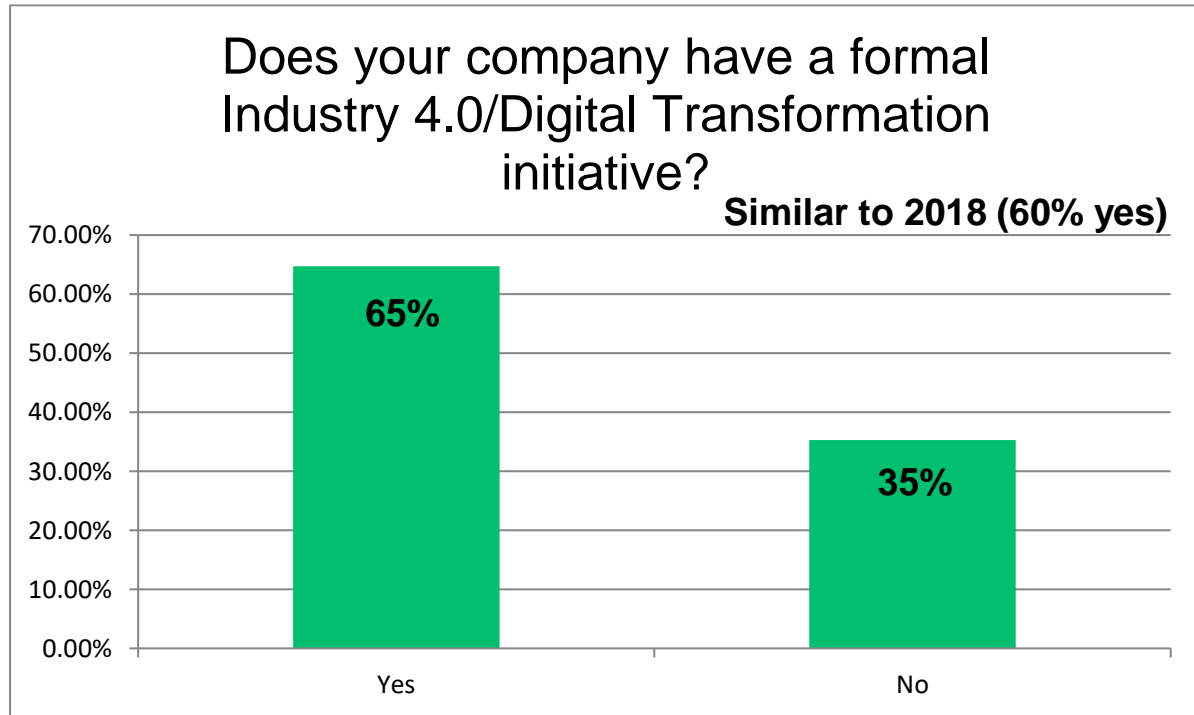
HOW MUCH PAT ADOPTION / INTEGRATION IN QUALITY, DEVELOPMENT, MANUFACTURING



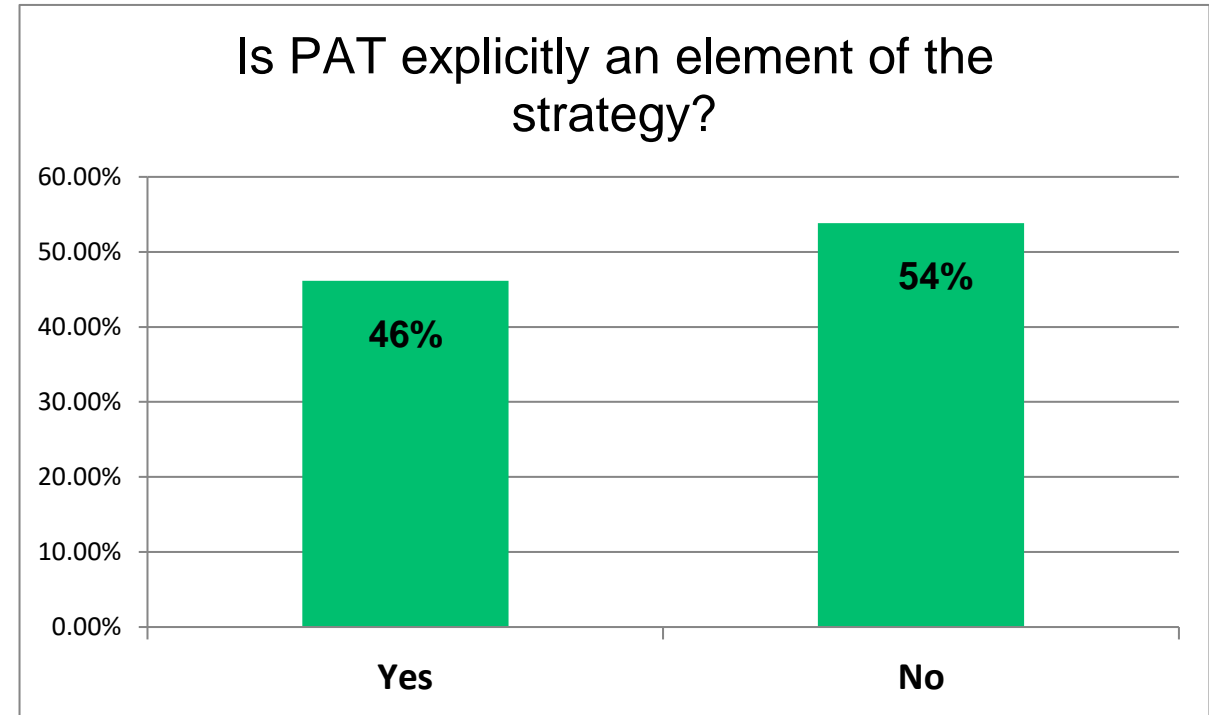
- Stronger adoption in Development
- Fair in Manufacture
- Quality is split:
 - 5 none
 - 5 good/excellent
- Likely aligned with strategy to use PAT in Regulatory submission (Cause or Consequence?)



INDUSTRY 4.0



Mostly at Enterprise level (64%) with some at Divisional level (36%) – no Local initiative



PAT not explicit in the I4.0 / Digital Strategy for 53% of the respondents



CHALLENGES

- Lack of available skills
- Budget constraints
- Data infrastructure, data access
- Vendor readiness, technology reliability
- Methods: Complexity of validation, not always sensitive enough,
- Lack of engagement between Development / Commercial:
- lack of strategy, lack of alignment
- Business case not well defined for commercial deployment
- Complexity to retrofit, need to integrate early during development
- Lack of capability from CRO/CMO
- Limited Student development opportunities / funding

Note:

- *Complete list in Back-up*



ENABLERS

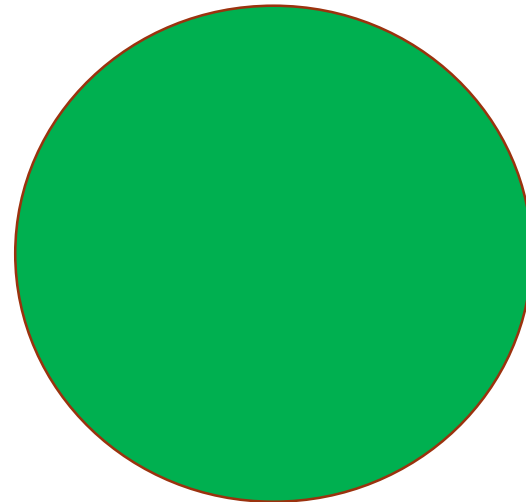
- Strong Strategy and vision, leadership, sponsorship from Executive level
- Skill set (Training, hiring)
- Demonstrated successes, Business value
- Digital Transformation / Robust PAT infrastructure / data management
- Integration of PAT in the Control Strategy
- Move to Continuous Manufacture

Note:

- *Complete list in Back-up*



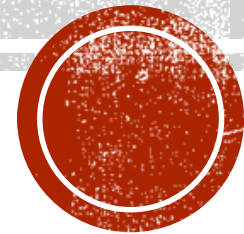
WOULD YOU BE SUPPORTIVE OF SHARING THE BLINDED RESULTS OF THIS SURVEY WITH ORGANIZATIONS THAT ARE REPRESENTED AT PPAR?



100% YES



BACK-UP



CHALLENGES – COMPLETE LIST OF RESPONSES 1/2

1 - Early engagement in dev process to impact project decisions

2- Method development / validation and MM efficiency

3 - Skills - not enough people

Lack of committed resources, data management tools and platforms, further organizational commitment (by users)

Regulatory complexity, (perceived) cost, too few SME's at the sites

1. Awareness of PAT capability to Co-Dev process

2. Budgeting for PAT into processes

3. Timelines for process development vs transfer

lack of common strategy

no clear definition of Business Case

lack of PAT platform (data/model)

Small molecules: awareness, resources, timelines

Large molecules: resources complicated business processes, device integration/data availability

technology readiness, method validation

Definition of the strategy by customers

Cultural changes in Commercial space

Switch from off-line to on-line concept

Commitment to include in Control Strategy

Vendor/technology readiness

1. Capital Cost

2. Variable commitment level and PAT maturity from PAT vendors

3. Demonstrated tangible benefits to manufacturing operation and complexity in model building and maintenance

4. Complexity in change control and method remediation processes to the on-going pipeline portfolio, unless to introduce PAT at the early stage of product and process development



CHALLENGES – COMPLETE LIST OF RESPONSES 2/2

1. Regulatory burdens, such as lifecycle management of models and lack of harmonization across global agencies on the acceptance of PAT-based RTRt method

2. Not enough PAT capability in external network, such as CRO and CMO, etc.

3. Need to continue aligning across development, manufacturing, quality and regulatory functions within an organization.

1. Resource bandwidth

2. Technology reliability

3. Technology cost

4. Technology integration (diagnostic information)

Simplification of model transfer and second source validation. Sensitivity to instrument calibration cycles. Low dosages.

- Lack of a central role

- Regulatory hurdle (perceived at least) for model maintenance in commercial supply

Robustness

Mindset/Culture

low dose

bias from model with not enough data/experiments

Funding for students and projects, buy-in from leadership, industry support for training students in the field of PAT



ENABLERS – COMPLETE LIST OF RESPONSES

Engagement of key partners, clearly articulated priorities, management support to (slowly) build infrastructure
Company vision/technology strategy, strong leadership buy-in, demonstrated success/benefits

1. Training 2. Past successes funding

Agreed strategy /change in business strategy awareness

management support, talent/skill of practitioners

customers providing pull for implementation

Digital Transformation

1. Clear business case

2. Sponsorship

1. Integrate PAT as part of process control strategy

2. Regulatory presentation and clarification on the role(s) played by the PAT tool

3. Management support and executive sponsorship on the use of PAT in the corporate environment.

1. Good sponsorship (from directors and above)

2. Mature PAT Management Software & competent resources

3. Improvements in technology reliability and integration

Good Formulations. An effective comparability protocol that allows our PQS to govern model updates. Redundant PAT methods.

- Company understanding of the importance on the use of models/digital aids

- Moving to CM where PAT is less of an option and more of an enabler

Skilled staff Integration into Control Strategy

Funding / Instrumentation / automation

More funding, more industrial support

