

**Quo Vadis Digital Printing Technologies:
Where are we headed?**
Andreas Forer





Need for Digital Print.





Requirement to automate becoming
non-negotiable.

Print Jobs
Declining run length & more
fragmented volumes


Applications
Need for automation to
deliver faster






Fragmentation of orders makes legacy print infrastructure unmanageable.

PAST



Relatively predictable orders

PRESENT



Smaller, more frequent orders

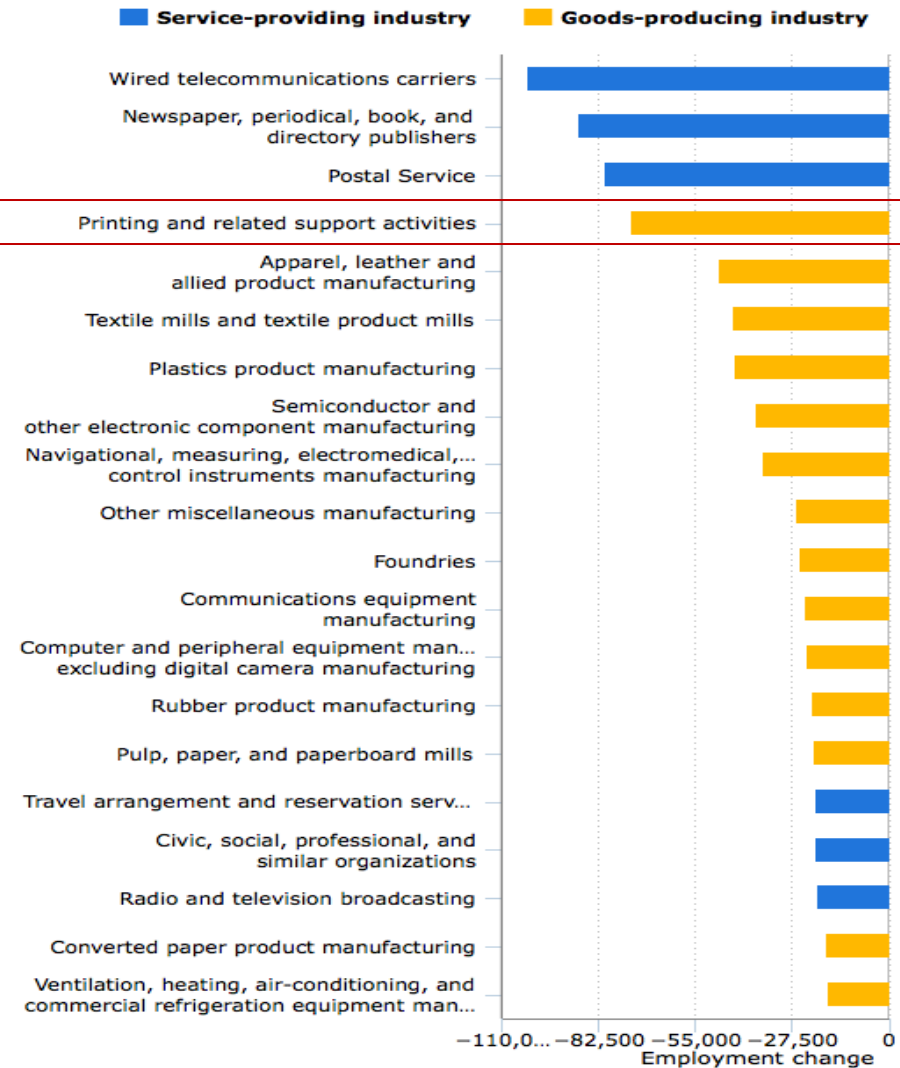
TOMORROW



Unpredictable, small run, frequent orders

Projections of industry employment in US, 2016–26.

- Average worker age: 42.
- Average print employee age: 48.
- Average offset press operator age: mid-high 50s.
- By 2025, lack of labor will require high automation of production systems.



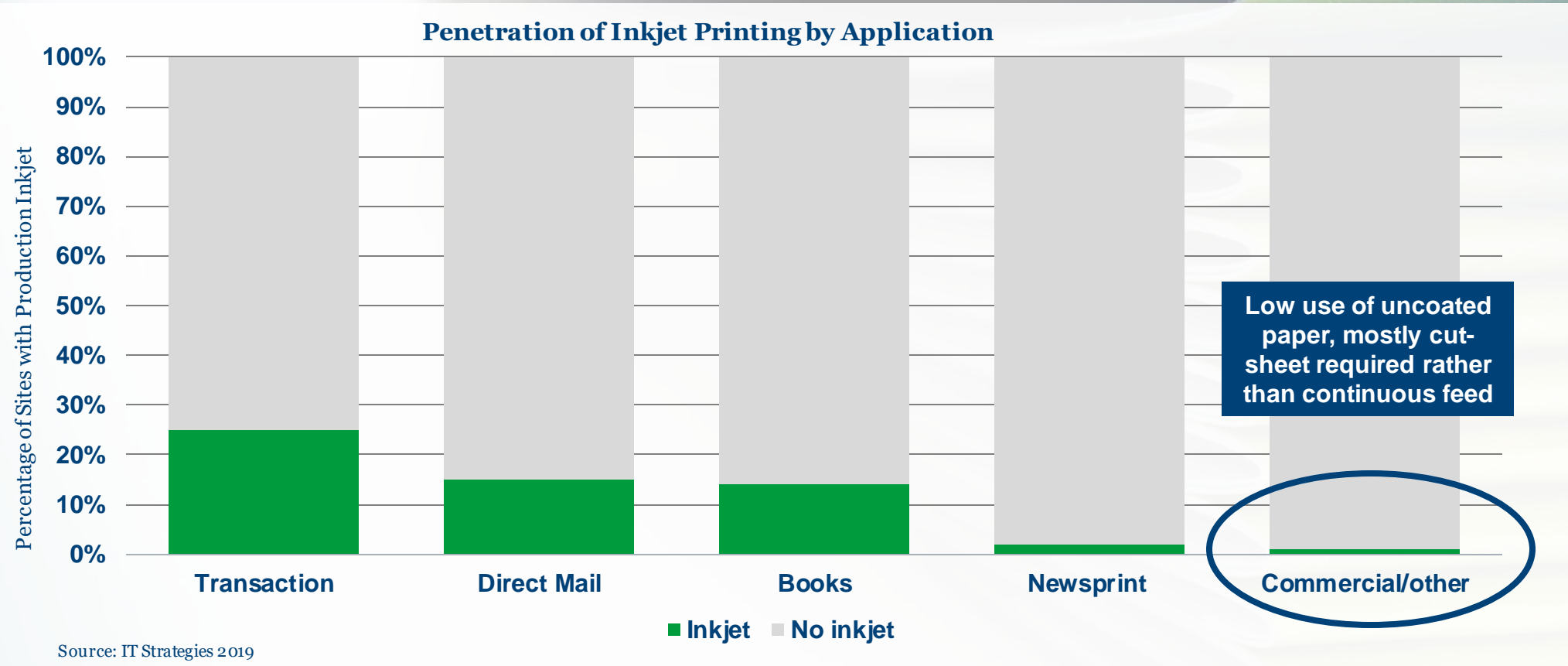
Source: U.S. Bureau of Labor Statistics.



Market Developments.



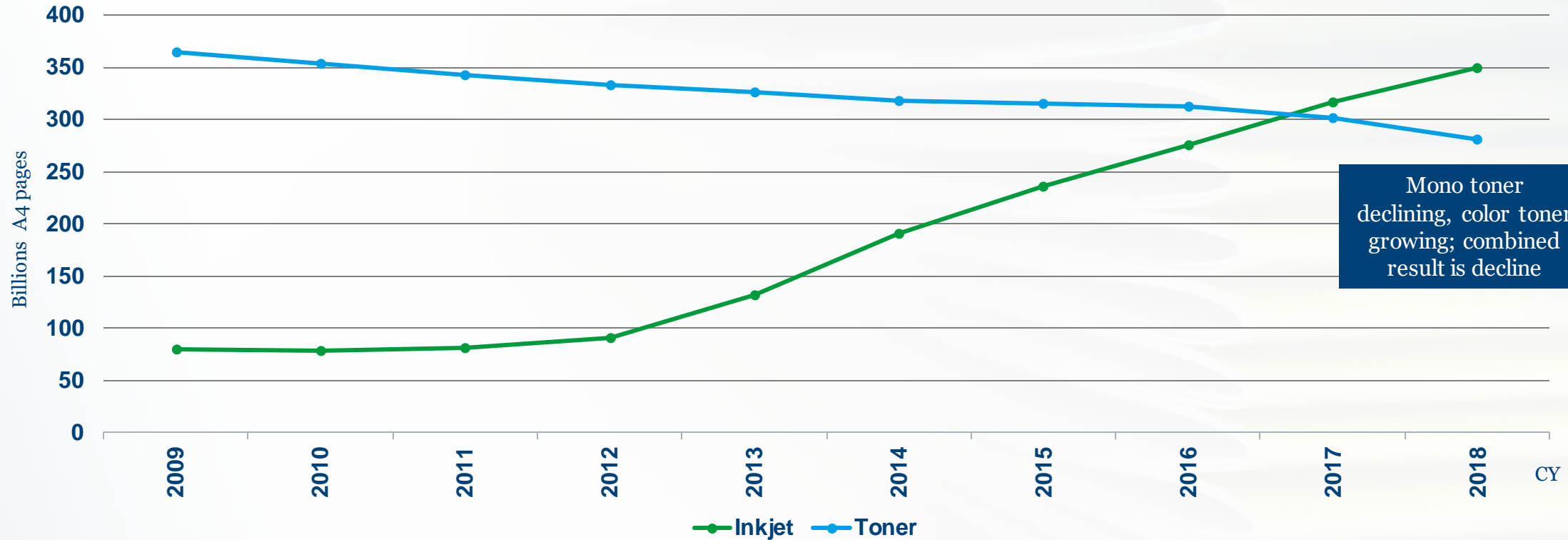
Production Inkjet Printing only just getting started in Commercial (uncoated applications)



Inkjet production printed pages have just exceeded toner printed pages (2017)



Total Print Production Volume by Technology (2009 – 2018)

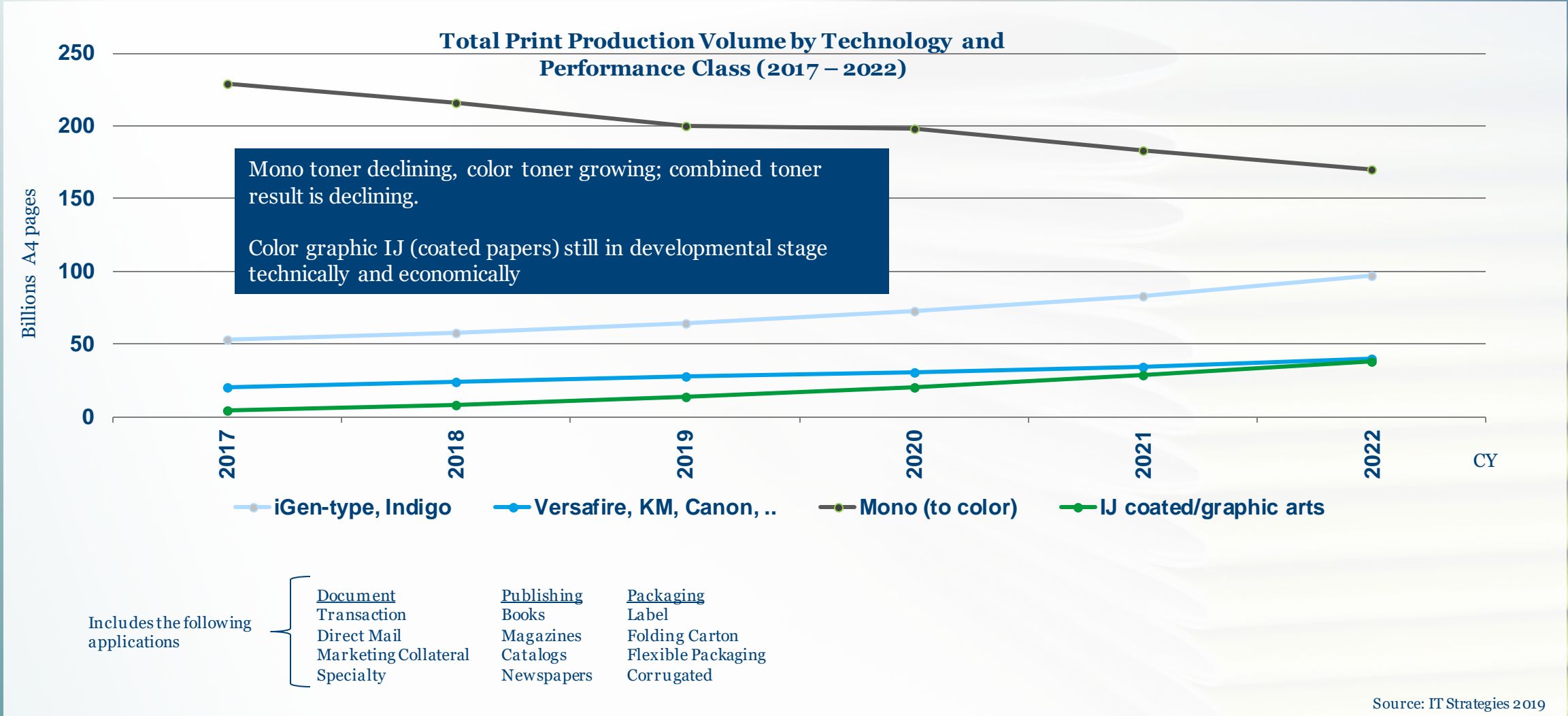


Mono toner declining, color toner growing; combined result is decline

- Includes the following applications
- | | | |
|---|--|--|
| <ul style="list-style-type: none"> Document Transaction Direct Mail Marketing Collateral Specialty | <ul style="list-style-type: none"> Publishing Books Magazines Catalogs Newspapers | <ul style="list-style-type: none"> Packaging Label Folding Carton Flexible Packaging Corrugated |
|---|--|--|

Source: IT Strategies 2019

Decline in mono toner printing driving this trend





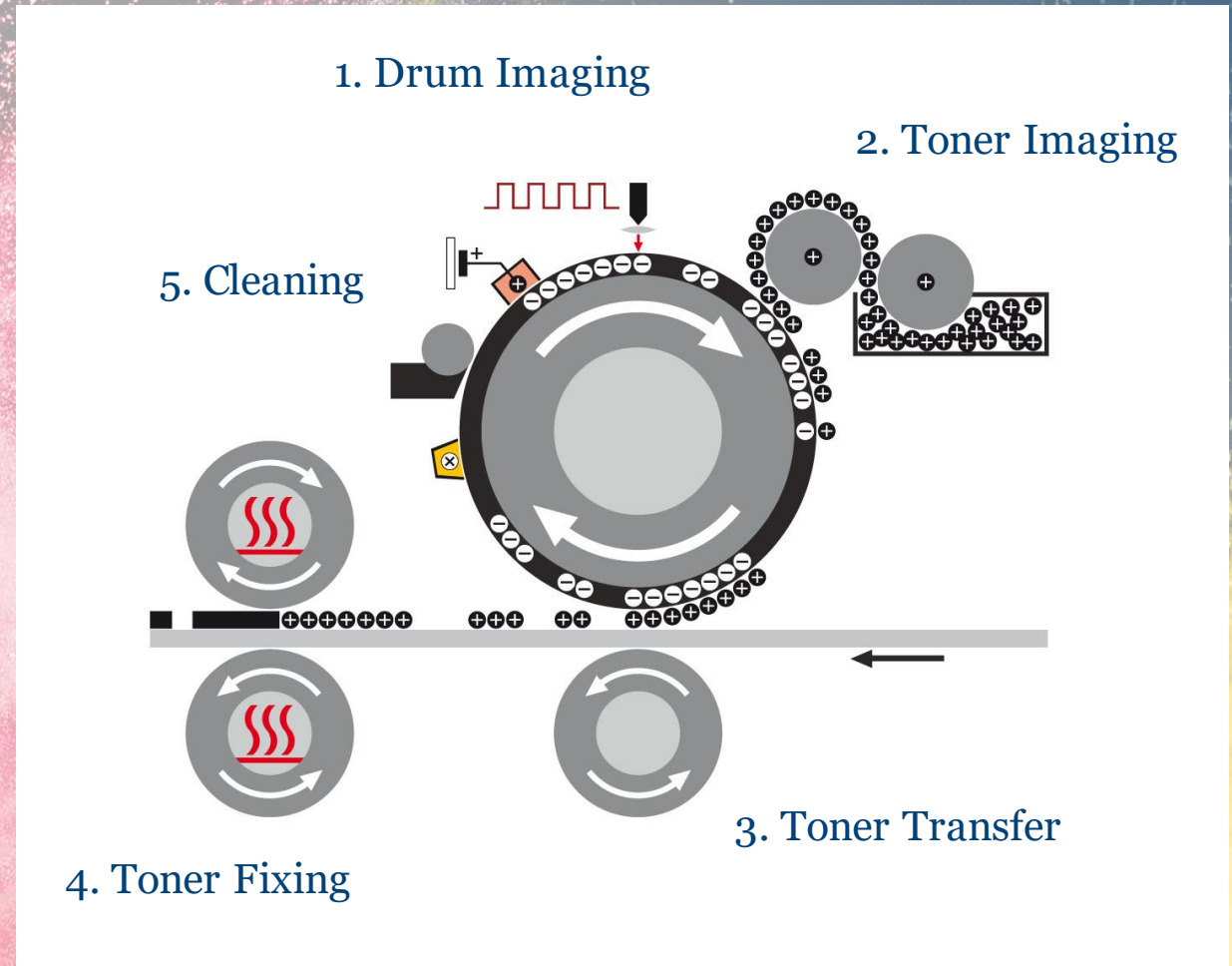
Technology Developments.





Dry Toner.

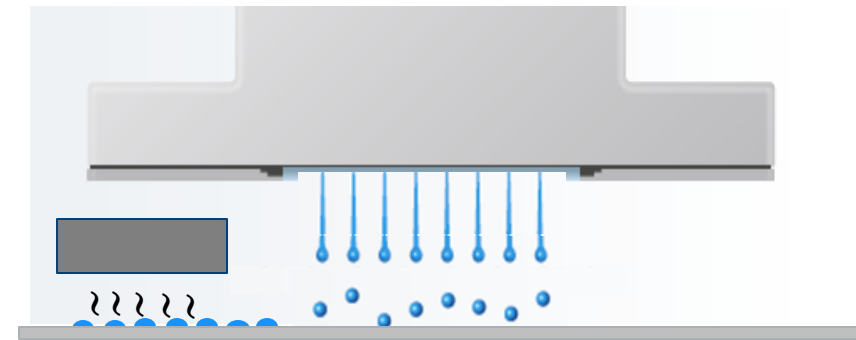
- Processes are well developed and proven solutions are on the market.
- Imaging process is of high complexity with many mechanical and electrical parts and process steps.



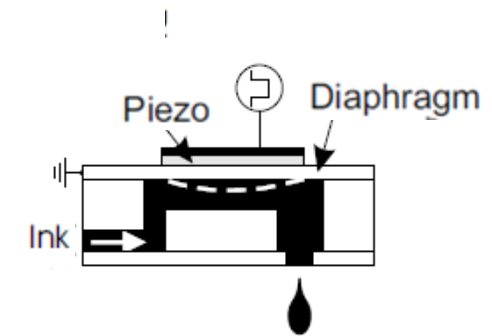
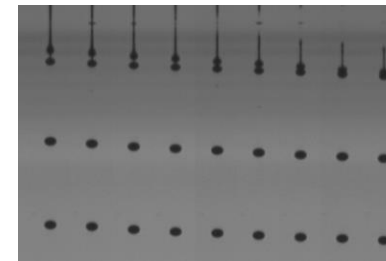
Inkjet.

- Process from image data to the ink on substrate is much easier than electrophotography.
- The challenge is the ink system and the control of the inkjet drops on the substrate
- Primefire example: 25 heads/bar x 7 bars = 175 print heads = 358.400 nozzles => 11,4 Billion drops per second in 4 different drop sizes.

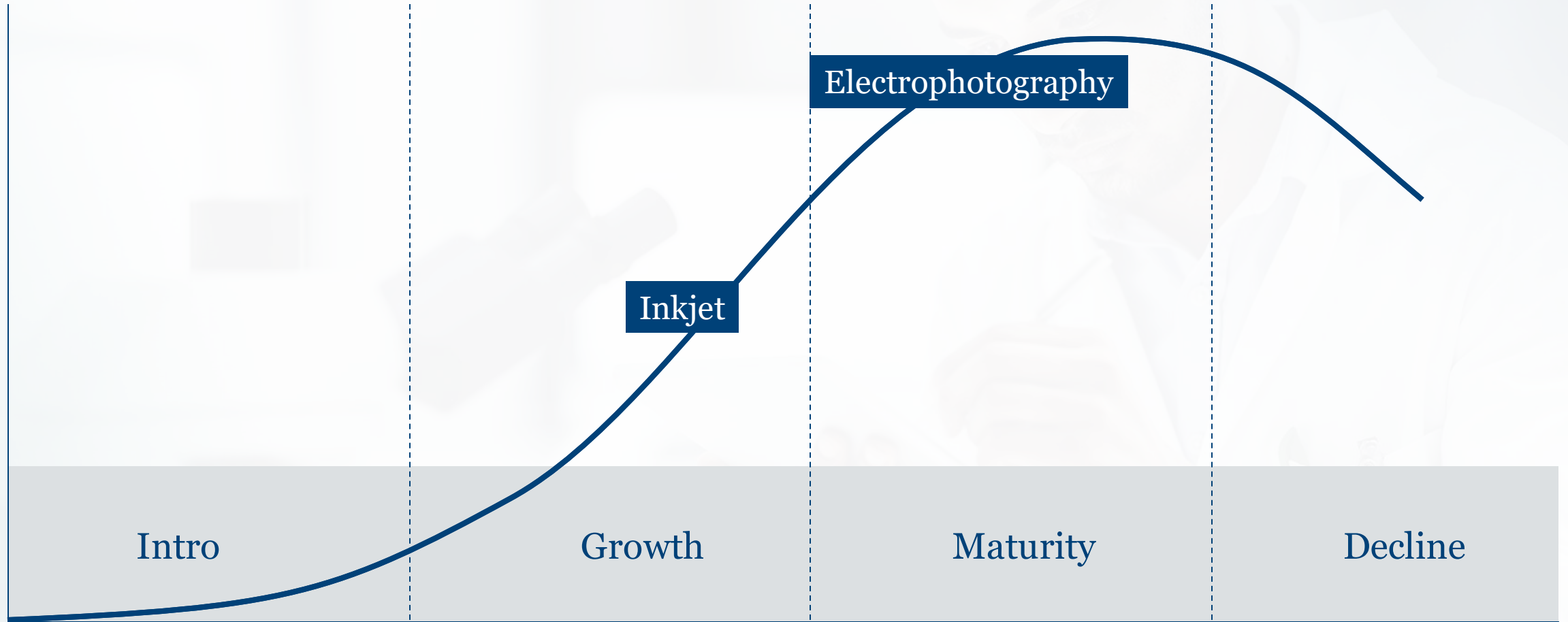
1. Imaging



2. Drying



Inkjet Technology still in Growth Phase



Technology developments.

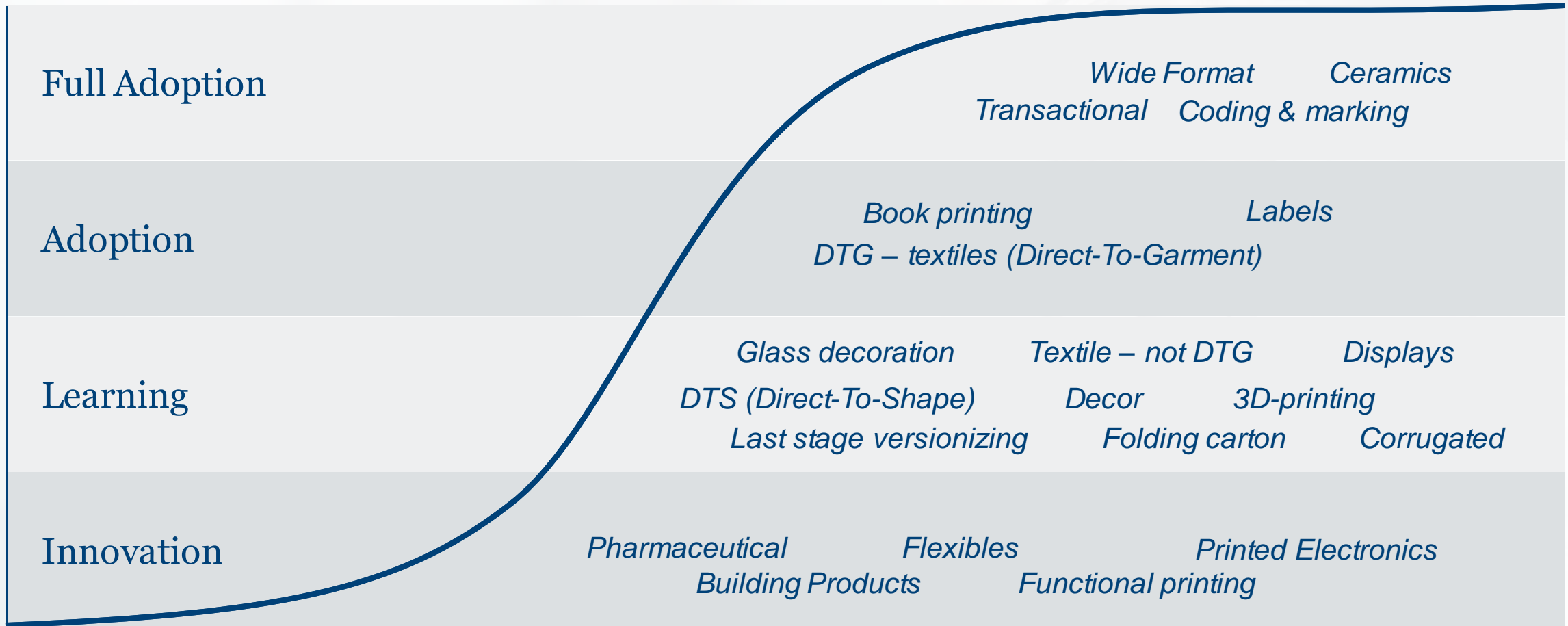
Comparison of Electrophotography and Inkjet.



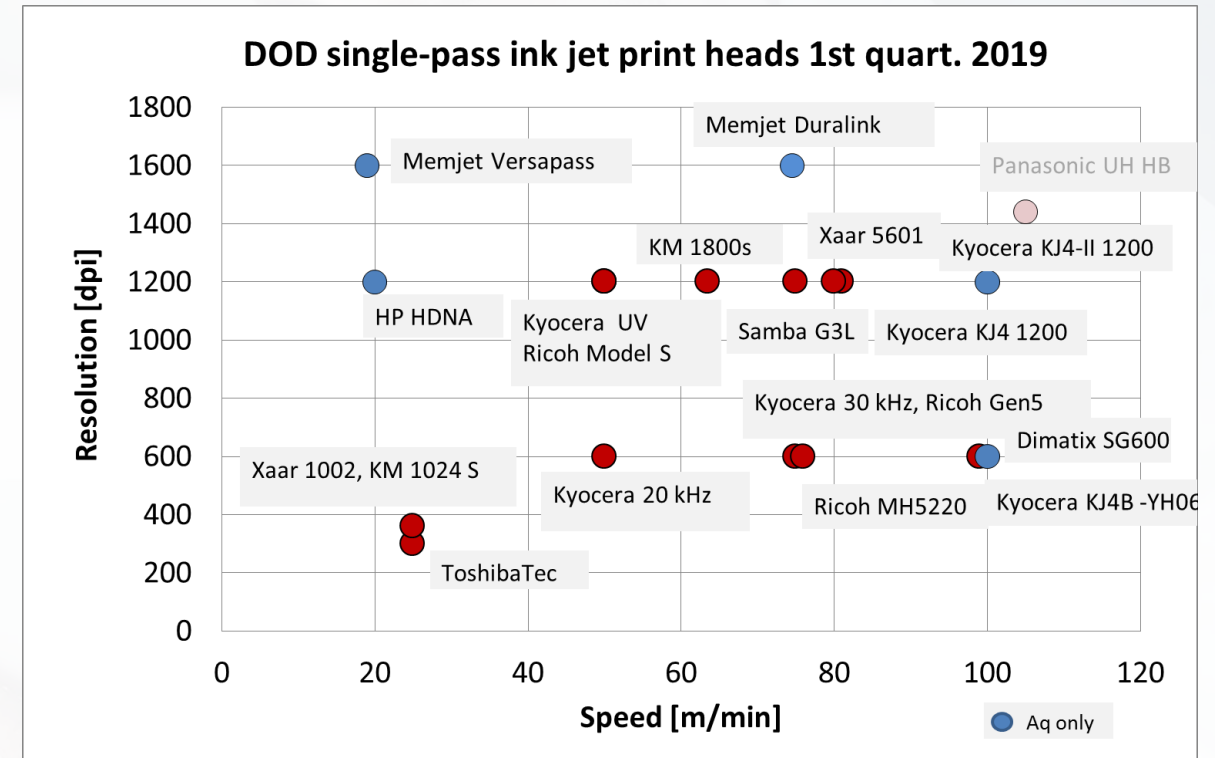
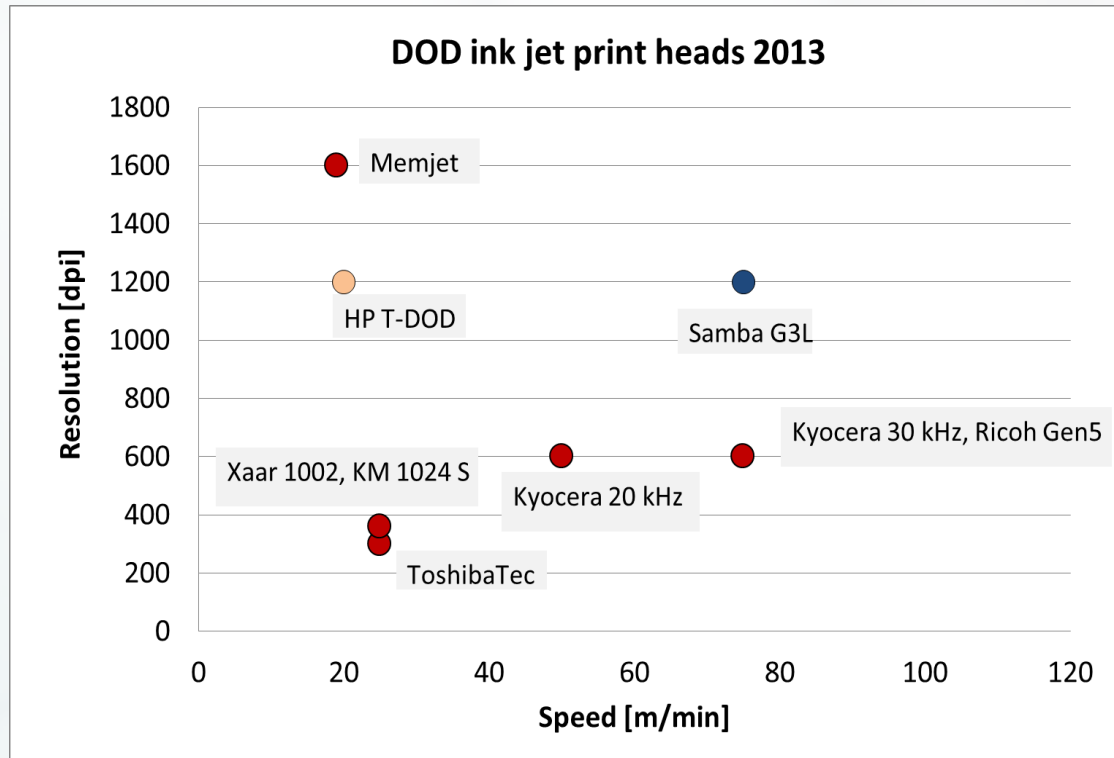
Characteristic	Electrophotography	Inkjet (Piezo)
Technology Readiness	Mature	Still high innovation curve for inkjet heads, fluids and processes
Speed	4C about 32 m/min	Up to 125 m/min (independent of number of colors)
Quality	Close to Offset	Like Offset or better
Print Width	Up to 550mm	> 2000 mm possible
Process Flexibility (Print Media Industry)	Well established	Learning Phase
Process Flexibility (All Industries)	Limited	High (small head sizes and diversity of fluids)

Technology developments.

Adoption Rate of inkjet in different industries.



Inkjet Print Head offering – continue to proliferate – speed and resolution increasing

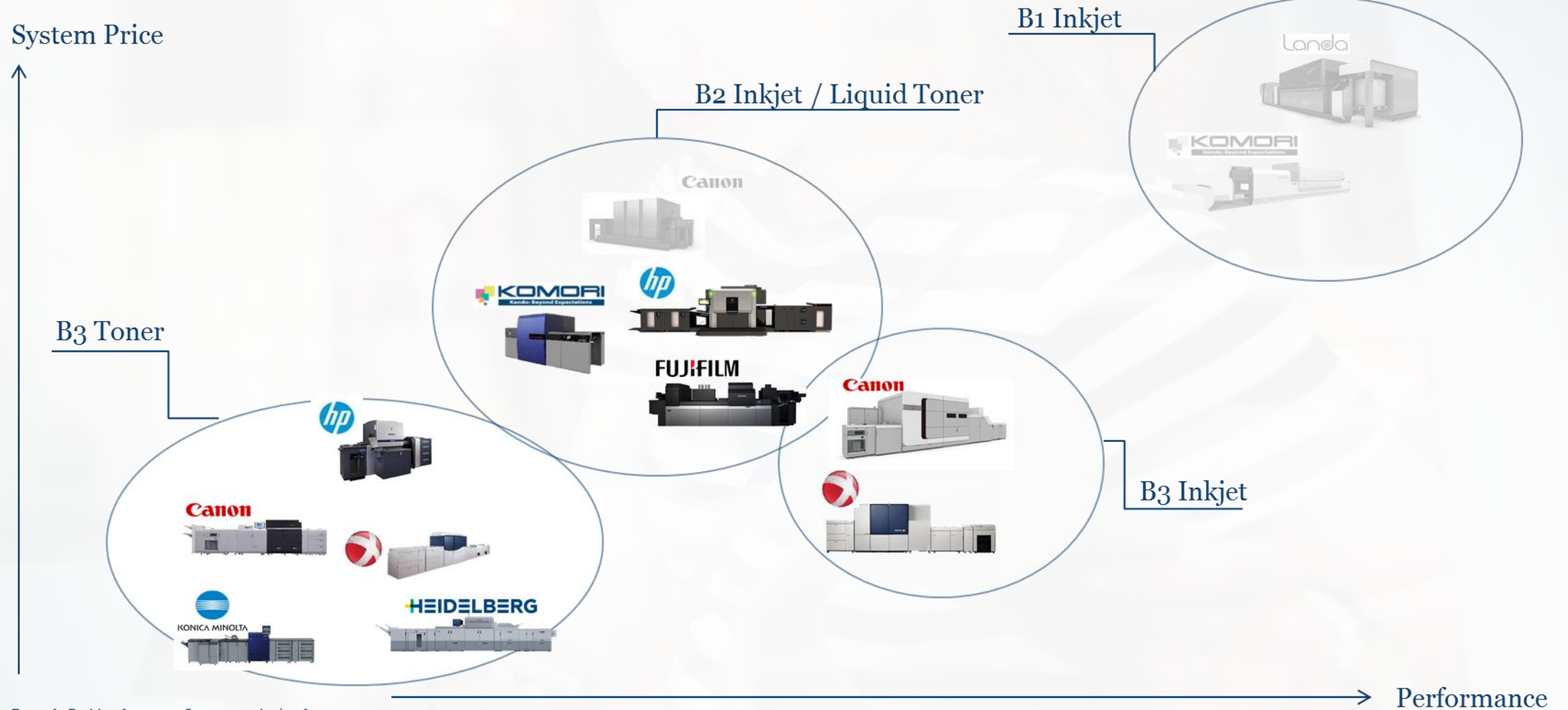




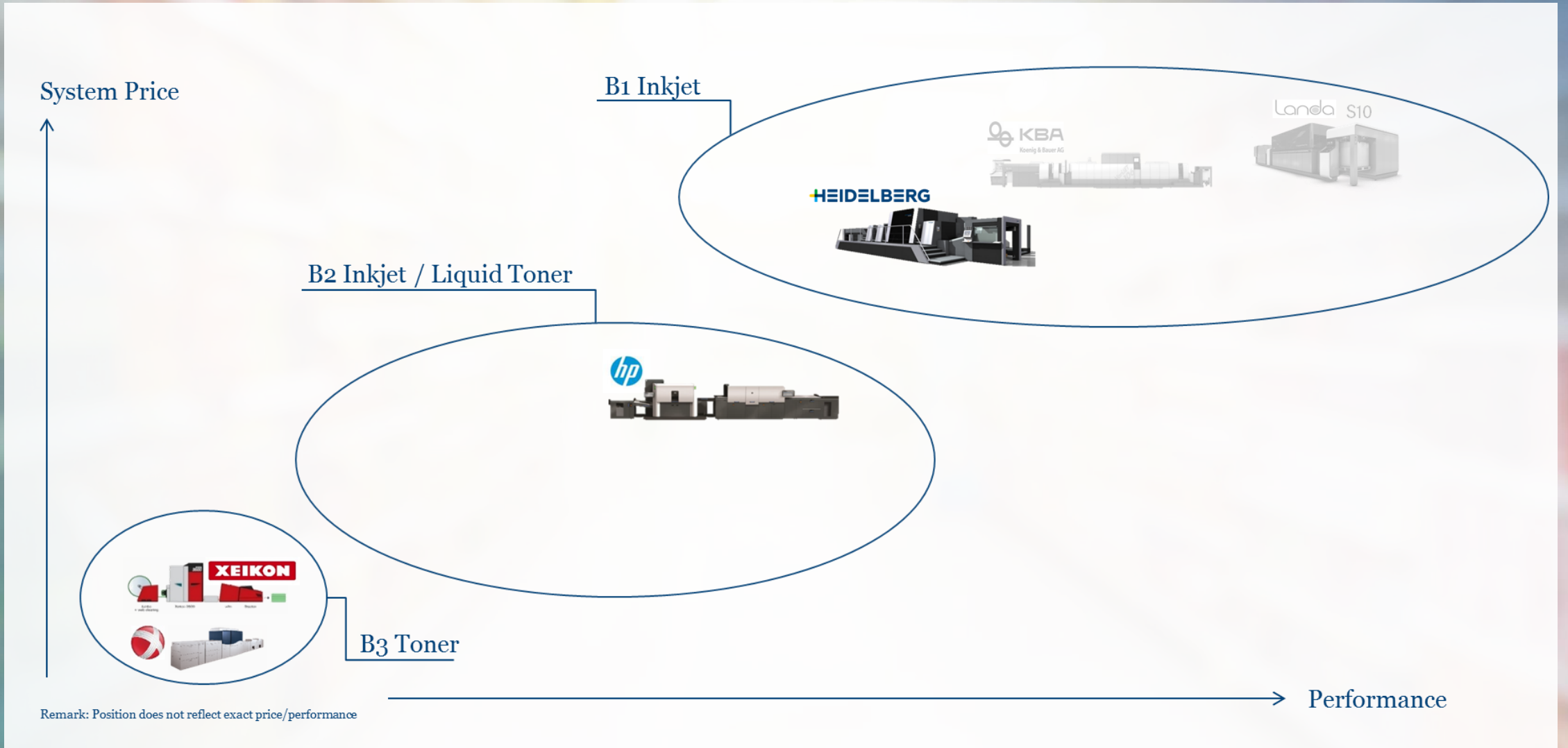
System Landscape.



System landscape. Commercial Print.



System landscape. Folding Carton.



System landscape.

Development steps during the last years.



Characteristic	Electrophotography	Inkjet (Piezo)
Flexibility	<ul style="list-style-type: none"> → Largest substrate range (400+) e.g. Synthetics, Coated & Uncoated, Sticker, NCR, ...) → Effect toner like Neon, Pink, ... → Spot varnish 	<ul style="list-style-type: none"> → Exact control of fluids → Innovations in ink for more applications → Qualified substrates
Technology	<ul style="list-style-type: none"> → Proven systems for SRA3 market → Banner formats → Mixed media productions → Performance capabilities not used in the market 	<ul style="list-style-type: none"> → Thin-Film-Technology for actuators → Small space, low temperature, high frequencies and higher speed → Through-Flow-Technology for reliable jetability, suitable for difficult fluids → Process control for inkjet nozzles



Quo Vadis Digital Printing Technologies. **Bottom line.**

- **Color toner will continue to best serve commercial printer needs for digital printing in the foreseeable future.**
- **Significant investment in expanding inkjet's capabilities, technically and economically are on the way.**
- **Beyond 2022, graphic arts quality inkjet technology may well exceed toner print volume.**
- **Investment decision always based on application- and capacity-requirements.**



Thank you very much for your attention.
I am happy to answer your questions.