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Nano-enabled multifunctional polymer components: from applied research to market

"innovating for business"

Upscaling nano-based multifunctional polymer components
Nuria García
EuroNanoForum, Bucharest, 13th June 2019

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Strategic areas

MULTI-SECTORIAL TECHNOLOGY EXCELLENCE

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Industrial area

1. Advanced materials and manufacturing processes
2. Functional printing
3. Interactive and autonomous robotics
4. Sustainability

Digital area

1. Data science & Big Data analytics
2. Artificial Intelligence and IoT
3. Multimedia technologies and user experience
4. Cybersecurity

Biotechnology area

1. Omic sciences
2. Food safety and toxicity
3. Bioactive components

160 Large R&D projects

81 patents

7 spin-offs

51M (€) **2018**

1,500 client businesses

658 professionals

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Singular facilities

EURECAT PILOT PLANTS FOR POLYMERIC PRODUCTS

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Plastic Processing Pilot Plant

- **Complete range of Plastic Injection Machines.** From microinjection to 1500 Tn of clamping force including 3K multi-material injection molding.
- Sustainably providing **services to industry for more than 30 years.**
- **Range of services:** Support to innovation in plastic, from idea to manufacturing through design and process.
- Mould testing//Process development// Pre-series manufacturing
- **More than 30,000 try outs** accumulated over time.
- **TRL 9**

Nano-pilot plant for nano-enabled functionalisation

- **Nano and Smart functionalisation of plastic products** in the bulk (nano-aadditives dispersión) and in the Surface (periodical nanotextures and IME) .
- **Clean room facilities** ISO8 (E.printing & I.Molding)
- **TRL 5 - 7** depending of the processes

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Eurecat's pilot plants for polymeric products

NANO-PILOT PLANT FOR NANO-ENABLED FUNCTIONALISATION

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FUNCTIONALISATION TYPE	Process	Nano-what	Current TRL*	Applications	Funding sources
Bulk	US- assisted Nano-dispersion in Extrusion and injection moulding	Nano-additives	TRL 7	Multifunctional nanocomposites	H2020- NMBP-Pilots Optinanopro
Surface	Injection Moulding Nanotexturing	Surface Nano-features	TRL 5	Multifunctional surfaces in thermoplastics and silicone rubber	Regional ERDF Internal funds
Opto-electronics	In Mold Electronics (IME)	Any of the above	TRL 7	Smart multi-functional plastic products	H2020-ICT Optintegral

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Differential value: Improved additives dispersion

BULK NANO-FUNCTIONALISATION

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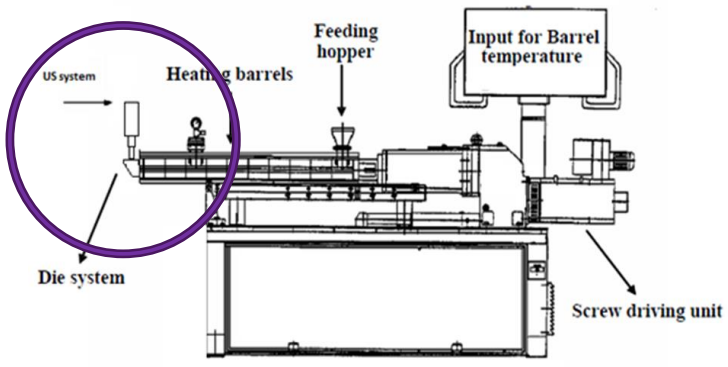
Extrusion-Compounding

- Obtention of plastic feedstock for injection moulding processes
- Homogeneous distribution of nanoparticles and fillers
- Part cost and weight reduction: Functionalities are obtained with less additives. Ex: 8% of well dispersed nano-clays are equivalent to 20% of talc.
- 50% improved barrier properties in solid packaging (OTR/WTR)

Additives dispersion maximised with Ultrasounds

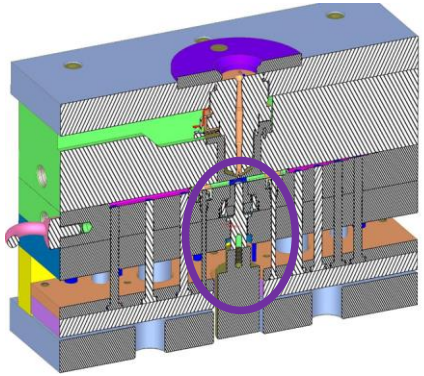
Injection Moulding

- Final product manufacturing
- Allows for weight reduction of structural parts
- Optimized distribution & homogeneity of nanoparticles and fillers = homogeneous structurally enhanced behaviour of part
- USs-technology directly fitted on I.Mould



OPTINANOPRO

H2020 – NMP - Pilots
GA no. **686116.**



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Differential value: low-cost tooling

SURFACE FUNCTIONALISATION

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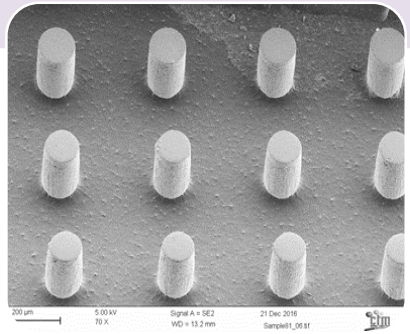
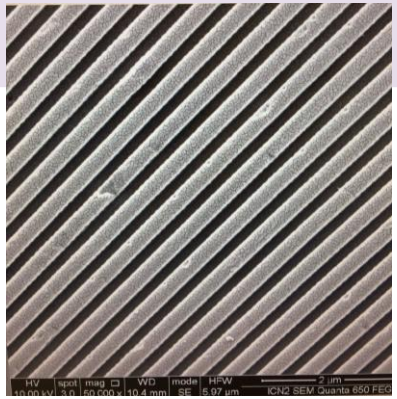
Thermoplastics nano-texturing

- Nano and micro-features < 170 nm.
- High aspect ratio pillars.
- Low cost moulds: adaptable to existing grain textured moulds.
- Suitable for short and long series manufacturing.
- Different commercial polymer materials such as PP, TPU, PMMA, PET, PC, PLA, COC and COP have been successfully tested.
- Good replicability and repeatability. High quality parts.
- Increased design freedom, more functionalities become possible.

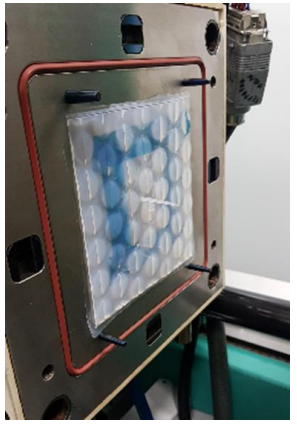




Low-cost tooling

Silicone nano-texturing

- Liquid Silicone Rubber, LSR
- Nano and micro-features < 170 nm
- Functional surfaces (antibacterial, low adhesion, structural color, etc.)
- Good replicability and repeatability. High quality parts



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Differential value: all steps integrated in the same pilot plant: from the electronics to the product

SMART FUNCTIONALISATION

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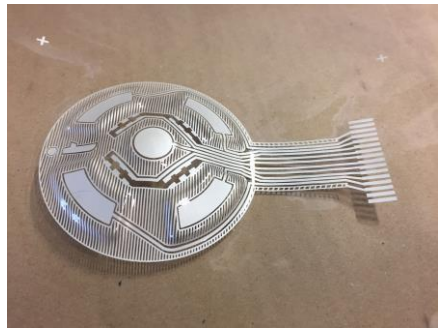
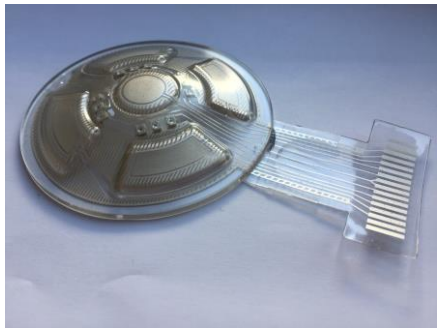
In Mold Electronics: plastic components with integrated printed opto-electronics

flat or curved surfaces

Benefits

- Simplification of the device arquitecture: thin & lightweight.
- Multifunctionality
- Integration of LEDs and optical functionalities in the plastics to perform as lenses.
- Encapsulated and protected printed electronics with overmoulded plastic.
- Compatible with curved 3D shapes.

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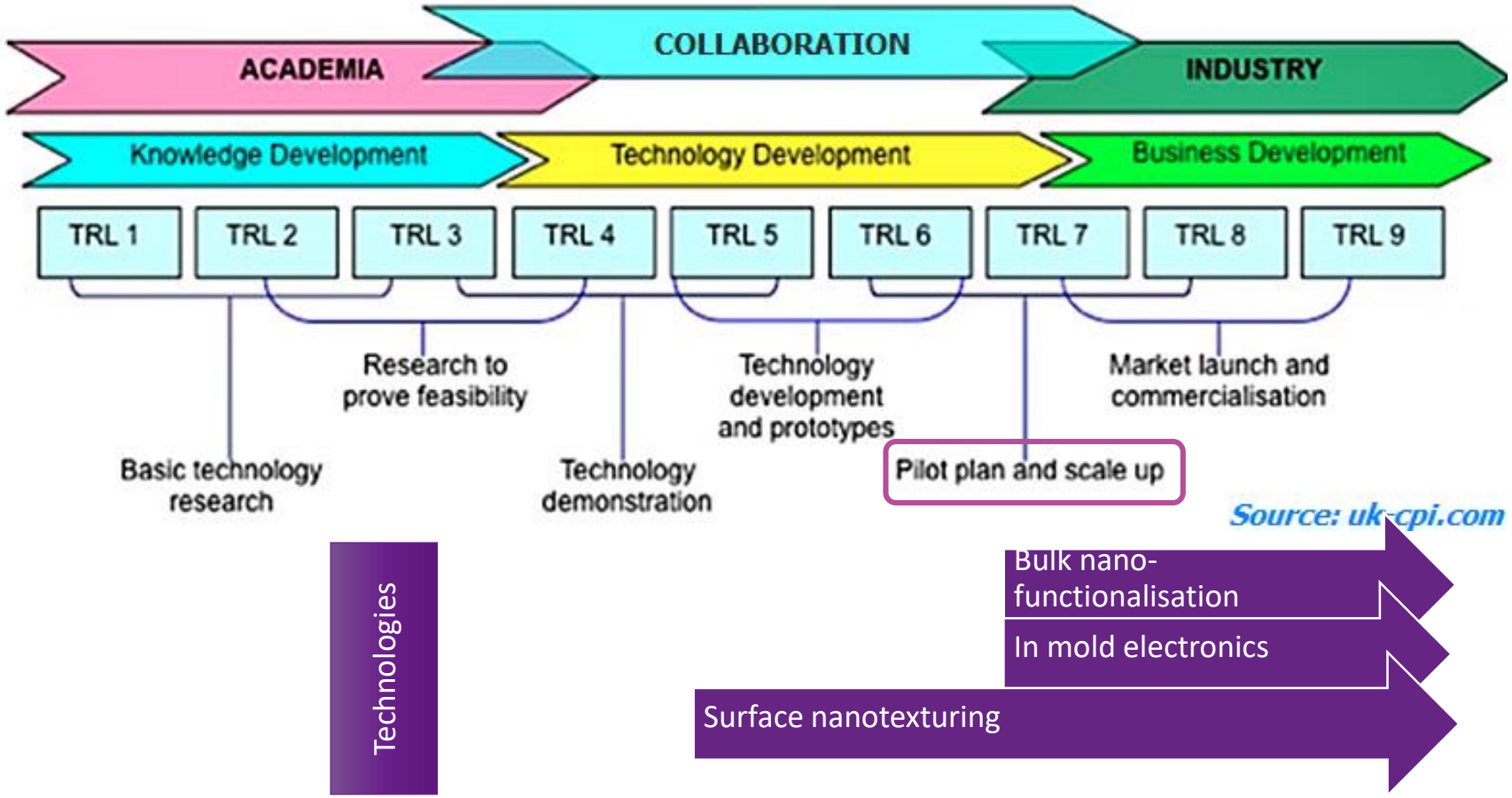
Steps

- Process development
- Industrialisation
- Pre-series manufacturing
- Validation
- Knowledge transfer

The Innovation Chain: Converting Science into Wealth



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SUSTAINABLE BUSINESS MODEL BEYOND PUBLIC FUNDING

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Problem

1. New added-value plastic products
2. decrease cost
3. costly equipment for trials and R&D

Solution

Product funtionalisation on customised products

R&D services for Scale-up & Industrialisation

Unique value proposition

Processes integration

Robustness

Low cost moulding

Biocompatibility

Validation at preseries level

Internal advantage

Whole value chain cover

Differential infraestructures & know-how

Combination of technologies

Channels

Direct comercial activity

networks (clusters, regional agency,...).

Dissemination activities

Customer segments

Plastic part producers:

Final Integrators

Tier 1 suppliers of complex products (auto, aero,...)

Early adopters

Very competitive sector (auto) or high added-value demands (health, photonics,...)

Cost structure

Fixed: Equipment and plant infraestructures amortization

Variable: Personnel, operating cost

Revenue Streams

Private product/process development projects (ad-hoc)

R&D collaborative public funded projects

Consulting on tech/economic viability and Pre-series tech. Services

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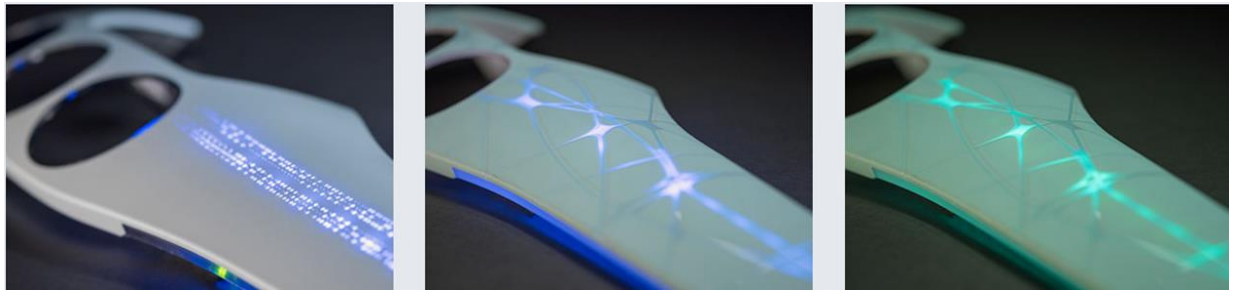
SECTORS AND PRODUCTS

Active & interactive products & surfaces

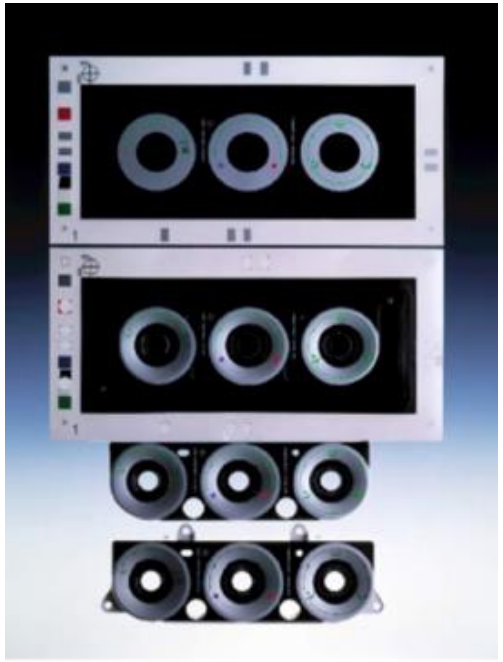
Automotive



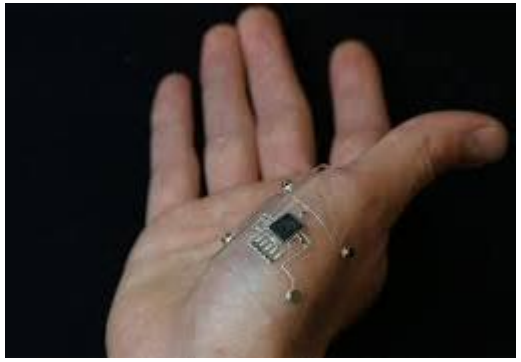
Sports

Medical

Household Appliances

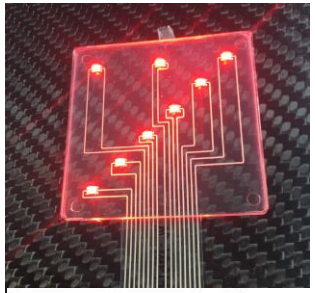


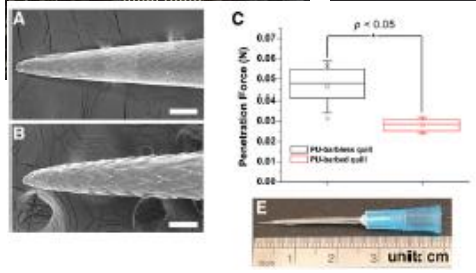
Medical devices



Wearables

Smart Lighting





Optics

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VALUE CHAIN

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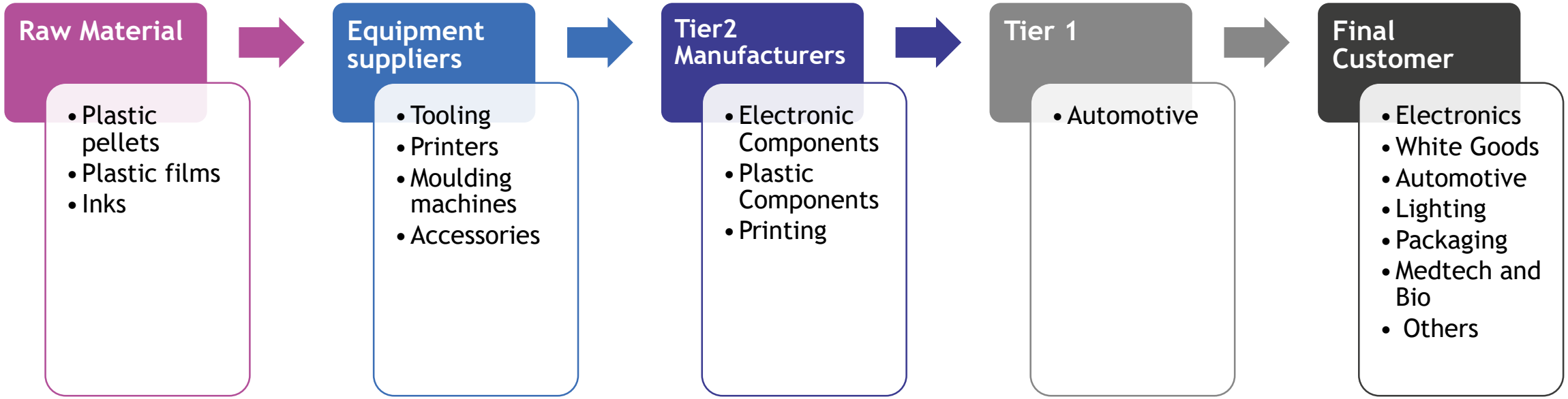

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LIFE CYCLE IMPACT

Material Reduction

- Less parts, integration of components
- Up to 70% reduction of thickness & weight

Material Separation

- Electronic inks & thermoplastic substrates & films : recoverable via mechanical & chemical separation

Material sourcing

- Use of biobased materials. Bioplastics processing capabilities

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SUCCESSFUL INDUSTRIAL IMPLEMENTATIONS

SMP

SRG GLOBAL™ A GUARDIAN COMPANY

Unex®

KOSTAL

WALTER PACK GROUP

ZANINI AUTO GRUP

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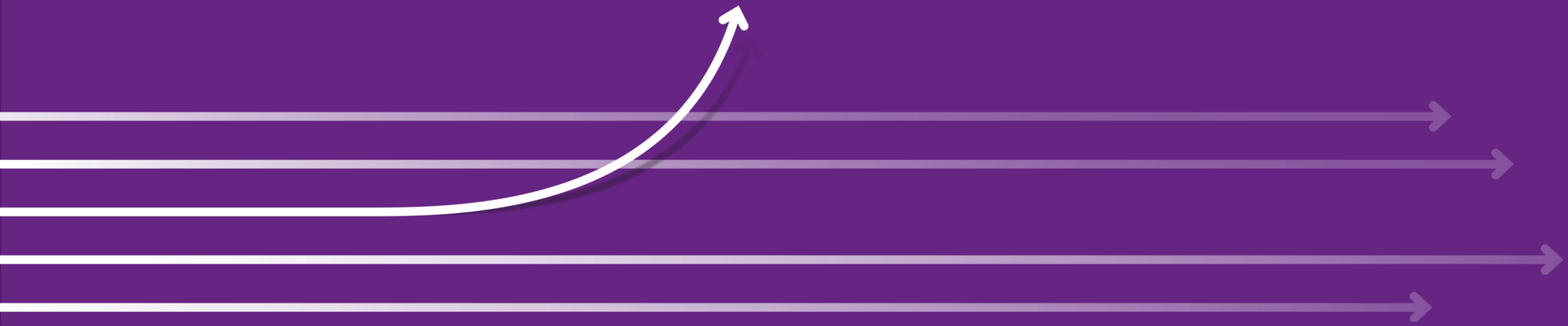
Thank you!



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