HP MULTI JET FUSION

The new era of Additive Manufacturing

Lead23
Leadership&
Innovation

Leadership & Innovation 2025-2026

POLITECNICO
MILANO 1863

TABLE OF CONTENTS

00

THE TEAM


Gabriele Faletto


Elisa Colavito


Júlia Drumond Caetano Caldeira Ferreira


Ayberk Dinçkol


Niroth Stefano Fernando Pulle


Giuseppe Daniele


Sara Maduhansi Perera

01

EXECUTIVE SUMMARY

Executive Summary

This report explores the relationship between innovation and leadership through the case of **HP Multi Jet Fusion**, a disruptive additive manufacturing technology developed by HP to move 3D printing beyond prototyping and toward real industrial production. The analysis focuses not only on the technical features of the innovation, but also on the organizational, strategic, and leadership conditions that allowed HP to transform an internal technological capability into a scalable manufacturing system.

HP represents a particularly relevant case because its entry into industrial 3D printing did not emerge from an isolated experiment, but from a **broader trajectory of technological diversification**. Historically known for computing and printing, the company progressively built strong capabilities in precision engineering, thermal inkjet systems, product development, and large-scale commercialization. Multi Jet Fusion can therefore be interpreted as a strategic extension of HP's existing knowledge base: rather than entering additive manufacturing as a pure newcomer, HP leveraged decades of accumulated expertise to challenge the limits of established 3D printing technologies.

The core innovation of MJF lies in its shift from a point-by-point production logic to an **area-wide process**. Traditional technologies such as FDM and SLS generally build parts by extruding material or selectively melting powder in a sequential way. MJF instead spreads a thin layer of thermoplastic powder, deposits fusing and detailing agents with high precision, and then applies energy across the full layer. This architecture enables faster production, higher control over part definition, and the possibility of influencing material properties at voxel level. Thus, MJF is not simply a faster printer, but a **new manufacturing architecture** combining hardware, software, materials, process control, and post-processing into an integrated industrial system.

From an innovation perspective, the case is especially interesting because it combines several theoretical dimensions. First, MJF can be read as a **radical innovation** that reset the technological S-curve of additive manufacturing. Existing technologies had improved incrementally over time, but they remained constrained by productivity, cost-per-part, and scalability limitations. HP's goal was not to refine the same trajectory, but to introduce a discontinuity capable of opening a **new performance curve**. At the same time, after the initial technological breakthrough, the innovation continued to evolve through incremental refinements, reliability improvements, and cost reductions.

Secondly, MJF shows the interaction between technology-push and market-pull dynamics. The early phase was strongly **technology-driven**: HP started from internal R&D capabilities, especially its thermal inkjet expertise, and explored how these assets could be recombined into a new additive manufacturing solution. However, market adoption required more than superior performance. HP had to understand why previous technologies had not scaled, educate customers, reduce perceived risk, and demonstrate concrete industrial applications. The innovation therefore evolved from an internal technological push into a more **market-oriented** process focused on customer use cases, service bureaus, and application development.

Moreover, the case illustrates the transition from **innovation of solution** to **innovation of meaning**. At the beginning, the problem was functional: make additive manufacturing faster, more reliable, and more economically viable. Over time, however, MJF also contributed to changing the meaning of manufacturing itself. Traditional production is usually associated with economies of scale, tooling dependency, centralized plants, and standardized volumes. MJF supports a different logic: flexible production, shorter iteration cycles, lower tooling dependency, localized manufacturing, and mass customization. Its relevance therefore goes beyond technical improvement; it challenges how companies understand the value and role of production.

Furthermore, MJF is best interpreted as an **architectural innovation**. Its competitive advantage does not come from one isolated component, but from the complex integration of multiple elements: thermal inkjet printheads, chemical agents, powder materials, energy control, software, post-processing, service support, and customer adoption mechanisms. This systemic complexity makes the technology difficult to replicate and explains why HP's complementary assets mattered so much. Financial scale, R&D capacity, brand credibility, distribution, and service infrastructure were not secondary factors; they were essential conditions for converting the invention into a viable industrial innovation.

The report also examines the leadership dimension through three key HP profiles: Sascha de Peña, Jesus López, and Davide Ferrulli. Together, they cover different phases of the MJF journey. **De Peña** represents the exploratory and technological core of the innovation, where uncertainty, experimentation, and failure management were central. **López** represents the transition from technological development to structured execution, industrial maturity, and cross-functional coordination. **Ferrulli** represents the market-facing dimension, where leadership involves customer education, trust-building, and adoption support.

Several leadership frameworks are applied to interpret these dynamics. Through Blake and Mouton's Managerial Grid, the three leaders show different but **complementary orientations**: López is more task and execution-oriented, Ferrulli emphasizes people, support, and relationship-building, while de Peña is closest to team management, balancing autonomy with performance. Situational Leadership adds a more dynamic perspective, showing that leadership style changes across the innovation lifecycle. Early uncertainty required autonomy, inspiration, and tolerance for failure; later phases required alignment, convergence, milestones, and operational discipline.

Transformational leadership emerges as the dominant logic of the case. In a radical innovation context, leaders cannot rely only on rules, incentives, or formal authority. They must **create purpose**, stimulate unconventional thinking, build credibility, and develop people. Transactional mechanisms are still present, especially in later phases through targets, gates, and efficiency metrics, but they support rather than define the leadership culture. Servant and shared leadership complete the picture: the MJF case shows that innovation depends on leaders who enable others, distribute responsibility, create psychological safety, and build a shared direction across highly specialized teams.

Overall, HP MJF demonstrates that disruptive innovation is never purely technological. A breakthrough can originate from internal capabilities, but it becomes industrially meaningful only when technology, market understanding, organizational integration, and leadership are aligned. HP's success with MJF lies in this combination: the ability to exploit existing competences, reconfigure them into a new architecture, guide customers toward a new manufacturing logic, and mobilize leaders capable of balancing vision, experimentation, execution, and trust. In this sense, MJF is not only a case of additive manufacturing innovation, but a broader example of how large organizations transform deep technological knowledge into a **new industrial paradigm**.

02

INTRODUCTION

2.1 Company Overview & Historical Background

HP Inc. is a global technology company with a business model centered on two main pillars, **Personal Systems** and **Printing**, supported by a broader structure that also includes corporate investments and innovation initiatives. Its activities span consumer and professional hardware, software, services, and printing solutions, ranging from PCs and displays to commercial print technologies. Within this broader industrial and technological positioning, **3D printing** represents a strategic extension of HP's printing business, reflecting the company's effort to move beyond traditional devices and strengthen its role in **Advanced Manufacturing** (AM) and industrial applications.

This positioning makes HP particularly relevant in AM innovation. As a matter of fact, capabilities built over decades in printing technologies, precision engineering, and large-scale product development. HP's industrial 3D printing business is positioned around themes such as production use, print expertise, quality, and manufacturing applications, reinforcing the company's ambition to evolve from a traditional technology brand into a credible player in industrial additive manufacturing.

HP's historical evolution shows a company that has repeatedly expanded its technological scope while preserving a strong link between **innovation and business transformation**. From its origins as an engineering-driven firm, HP progressively built capabilities across electronics, computing, and printing, using each phase of growth to enter adjacent markets and strengthen its industrial relevance. This trajectory is useful because it highlights how the company's move into 3D printing was not an isolated shift, but part of a longer pattern of technological diversification, capability building, and adaptation to changing market opportunities.

Company Milestones

1939 – Founding in Palo Alto

HP was founded by Bill **Hewlett** and Dave **Packard** with **$538**. Its first product, the **200B** audio oscillator, established HP's engineering-driven identity.

1957 – IPO and "The HP Way"

HP went public and formalized a management culture based on **trust**, employee **autonomy**, and **shared innovation**.

1966 – Entry into Computing

With the **2116A**, HP entered the **computer market**, expanding beyond measurement instruments into computing systems.

1984 – Printing Breakthrough

HP launched key **inkjet** and **laser printing technologies**, building the technological base that later supported its move into 3D printing.

2002 – Compaq Merger

The **Compaq** acquisition expanded HP's global scale and reinforced its position as a **leading hardware company**.

2014 – MJF Announcement

HP announced its entry into **industrial 3D printing** with **MJF**, targeting production of end-use parts rather than hobbyist applications.

2015 – Split into HP Inc. and HPE

The separation created **HP Inc.**, focused on PCs, printing, and 3D printing, giving the company a clearer hardware and manufacturing innovation focus.

2021–2026 – Additive Manufacturing Expansion

HP consolidated its additive manufacturing strategy through **polymer and metal** 3D printing solutions for industrial sectors such as automotive and healthcare.

2.2 Internal Analysis

HP's competitive advantage is rooted in a unique combination of core resources and distinctive competences, with a strong contribution resulting from Innovation capabilities and Brand Equity.

CORE RESOURCES

Global Brand & Distribution — Strong recognized brand & extensive distribution network

R&D Excellence — Large Investment capability and high-level technologists.

Technological Expertise — Historical experience in Technological Innovation and intellectual property

CORE COMPETENCIES

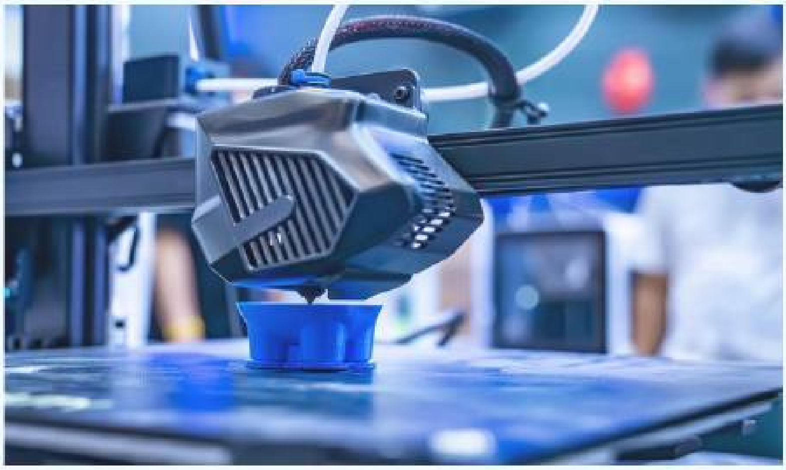
Innovation & Continuous Product Development — Excelling in continuosly developing new products and constantly improving previous ones. enabling market responsiveness and fit.

Operational Efficiency — Efficient supply chain and operations management, enabling cost effectiveness.

Customer-Centric Approach — Deep understanding of customers' needs and ability to design tailored solutions.

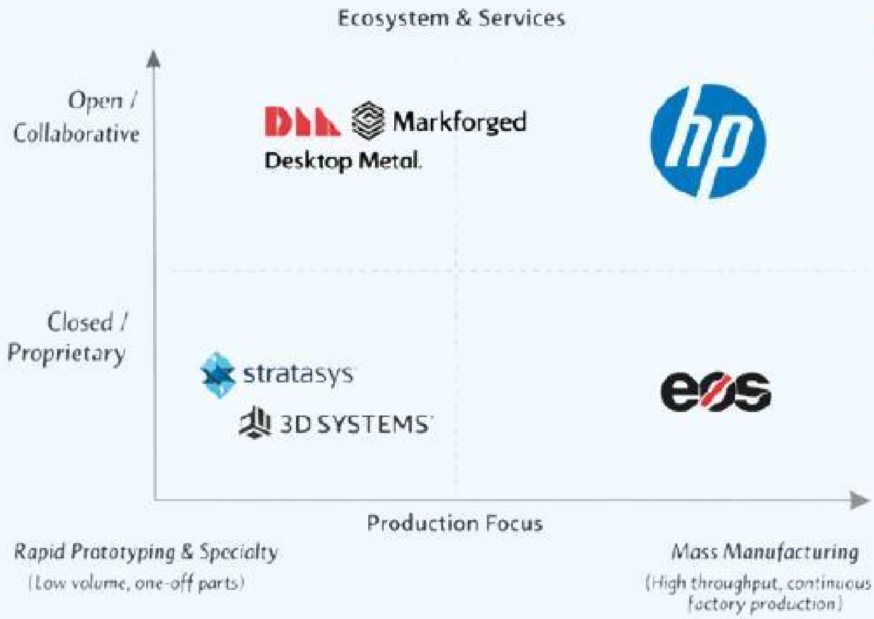
2.3 Market Analysis

3D printing market overview



The global Additive Manufacturing industry is experiencing unprecedented expansion, transitioning from a rapid prototyping tool into a **foundational pillar** of modern industrial mass manufacturing. Valued at $30.5 billion in 2025, the sector is projected to reach $88.2 billion by 2030, with a **CAGR** of 23.9%.

This growth is driven by the need for l**ocalized digital supply chains** that reduce inventory costs and maintain production flexibility. **Italy** represents a critical center for this adoption, showing a CAGR of over 23.5%, fueled by its advanced automotive, aerospace, and healthcare sectors.



Competitive Landscape

Historically, the competitive framework was dominated by pioneers like **Stratasys**, **EOS**, and **3D Systems**, relying on expensive, **closed** ecosystems tailored for low-volume parts. Recently, challengers like **Desktop Metal** and **Markforged** have intensified competition.

Unlike its incumbent position in 2D printing, HP entered this fragmented market as a **strategic disruptor**. Backed by massive corporate revenue and R&D power, HP managed to leverage its **historical complementary assets** - specifically its thermal inkjet expertise. By introducing an **open materials** approach and exploiting its huge financial scale, HP aimed to disrupt legacy competitors and push the market toward full-scale industrial mass production

2.4 The Interviewees

Davide Ferrulli, Regional Manager (EMEA)

*"**A good leader must hire future good leaders.** I must not be afraid of someone taking my place. If that happens, it means that I've been a good leader"*

Driven by the conviction that MJF was the key to industrial-scale manufacturing, he hasn't just been closing deals at HP: he's been redefining the way industries think about manufacturing.

Sascha de Peña, Distinguished Technologist for 3D Printing Business

*"If you want to find the right path, **you have to fail nine other paths.** [...] You have to put your feet into the cold water as early as possible in order to see if what you're thinking is true or not."*

Sascha was among the conceptual architects of the MJF technology, leading its early **open innovation** phase to combine existing ideas into a brand new architecture.

Jesus López, Global Head of Services & Operations at HP AM

*"Your responsibility is not only to have them delivery their work and realize great products, **your responsibility is to help them grow**"*

With over 32 years at HP, Jesus is now the Head of Services and Operations, after leading 3D R&D for the last 12 years. He was crucial in turning MJF into a mature, scalable commercial system.

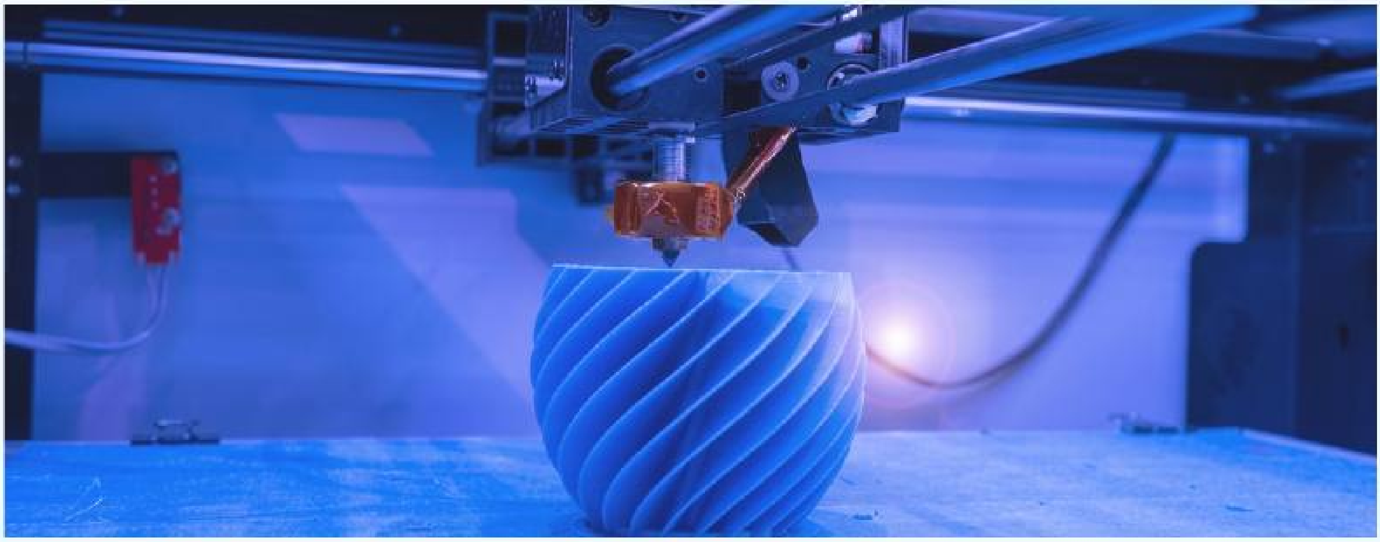
These three distinct profiles provide a **comprehensive perspective** on the MJF journey. Together, they cover the **entire lifecycle of the innovation**: from Sascha's initial technological exploration and architectural design, through Jesus's structural transition into a scalable industrial solution, up to Davide's focus on market adoption and customer mindset transformation. This complementary triad allows us to thoroughly analyze how different leadership styles and strategic approaches must **dynamically evolve** and integrate to turn a disruptive idea into a global market standard.

03

INNOVATION CASE

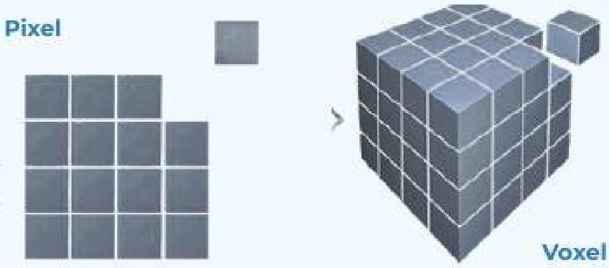
3.1 Description of the Innovation

HP Multi Jet Fusion (MJF) is a 3D printing technology developed by HP that represents a fundamental shift in how physical objects are manufactured. Traditional 3D printing technologies - such as **Selective Laser Sintering** (SLS) and **Fused Deposition Modeling** (FDM) - build parts either by melting powder with a laser ray point by point, or by extruding melted filament layer by layer. Both approaches are **slow, costly** at scale, and produce parts with **structural weaknesses**. MJF was conceived to overcome all these limitations at once, moving from a "point-by-point" logic to a far more powerful **"area-wide"** approach, where an entire surface is processed in a single, continuous pass.



MJF works through a **powder-bed** process in which a thin layer of thermoplastic powder is first spread across the build area. A carriage then moves over the surface and deposits **chemical agents** with high precision: a **fusing** agent in the regions that must become solid, and a **detailing** agent along the boundaries to control heat diffusion and preserve dimensional accuracy. Then, energy is applied to the full layer at once, so that only the selected areas fuse. The sequence is repeated layer by layer until the final geometry is completed, combining relatively **high productivity** with fine **control** over part definition.

A more advanced aspect of the technology is its ability to control material behaviour at the **voxel level** through transforming agents. A voxel can be understood as the three-dimensional equivalent of a pixel: instead of defining colour on a flat image, it defines local **physical properties** inside a printed object.



By varying the agents deposited at specific points, MJF can potentially create parts with **different** mechanical, visual, or functional **properties** within a single build, such as variations in hardness, flexibility, texture, conductivity, colour, or transparency. Once printing is complete, the parts move to a post-processing stage where they are cooled, extracted, and cleaned, while the unfused powder is recovered and reused, improving **material efficiency** and reducing waste.

3.2 Impact on the Market and Transformative Role

The introduction of MJF marked a strategic turning point for HP, extending its printing expertise into industrial additive manufacturing. At the same time, it strengthened HP's positioning beyond PCs and traditional printers, allowing the company to enter a high-potential manufacturing market with a technology aimed at **real production**, not only prototyping. Right after its release, the **performance gap** with existing competitors was measurable: MJF delivers build speed up to **ten times** faster than comparable FDM and SLS solutions, while the cost per part is up to **65%** lower than equivalent systems. These figures allowed HP to position MJF not merely as a faster printer, but as a genuinely **disruptive alternative** to the dominant technologies of the industry.

This simultaneous compression of time, cost, and design constraints fundamentally changes what is feasible for manufacturers of all sizes. The most immediate effect companies report after adopting MJF is a dramatic reduction in both time and cost.

Blazin Rodz completed an entire custom vehicle build in twelve months instead of the typical three to five years.

Blazin Rodz 1970 Chevrolet Chevelle, aka "Doughboy"


AGCO 3D prototype

AGCO reproduced a prototype previously quoted at $120,000 for just $3,200.

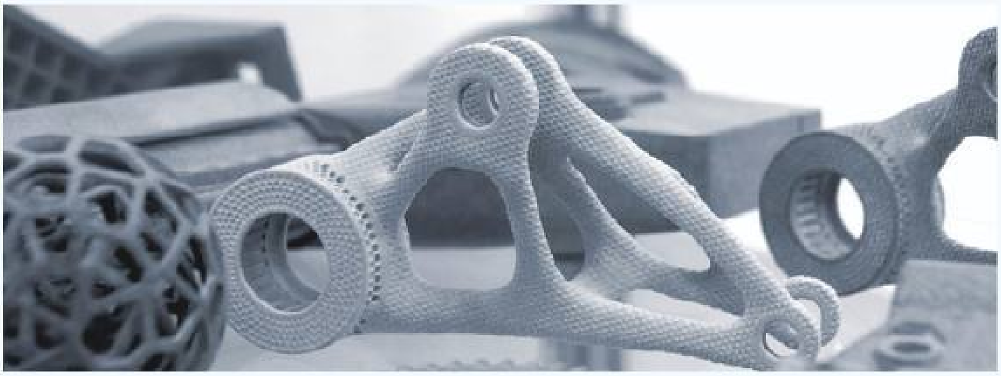
But the impact goes beyond economics. MJF has also allowed companies to build things that were simply not achievable before. **Point Designs** created prosthetic sockets that are rigid and flexible within the same part. **WEERG** rewrote the rules of industrial on-demand, deploying the **world's largest centralized fleet** of MJF systems: an unprecedented production power that unlocked the printing of tens of thousands of TPU and nylon parts, transforming additive manufacturing from a prototype niche to a true alternative to injection molding.


Point Designs' Prosthetic hand

Taken together, what these cases illustrate is that MJF has not simply improved an existing process: it has **changed the logic of production** itself, removing the dependency on expensive tooling, enabling on-demand manufacturing, and making **mass customisation** economically viable across virtually every industry that involves physical components.

3.3 Interest in the Study of this Innovation

HP Multi Jet Fusion is a compelling study because it demonstrates how deep-seated **internal expertise** can shatter **long-standing industrial limits** to launch an entirely new performance trajectory. The case is noteworthy because it transcends simple hardware improvements, instead orchestrating a complex web of materials, software, and services into a unified production ecosystem.



This journey illustrates the shift from merely overcoming technical speed barriers to fundamentally redefining the logic of manufacturing, moving toward a decentralized, on-demand paradigm. Ultimately, the case reveals how navigating extreme technical and market uncertainty requires a **leadership approach** that empowers **diverse teams** to iterate through failure to **reshape global value propositions**.

04

INNOVATION LENS

4.1 S-Curve and Radical vs Incremental Innovation

The decision to apply the **S-curve framework** stems from the need to interpret Additive Manufacturing evolution through a dynamic lens of technological change. This model maps performance over time across three distinct phases: **initiation**, where progress is slow; **development**, offering rapid growth and high payback; and **maturity**, where technologies approach their structural **technical limit**. At this saturation point, companies face diminishing marginal gains, as traditional optimization fails to yield substantial performance breakthroughs.

Within this context, the distinction between **incremental and radical innovation** is crucial. While incremental innovation focuses on refinements within an existing trajectory, radical innovation introduces a **discontinuity** capable of initiating an entirely new technological curve.

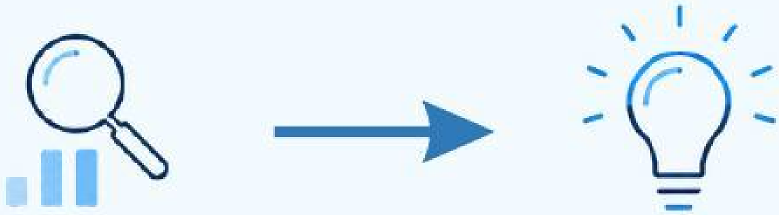
This perspective is vital for analyzing HP's development of Multi Jet Fusion. Existing technologies had **reached a stage of maturity** characterized by significant industrial limitations; as Davide Ferrulli observed, previous methods were "***good if you need to do one part... but you could not scale to thousands of parts***". Consequently, MJF is interpreted not merely as an optimization, but as a **radical attempt to overcome the maturity of previous paradigms**. By introducing a new production logic, HP effectively reset the technological trajectory to shatter previous limits in speed and scalability.

> **"THERE WAS JUST THIS CHALLENGE THAT WE SHOULD COME UP WITH A DISRUPTIVE 3D PRINTING TECHNOLOGY FOR HP. [...] WE WERE TRYING TO IDENTIFY HOW THE EXISTING TECHNOLOGIES WERE WORKING, ANALYZING THEIR GAPS, AND MAKING PROJECTIONS OF WHERE THOSE TECHNOLOGIES COULD BE IN THE FUTURE."**
>
> Sascha de Peña

The Radical Leap: Resetting the Additive Manufacturing S-Curve

Before Multi Jet Fusion, the industrial Additive Manufacturing landscape was dominated by established paradigms like Selective Laser Sintering (SLS) and Fused Deposition Modeling (FDM). While these technologies underwent decades of **incremental innovation** to improve precision and material variety, they were approaching a plateau on their **S-curve**.

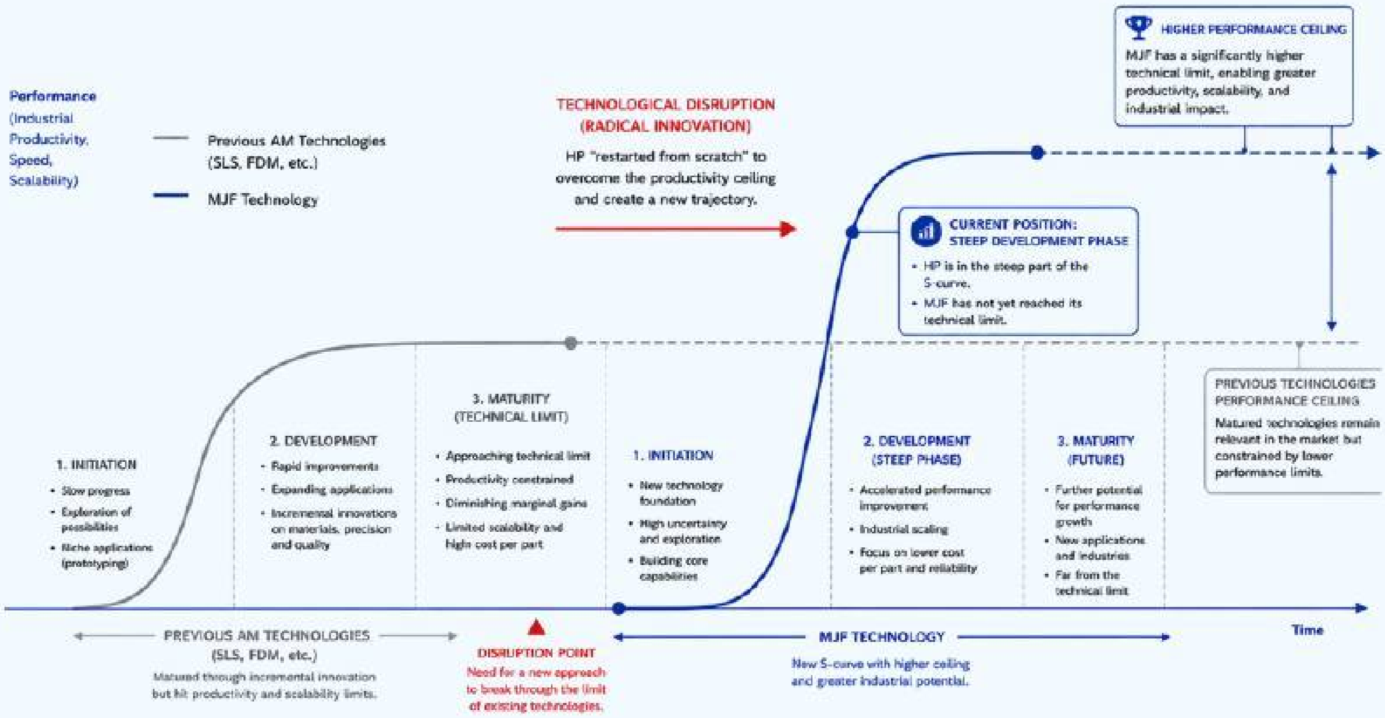
The "technical limit" of these was productivity; as Jesus López reflected, the HP team focused on identifying "***what was limiting the growth***" noting that in previous systems, "***the time to produce a part... was taking days***". In this **maturity phase**, further investments yielded only marginal gains in speed and industrial cost-efficiency, as these technologies remained primarily "***devoted to prototypes***" where growth potential was "***very limited***".



> **THE FIRST PART OF THE INNOVATION WAS ABOUT HOW WE DEVELOP A TECHNOLOGY THAT IS MORE CAPABLE THAN THE EXISTING ONES. THE EARLIEST STAGES WERE VERY TECHNOLOGY-DRIVEN: TRYING TO GET A FASTER TECHNOLOGY THAT COULD PRODUCE BETTER QUALITY, FUNCTIONAL PARTS.**
>
> Jesus López

HP's entry was not a mere attempt to optimize these existing trajectories but a **radical innovation** designed to trigger a **technological discontinuity**. Rather than refining the status quo, HP "***focused on learning why the other 3D printing technologies weren't adopted that much***". By identifying gaps in speed and scalability, HP "***restarted from scratch***" to develop a technology that shattered the previous productivity ceiling, with MJF establishing a **new technological trajectory** with a significantly higher performance ceiling.

However, the nature of MJF's innovation is dual-layered: a **radical breakthrough followed by continuous incremental refinement**. This transition marked a strategic shift from what Sascha de Peña described as a highly exploratory phase to a "***structured product development***" phase. Today, HP is climbing the **steep development phase** of this new curve, focusing on industrial scaling by "***enabling lower cost per part***" and making systems "***more and more reliable***": all characteristic dynamics of incremental innovation within a radically new technological trajectory.



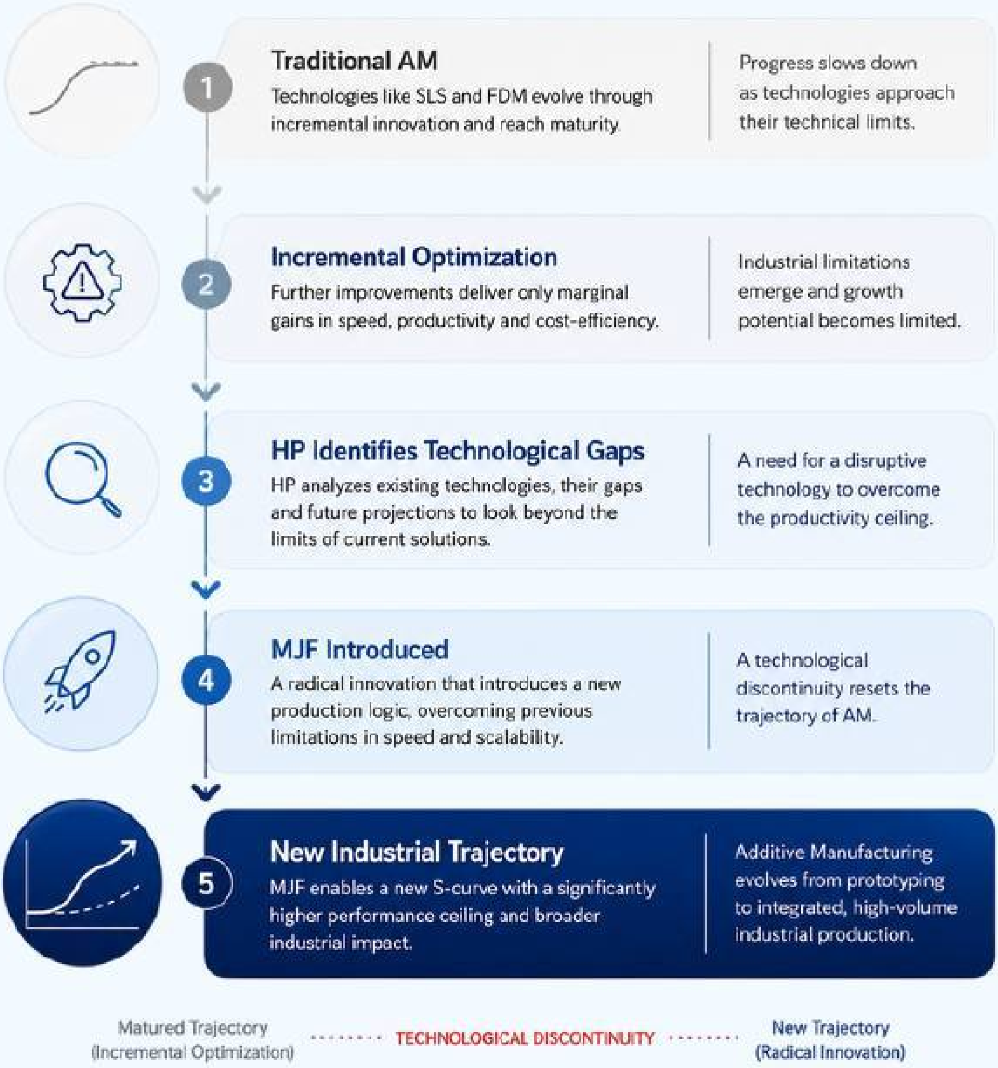
Rather than representing a finalized technological endpoint, MJF appears to constitute the **foundation of a new phase** in additive manufacturing evolution. As industrial adoption continues expanding across sectors such as automotive, drones and medical orthotics, the technology remains positioned within a **trajectory of sustained performance growth**, suggesting that the new curve is still **far from reaching its maturity stage**.

"TODAY, THERE ARE STILL MANY CUSTOMERS USING THE INITIAL PRINTER BECAUSE, OVER TIME, THE SYSTEM RECEIVED UPGRADES THAT SOLVED THE INITIAL PROBLEMS, AND CUSTOMERS ARE NOW VERY SATISFIED WITH IT."

Davide Ferrulli

Establishing a New Industrial Paradigm

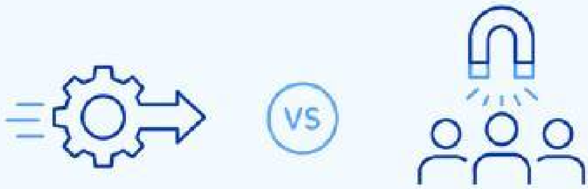
Ultimately, HP's strategic positioning with Multi Jet Fusion represents a deliberate resetting of the technological **S-curve** to establish a **new industrial paradigm.** By recognizing that previous prototyping-centered trajectories had reached their **technical limit** in terms of productivity, HP executed a **radical innovation** designed for volume manufacturing.



This shift redefines HP's market position; they are no longer merely hardware suppliers but partners in industrial scaling. As Davide Ferrulli reflected, the mission was to find a technology that would "***open doors to real production***". Through **continuous incremental refinements**, HP ensures that MJF remains the primary driver for a future where additive manufacturing is an integrated, high-volume production standard.

4.2 Technology-Push vs Market-Pull

The decision to analyze HP's Multi Jet Fusion strategy through the lenses of Technology-Push and Market-Pull innovation stems from the technology's **dual-phase evolution**. **Technology-Push** occurs when innovation is primarily driven by internal R&D capabilities and technological competencies: an "**inside-out**" approach that often precedes explicit market demand. On the other hand, **Market-Pull** represents an "**outside-in**" dynamic where solutions are "pulled" from the firm by identified customer needs and industrial requirements.



Initially, MJF's development reflects a strongly **technology-driven approach**. HP leveraged its historical expertise in thermal inkjet technology to "push" a **disruptive solution** capable of **overcoming** existing speed and quality **barriers**. As López noted, "*the earliest stages were very technology-driven*" with the primary objective being a technology capable of **surpassing existing alternatives**.

However, as the project moved toward industrial commercialization, HP increasingly adopted **market-oriented dynamics** centered on customer applications, manufacturing integration and industrial scalability. This transition highlights how the **successful adoption** of disruptive industrial technologies often depends not only on technological superiority, but also on the ability to **align innovation with evolving market requirements** and industrial realities.

Leveraging Internal Capabilities for Innovation

HP's development of MJF strongly reflects the **logic of Technology-Push innovation**, where **disruptive technological capabilities emerge primarily from internal expertise** and exploratory R&D **rather than direct market demand**. This approach began not with a defined product, but with a strategic ambition to explore the **untapped potential** of additive manufacturing through HP's specific technological lens, leveraging its historical competencies in thermal inkjet technology, engineering integration and large-scale R&D infrastructure to develop a **fundamentally different production approach**.

A key aspect of this process was the **transfer of knowledge** from thermal inkjet technology into additive manufacturing. As Sascha de Peña explained, "***there were some synergies between the thermal inkjet technology that HP knew well and the needs of additive manufacturing***". This capability transfer allowed HP to approach additive manufacturing through a different technological perspective, using **existing engineering competencies** as the basis for innovation while simultaneously **creating a significant competitive advantage.**

> **[USING THERMAL INKJET] WAS A PRETTY GOOD SYNERGY THAT ALLOWED OUR TEAM TO REUSE A LOT OF KNOWLEDGE AND A LOT OF ASSETS THAT HP HAS BEEN BUILDING IN THE PAST.**
>
> Jesus López

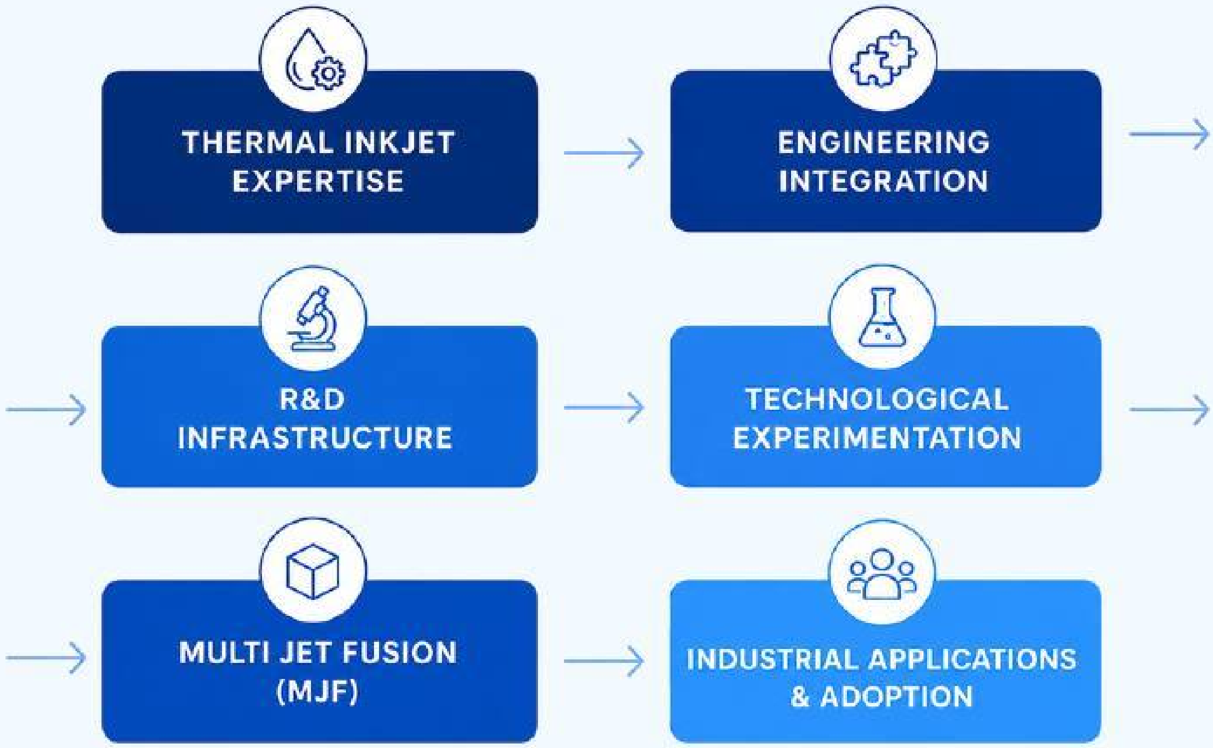
Rather than responding to clearly articulated customer requests, HP initially focused on **technological capability development**. As de Peña reflected, the team "***explored multiple paths and eventually converged on Multi Jet Fusion as the most promising***", illustrating the **highly experimental nature** of the early innovation process. This required HP to move beyond dominant additive manufacturing paradigms and **"restart from scratch"** in order to **overcome the limitations** constraining broader industrial adoption.

Ultimately, MJF emerged through HP's ability to **leverage substantial R&D resources, engineering expertise and technological infrastructure**, providing the complementary assets required to develop and industrialize the technology at a **scale difficult for competitors to replicate**.

> **"THE ABILITY OF HP TO INVEST BIG RESOURCES IN R&D AND INNOVATION IS UNMATCHED IN THE 3D PRINTING INDUSTRY. BECAUSE WE HAVE HP IN THE BACK, THIS CAPACITY OF INVESTING IN R&D IS THE KEY."**
>
> Davide Ferrulli

From Technological Superiority to Industrial Adoption

Although MJF originated through a strong Technology-Push process, HP quickly recognized that **technological superiority alone would not guarantee large-scale industrial adoption**. One of the main challenges identified throughout commercialization was the **market's limited understanding of the technologies**. As Davide Ferrulli explained, "***the main enemy is the lack of knowledge about 3D printing***", highlighting how adoption depended not only on technical performance, but also on **customer education** and **legitimacy-building**.

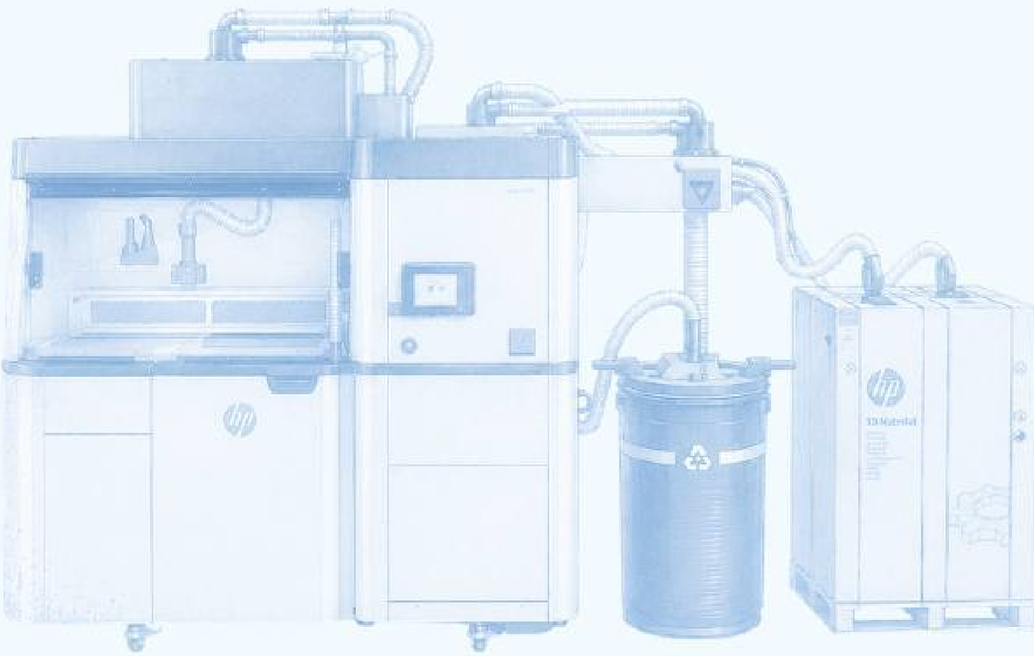


Consequently, HP progressively shifted toward a more **market-oriented innovation approach** focused on **applications, manufacturing integration and customer transformation**. Rather than simply selling machines, the company increasingly concentrated on demonstrating how MJF could **create value within real production environments**. This transition required HP to reduce customer uncertainty and support firms throughout the adoption process. As Ferrulli noted, HP needed to "***grant the security to the customer that [they were] not doing something crazy***".

This logic became particularly visible through HP's use of ***service bureaus*** as **intermediary adoption platforms**. As Ferrulli explained, "***we go through a service bureau, so you [the client] don't need to spend half a million on the printer, but you buy a few parts and you start demonstrating internally***". Rather than requiring immediate large-scale investment, this model allowed firms to **experiment**, reducing both financial and organizational barriers to adoption while **building confidence** in the technology's industrial value.

> **AFTER A FEW SUCCESSFUL PROJECTS, THEY NORMALLY COME BACK TO US AND THEY SAY, OKAY, NOW IT'S TIME FOR US TO BUY THE PRINTER.**
>
> Davide Ferrulli

This evolution is further reflected in HP's emphasis on **application-based innovation**. As López explained, "***all our innovation process at this moment gets this application very top in the priorities***", illustrating how industrial use cases progressively became central to the company's innovation strategy.



4.3 Innovation of Solution & Innovation of Meaning

Multi Jet Fusion illustrates how innovation can evolve beyond technical performance improvement and progressively reshape the broader logic of industrial production. In this context, the distinction between Innovation of Solution and Innovation of Meaning becomes particularly relevant. Although Innovation of Meaning is more commonly applied to **consumer-oriented** and **design-driven** contexts, the framework remains relevant here because MJF reshaped not only manufacturing performance, but also the industrial interpretation of flexibility, scalability, and production value.

While **Innovation of Solution** focuses on improving the functional and technical performance of an existing system, enhancing how a product or technology operates, **Innovation of Meaning** goes beyond technical optimization and redefines the underlying logic and interpretation associated with a product or industrial process.

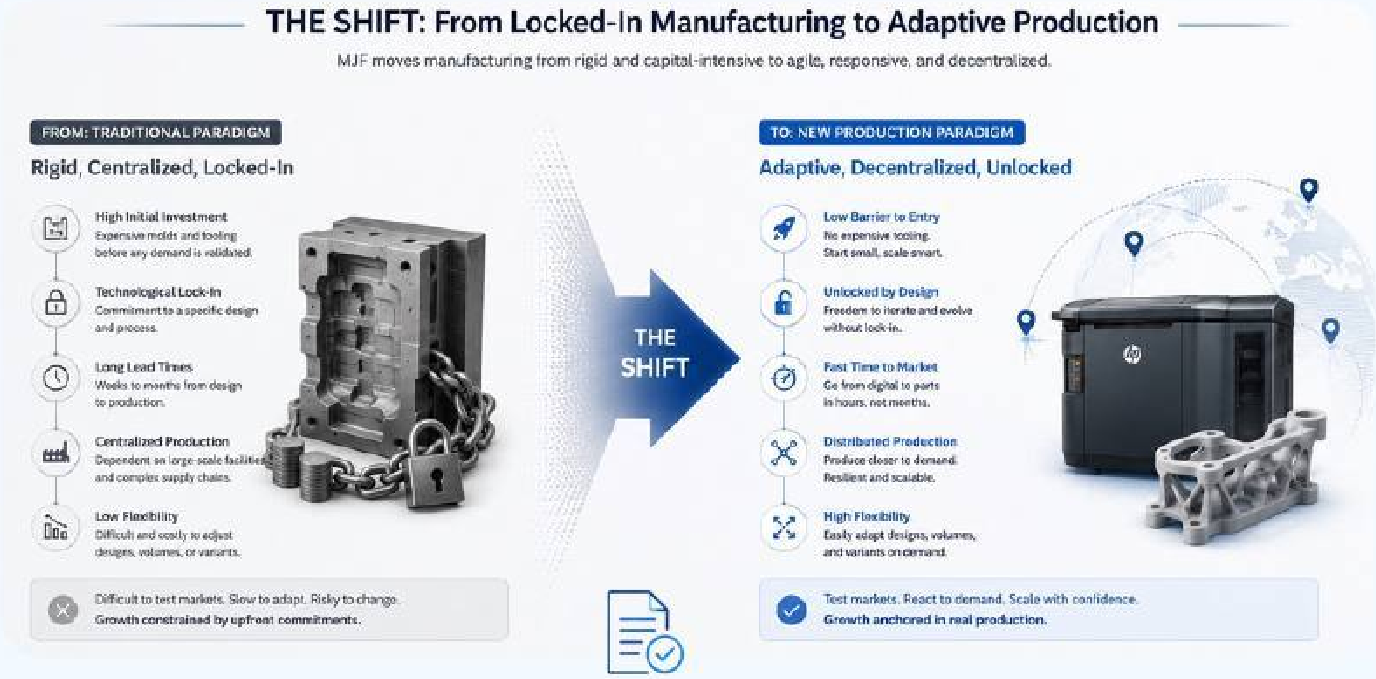
In the early stages, the innovation challenge was primarily technological. Existing additive manufacturing systems remained constrained by limitations in speed, reliability and industrial scalability, with most applications still largely confined to prototyping rather than functional end-use production. As *Jesus López* explained, the team initially focused on developing ***"a faster technology that could produce better quality, functional parts"***, reflecting the objective of overcoming the operational barriers limiting broader industrial applicability.

However, HP progressively realized that the challenge extended beyond technical performance alone. Existing AM technologies had also struggled to achieve wider industrial integration and adoption within production environments. As Davide Ferrulli reflected, the mission was to find a technology that would ***"open doors"*** to an entirely new industrial paradigm. In this sense, Multi Jet Fusion introduced not only new technological capabilities, but also new ways of approaching industrial production.

> ***We were focusing on learning why the other 3D printing technologies weren't adopted that much. So our innovation was about how to develop a technology that is more capable than the existing ones to solve that adoption problem." (Jesus López)***

Innovation of Solution

During the initial phases, the challenge primarily represented an Innovation of Solution dilemma. As Ferrulli explained, previous technologies were ***"good if you need to do one part... but you could not scale to thousands of parts"***, illustrating the productivity and scalability limitations that restricted broader industrial adoption. Within this context, the innovation challenge initially focused on **improving performance** in terms of speed, quality, and cost-per-part to make the systems industrially viable. However, the implications of these improvements progressively extended beyond technical optimization alone.



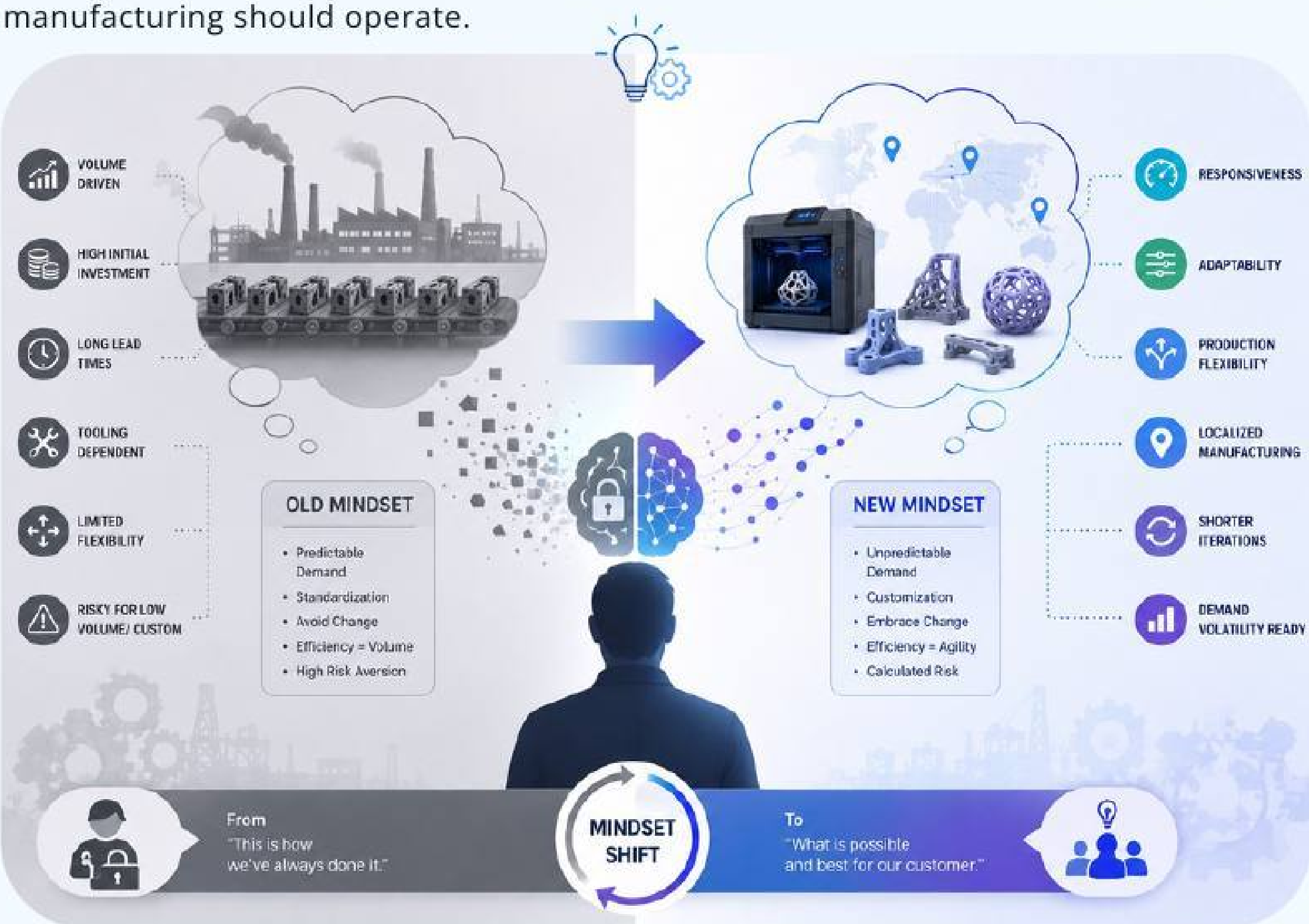
This shift redefined 3D printing as an adaptable production environment capable of supporting greater responsiveness, adaptability, and manufacturing flexibility. As Ferrulli explained, MJF allowed companies to test markets and react to demand ***"without big initial investments in traditional tooling,"*** effectively removing the ***"technological lock-in"*** of expensive molds.

Ultimately, this transition anchors the technology in ***"real production"***. As López noted, ***"the real business growth... is when you go into manufacturing"*** illustrating that MJF's evolution was not just about better hardware, but about achieving a more flexible and decentralized industrial paradigm that allowed for large-scale manufacturing.

Innovation of Meaning

As MJF evolved, its implications extended beyond operational improvement to challenge the foundational assumptions of traditional industry. Historically, manufacturing was governed by a logic of economies of scale and tooling-intensive processes, where efficiency was synonymous with volume and standardization. In this paradigm, low-volume or customized production was dismissed as **economically unviable**.

By reducing some of these constraints, MJF allowed Additive Manufacturing to progressively become associated not only with prototyping, but also with **agile production systems** capable of supporting shorter iteration cycles, localized manufacturing and demand volatility. This transition required more than a technical upgrade; it demanded a fundamental shift in industrial logic. As Ferrulli observed, ***"the most difficult thing is to change the customer mindset"*** precisely because the adoption of MJF requires abandoning long-established assumptions regarding how manufacturing should operate.



Ultimately, MJF can be interpreted not only as a technology that improved performances and business standards, but also as an innovation that progressively **redefined the meaning** of industrial production itself. In this sense, MJF did not simply introduce a better manufacturing technology; it contributed to reframing manufacturing as a more **adaptable, responsive and application-driven** industrial paradigm.

4.4 Architectural vs Component Innovation

The competitive importance of MJF did not emerge from one isolated technological breakthrough, but rather from HP's ability to integrate multiple technologies, capabilities and manufacturing processes into a coherent industrial system. This perspective closely aligns with Henderson and Clark's distinction between **Component** and **Architectural** Innovation. While Component Innovation focuses on improving individual technological elements, Architectural Innovation occurs when competitive advantage emerges from reconfiguring the relationships between interconnected components within a broader system architecture.

HP's development of MJF strongly reflects this architectural dimension. Rather than depending on a single revolutionary invention, the technology progressively evolved through the integration and coordination of several existing technological capabilities and manufacturing processes. As Sascha de Peña explained, MJF was ultimately "***the combination of several ideas that were already in the market or in research areas***", illustrating how the competitive advantage of the technology emerged not only from individual components, but from the way those elements were integrated into a scalable production system.

This interpretation is reinforced by HP's ability to leverage internal technological synergies across multiple domains. As Jesus López noted, the integration of thermal inkjet technology created "a pretty good synergy" that allowed HP to reuse capabilities and assets developed over decades. In this sense, MJF can be interpreted not simply as a technological improvement, but as an architectural integration process capable of coordinating previously disconnected competencies into a new industrial manufacturing system.

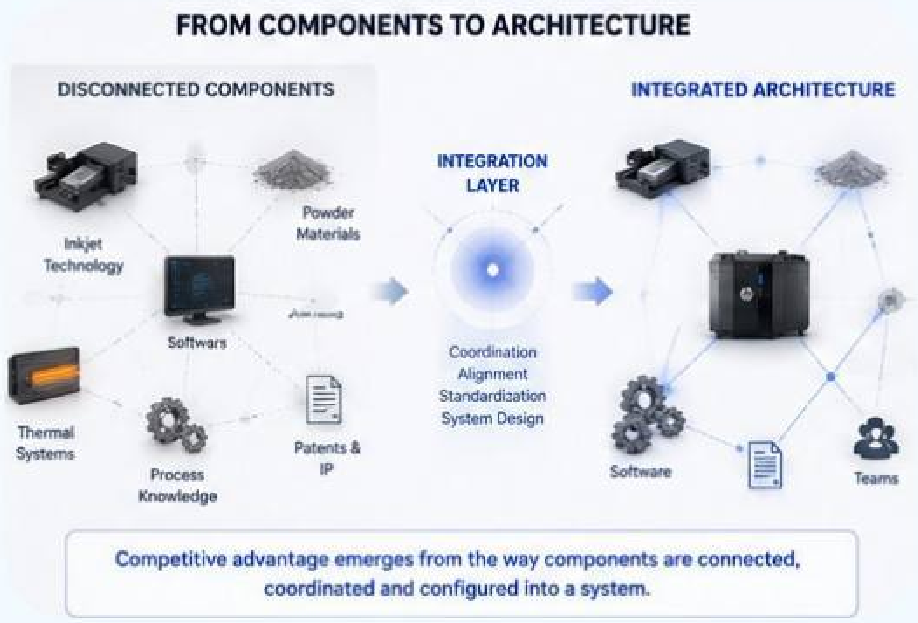
Recombining Technologies into an Integrated Manufacturing Architecture

MJF's competitive advantage emerged less from isolated technological inventions than from the coordination of existing capabilities into a scalable production architecture. This closely reflects Henderson and Clark's distinction between Architectural and Component Innovation. While individual technologies remained important, HP's competitive advantage emerged from the system-level integration connecting those capabilities into an industrial production platform.

This integration process combined multiple technological domains simultaneously. Thermal inkjet expertise, software systems, materials engineering and manufacturing process knowledge all had to operate cohesively within the same production architecture. As de Peña explained, MJF was ultimately ***"the combination of several ideas that were already in the market or in research areas"***, illustrating that the competitive advantage of the technology emergednot from isolated components alone, but from the coordination of existing capabilities into a scalable industrial system. Rather than inventing every capability independently, HP progressively reconfigured existing technologies and competencies into a unified manufacturing architecture capable of supporting industrial production.

Importantly, this integration process was not purely technological. Developing a scalable industrial production system also required coordination between R&D, software, manufacturing and commercial teams. As López described, the process increasingly focused on ***"product architecture, product development, and product convergence"***, illustrating that organizational integration was inseparable from technological integration itself.

Beyond internal integration, HP's architectural advantage also depended on absorbing and recombining external technological knowledge through "technology scanning" of research centers and existing patents. By integrating these internal and external capabilities into a scalable industrial platform, HP developed a level of architectural complexity de Peña described as ***"hard to replicate"***, creating a significant barrier to replication for competitors.



Complexity as a Competitive Barrier

A central point of Architectural Innovation is that competitive advantage shifts from individual components to the **complexity of relationships between them**. In the case of MJF, differentiation did not emerge from a single breakthrough, but from the difficulty of replicating the architecture coordinating technologies, processes and organizational capabilities into a coherent industrial system.

This complexity requires the simultaneous synchronization of multiple domains. As López reflected, ***"the challenge was not only developing the technology itself, but making all the different elements work together in a reliable industrial process"***. By focusing on these interconnected relationships, HP established a robust production architecture where systemic performance outweighs the sum of its parts.

The interviews further suggest that organizational complexity became inseparable from technological complexity itself. Developing a commercially viable production platform required cross-functional alignment and the coordination of “big resources in R&D and innovation”, a capability Davide Ferrulli noted is unmatched by smaller competitors. Ultimately, HP’s competitive advantage resides in this highly integrated, difficult-to-replicate architectural system, where complexity functions as a definitive strategic barrier.

> ***"One of the advantages of our technology is that it's very complex. It's complex to develop, but it's also very complex to copy, and this gives us a competitive advantage." (Sascha de Peña)***

05

LEADERSHIP LENS

5.1 Identification of the Leaders

Three key figures shaped the development of HP's Multi Jet Fusion technology, each contributing a distinct and complementary form of leadership across R&D, market development, and technology.

Jesus López

Jesus López represents the **operational backbone** of the MJF journey, bridging innovation and cross-functional execution. Defining himself as a ***"knowledge-based"*** leader, he applies engineering pragmatism while adapting his style dynamically — motivating through shared purpose in early phases, then shifting to measurable outcomes as the project matures. Central to his approach is **talent design**: strategically matching creative and analytical profiles to maximize team growth.

"LISTENING MORE... MAKING QUESTIONS IS MORE EFFECTIVE THAN GIVING ADVICE"

Davide Ferrulli

Davide Ferrulli embodies the market-facing and relational dimension of leadership. He explicitly rejects **micromanagement** in favour of **trust** and **empowerment** — placing talent development above short-term results:

"I TELL MY TEAM THAT I DON'T WANT TO MANAGE THEM. I WANT TO SUPPORT THEM."

Beyond internal leadership, he also acts as a transformation enabler for customers, helping them adopt new technologies by building confidence and guiding organizational change.

Sascha de Peña

Sascha de Peña represents the technological and exploratory core of the project. His leadership is built on **managing uncertainty** — creating the conditions for teams to experiment, iterate, and pivot freely:

"YOU HAVE TO TRY, BUT YOU HAVE TO FAIL FAST. AND ONCE YOU FAIL, YOU HAVE TO PIVOT"

He argues that leadership cannot be taught directly, only developed through observation and experience — a philosophy that combines **empowerment**, **humility**, and **long-term vision.**

Application of the Leadership Models

Four complementary frameworks — the **Managerial Grid**, **Situational Leadership**, **Transformational and Transactional Leadership**, and **Servant and Shared Leadership** — are applied to analyse leadership dynamics across the MJF innovation lifecycle. Each is addressed in its own section, providing an integrated yet non-overlapping lens for understanding how leadership adapted to evolving demands.

5.2 Managerial Grid

The Managerial Grid evaluates leadership behaviour across two dimensions: **concern for production** (task-oriented) and **concern for people** (relationship-oriented). Applied to the three HP leaders, it reveals distinctly different dominant styles and highlights why a range of approaches is necessary across the innovation lifecycle.

Jesus López's leadership style is primarily **Authority-Compliance**, with a strong focus on operational efficiency, measurable results, and achieving organizational objectives. His approach is highly **task-driven:** he relies on metrics, performance monitoring, and data-driven decision-making centred on execution and continuity. This is evident in his emphasis on cost reduction - **"Even in R&D, you need to learn how to be more efficient, how to be more cost effective"** - and in his objective management of team restructuring and resource allocation. However, a deeper analysis reveals that Lopez operates **on the borderline of Team Management**. While his drive for industrial efficiency anchors him in Authority-Compliance, he recognizes that high performance requires an **empowered team**. By actively investing in talent design, adopting a non-directive coaching approach, and using radical transparency to explain the "why" behind tough decisions, his genuine commitment to people development strongly pulls him toward Team Management.

Davide Ferrulli's approach aligns primarily with the **Country Club Management** orientation, reflecting a dominant concern for people over production. He views his role as a **facilitator** rather than a director, explicitly rejecting the mechanics of traditional management — prioritising support over control and placing the growth of his team above short-term results. His leadership is defined by removing obstacles, accommodating individual needs, cultural backgrounds, and distinct mindsets across a highly diverse regional team, placing relationship-building and talent development at the core of his approach: **"A good leader must hire future good leaders."**

Sascha de Peña sits closest to the **Team Management** orientation, demonstrating a genuinely high concern for both people and production. His leadership is built on **trust** and **empowerment**, with the conviction that the best results emerge when individuals are free to explore, fail, and iterate: "Leaving teams quite open in how they reach the end goal."
His position within the Grid is the most fluid among the three leaders — during early exploratory phases, psychological safety and creative autonomy take precedence; as execution becomes more critical, his concern for production progressively increases.

The Grid captures where a leader stands at a given moment, but says little about how that position shifts as context evolves. For that, the **Situational Leadership** model offers a more dynamic and developmental perspective.

5.3 Situational Leadership

Hersey and Blanchard's model holds that effective leadership must **adapt to the readiness** of followers—defined as their combination of ability and willingness. However, applied to the MJF case, this framework reveals a **critical nuance**: leadership style shifts are not always solely driven by fluctuations in follower readiness, but predominantly by the evolving **phase** and **type** of the innovation. Instead of readiness changing in a vacuum, it shifted relative to the task: as the solution moved from **radical exploration** closer to market commercialization, the task requirements transformed, necessitating tighter boundaries and structural limits.

Early Phase – Delegating with selective Telling

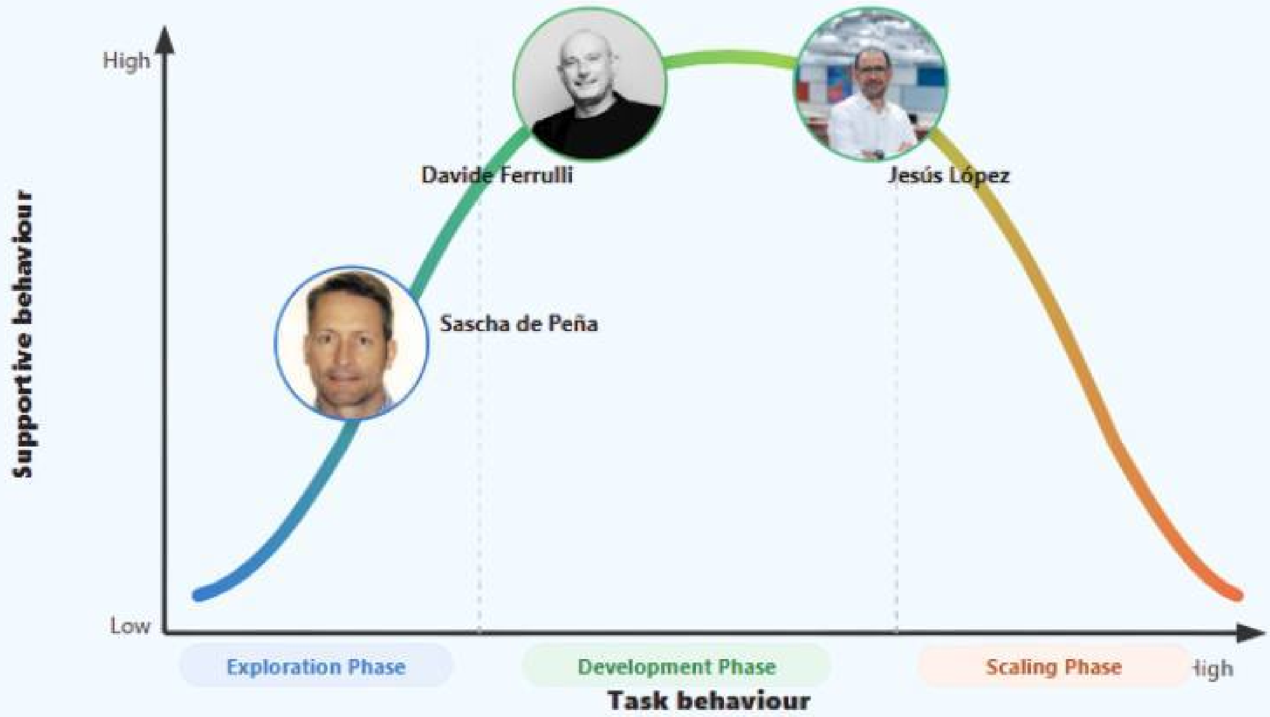
In the initial stages, teams operate at the frontier of what is technically feasible. With highly competent specialists, a Delegating style dominates, **granting autonomy** to explore alternatives, fail fast, and pivot. Concurrently, López uses **inspirational framing** - presenting the work as a "***mission***" rather than a prescribed set of tasks - since outcomes are inherently unpredictable. A Telling approach is applied **only selectively** to newly integrated members who need clear task boundaries. Here, style aligns with individual readiness, granting creative and visionary profiles maximum freedom

Development Phase – Selling

As shared knowledge accumulates and uncertainty narrows, the challenge shifts from exploration to **convergence**. Teams have the competence but need alignment. Leadership moves toward a **Selling** style: leaders explain the rationale behind decisions, integrate creative and analytical profiles, and guide the team toward execution without imposing direction - combining different personality types is a deliberate act of **coordination rather than control**. Ferrulli mirrors this commercially: rather than simply delegating, he builds a shared understanding of the stakes, insisting that "***if there is a problem, let's put it on the table***" guiding execution without imposing rigid control

Mature Phase – Selling / Participating

As de Peña points out, "***I wouldn't say that the technology is already mature***" meaning uncertainty never fully vanishes, making a purely directive approach misplaced. Leadership stays collaborative (Selling/Participating): structured milestones are introduced - where leaders "***give them metrics and [...] show them what success looks like***" (López) - but the team retains ownership of how to reach those targets.



In conclusion, the MJF case shows that situational leadership in radical innovation is a **continuous calibration**. From a methodological standpoint, our assessment of follower readiness is inherently mediated by the leaders' own testimonies. However, even through this indirect lens, it would be inaccurate to interpret the shift toward tighter guidance in later stages as a decline in team maturity. Rather, this shift represents the leaders' **strategic response** to the increasing commercial limits, deadlines, and complexities dictated by the new phase of the innovation task.

5.4 Transformational & Transactional Leadership

Throughout the MJF innovation lifecycle, **transformational leadership** is the dominant logic across all phases and all three leaders — while **transactional** elements remain secondary, serving as operational tools rather than a defining culture. The four core dimensions each find clear expression in the case, distributed across the leaders in ways that reflect their distinct roles.

IDEALIZED INFLUENCE

Idealized Influence is most visible in Ferrulli, whose authority rests on demonstrated **competence** rather than hierarchy. His teams follow his direction because he has built **credibility** through a consistent track record in the field:

> ***"One thing for a leader is the credibility. I've been lucky to have a track record in successfully selling products - and so, they don't see me as a boss who doesn't understand anything."***

This matters particularly in his EMEA role, where he manages people who previously held parallel positions and may have aspired to his role — making demonstrated competence, not hierarchy, the only viable source of legitimacy. López reflects a **similar logic** in R&D, where technical depth gives his guidance weight among highly specialized engineers.

INSPIRATIONAL MOTIVATION

Inspirational Motivation characterizes the early stages of the project, when uncertainty is at its highest and metrics cannot yet anchor the work. López frames this phase as a **collective mission**:

> ***"In the early days of the Multi Jet Fusion product development, we were using a very inspirational mantra. We used to say, 'we are on a mission.' Because at the end of the day, many people need to put the best of them — the final outcome you don't really know what is going to be. So it's better that you help them inspire themselves."***

De Peña reinforced this from a different angle: by providing the team with just a "***North Star***" he kept the destination stable while leaving the exploratory path entirely open, creating the conditions for people to contribute genuinely rather than simply execute someone else's plan.

INTELLECTUAL STIMULATION

Intellectual Stimulation is where de Peña's contribution is most distinctive. By normalizing failure as a **structural feature** of innovation rather than an exception, he creates an environment where teams feel safe to experiment and pursue unconventional paths:

> ***"If you want to find the right path, you have to fail nine other paths. [...] You have to put your feet into the cold water as early as possible..."***

This is the psychological condition that radical innovation requires: without it, people default to safer and more predictable choices that are unlikely to produce breakthrough results.

INDIVIDUALIZED CONSIDERATION

Individualized Consideration runs through all three leaders, each expressing it differently. López prioritizes **listening** and asking questions over giving advice, helping individuals find their own solutions. Ferrulli extends this to investing in people's careers, having honest conversations about promotions even when the answer is tough:

> ***"If you don't have an opening for a promotion, you need to keep them motivated... without giving illusion. [...] If you want to go outside of HP, I will not be the one blocking you".***

De Peña, in turn, keeps the message consistent across the team while calibrating how it is delivered based on each person's profile and sensitivities.

Transactional Leadership mechanisms are present but play a **subordinate role**. As de Peña makes explicit, structured targets and measurable objectives only become appropriate once the work becomes predictable — and by his own assessment, **MJF** has **not yet fully crossed that threshold**. Transactional elements do surface at the margins — in López's use of efficiency metrics during convergence phases, and in Ferrulli's direct handling of underperformance when necessary — but they serve the broader transformational culture rather than defining it.
In contexts of radical innovation, **transformational leadership** is not one option among many: it is the **precondition** for the rest. Transactional mechanisms can reinforce execution, but they cannot generate the **trust**, **autonomy**, **and shared purpose** that exploration demands.

5.5 Servant & Shared Leadership

Servant Leadership shifts the focus from what a leader controls to what a leader **enables** - placing the growth, autonomy, and wellbeing of others at the centre of the leadership act. **Shared Leadership** challenges the idea that direction flows from a single person at the top, distributing influence instead across the team. Together, they reveal both the **relational quality** and the **organizational logic** that made the MJF innovation possible.

SERVANT LEADERSHIP

Six characteristics define servant leadership - **Empowerment**, **Humility**, **Authenticity**, **Interpersonal Acceptance**, **Providing Direction**, and **Stewardship** - all of which find clear expression in the MJF case.

EMPOWERMENT

Empowerment is most clearly embodied by Ferrulli, who explicitly separates the concepts of managing and supporting, placing the development of others at the centre of his leadership philosophy:

"A good leader must hire future good leaders... if that happens, that means that I've been a good leader."

This is reflected in practice: he delegates even activities he personally enjoys, recognizing that true empowerment requires the leader to **step back** and create space for others to grow.

HUMILITY

Humility is most evident in de Peña's view of leadership development. He explicitly rejects the idea that leadership can be taught directly, arguing instead that growth comes from observing others and translating their behaviours into one's own:

"You have to learn by observing, trying to find out what makes them a leader."

This reflects a genuine recognition that experience carries more weight than formal authority.

AUTHENTICITY

Authenticity is particularly visible in López's approach during a period of organizational restructuring. Rather than announcing decisions top-down, he chose to first explain the reasoning behind them - communicating the **why before the what**:

"Before that, they need to understand why we are doing what we are going to do."

For López, transparency is not a communication tool but a **condition for trust**. When people genuinely understand the situation, they often reach the right conclusions on their own.

INTERPERSONAL ACCEPTANCE

Interpersonal Acceptance is rooted in Ferrulli's consistent effort to put himself in the shoes of those he leads — an approach that shows up concretely in two situations. The first is when he took over a region where former peers had wanted the same role, letting his track record speak rather than letting the dynamic build up. The second is a direct conversation with a high performer for whom no promotion was available:

"For the next year and a half, I don't foresee your promotion"

Followed by a genuine offer to look elsewhere - inside or outside HP - without standing in the way. In both cases, **honesty and the willingness to let go** are what kept the relationships intact.

PROVIDING DIRECTION

Providing Direction is what prevents servant leadership from collapsing into passivity. In the MJF context, this finds its clearest expression in Ferrulli's approach to guiding his regional teams - **empowerment does not mean absence of structure**:

"To give them directions. Of course, we will have checkpoints to see that everything is going according to what has been agreed."

Direction here does not mean prescribing answers; it means setting a **clear destination** while leaving the path open. De Peña applies the same logic in R&D: teams are expected not only to explore, but to know when to stop - recognizing a dead end early and pivoting without attachment. The space remains open, but it is **not shapeless**.

STEWARDSHIP

Stewardship surfaces in the way both Ferrulli and de Peña think about their own role over time. For Ferrulli, developing people who can eventually replace him is not a threat but a **measure of success:** the goal is not to remain indispensable, but to leave something behind that works without you. De Peña's position as Distinguished Technologist reflects the same logic from a different angle: his focus is not on current results but on where the technology needs to be in five or ten years. In both cases, the horizon extends well beyond personal visibility, and contribution is measured not by immediate output, but by **what the organization becomes capable of over time**.

SHARED LEADERSHIP

While servant leadership explains the relational quality of the MJF culture, shared leadership explains its **organizational logic** - distributing influence across the team through three internal conditions: **Shared Purpose**, **Social Support**, and **Voice**, sustained by an external leader who empowers rather than centralizes. All three find clear expression in the MJF case.

SHARED PURPOSE

Shared Purpose takes shape most clearly in how López approached the earliest phase of development, when the innovation had no defined outcome and conventional metrics were useless. Rather than waiting for clarity, he reframed the uncertainty itself — positioning the work as a **collective mission** at a moment when progress could not yet be measured. When direction cannot be anchored to results, a common sense of purpose becomes the only available instrument of **alignment**. De Peña reinforced this from a different angle: by keeping the destination stable while leaving the path entirely open, he created the conditions for people to contribute genuinely rather than simply execute someone else's plan.

SOCIAL SUPPORT

Social Support is where de Peña's influence on the team's working culture is most visible. One of his consistent practices was teaching people to **separate themselves from their ideas:** to present a proposal without becoming it, and to let it go without feeling defeated when it didn't hold up. This was not a matter of psychological comfort; it was a **functional requirement**. When people identify too closely with their ideas, challenge becomes personal and the team loses its capacity to self-correct. By normalizing the abandonment of non-viable paths as the right and professional thing to do, de Peña made it possible for peer influence to circulate freely, without the **friction of ego** getting in the way.

VOICE

Voice is most concretely illustrated not by what López says in one-on-one conversations, but by how he **designed the spaces** around him. Rather than positioning himself as the central node through which decisions pass, he deliberately built forums where teams could align on their own:

"I rather create the right forums and let them work together... and only be more present whenever there is something that needs to be solved."

Within these forums, voice is structured around a shared norm of rigour: **data-driven** discussion where every perspective is heard before converging on the best solution. The implication is significant: voice is not guaranteed by an open-door policy but by the **architecture of interaction**. López institutionalized it structurally, so that it could operate even in his absence.

Servant and **Shared** leadership are not just two more frameworks — they explain something more fundamental about how the MJF project worked. One accounts for why people felt safe enough to take risks and invest genuinely; the other for how a project spanning physics, engineering, manufacturing and commercial strategy stayed coherent without becoming rigid. Together, they describe a leadership culture where direction came from **purpose**, **not from position**.

06

CONCLUSIONS

6.1 Key Insights from the story

A **half-million-dollar** industrial system is never sold on technical merit only. The MJF case indeed reveals that scaling a radical innovation demands a profound fusion of visionary leadership, ecosystem orchestration, and extreme organizational agility. In this context, engineering excellence was merely the **entry ticket**. Below, we outline the critical **success factors** and the most unexpected **strategic insights** that transformed a bold technological push into a new manufacturing standard.

Critical Success Factors:

IMMENSE R&D CAPACITY AND FINANCIAL POWER

Unlike startups entering the 3D printing space, HP leveraged the backing of a **$50 billion** corporate structure. As highlighted by Davide Ferrulli, this **unmatched capacity** to invest in long-term **R&D** allowed the company to survive the highly expensive, iterative development cycles required to refine the MJF technology, without relying on short-term market fluctuations.

THE POWER OF THE BRAND IN BUILDING TRUST

Selling an industrial manufacturing system that costs nearly half a million dollars requires overcoming significant **customer hesitation**. The strength of the **HP brand** acted as a crucial catalyst for market entry. The brand's **historical legacy** provided the necessary credibility to convince risk-averse manufacturers that the MJF was not a risky experiment, but a reliable industrial standard.

OPEN INNOVATION APPROACH

In the early stages, HP did not lock itself into a predetermined path. The team, guided by Sascha de Peña, engaged in a highly **exploratory phase**, looking outside the company to understand **existing gaps** in the market and testing multiple technological avenues. This **open-minded** approach was critical in identifying the "*area-wide*"printing logic as the true disruptive path.

EXPLOITATION OF COMPLEMENTARY ASSETS

HP did not invent 3D printing from scratch; instead, it achieved a breakthrough by transferring its **historical knowledge** of thermal inkjet technology (2D printing) into the 3D domain. This "***synergy***", as Jesus Lopez defined it, allowed the company to **reuse** decades of intellectual property and assets, creating a **massive competitive advantage** that new entrants simply could not replicate.

Unexpected Insights

THE MATERIALS "MISCONCEPTION"

A highly unexpected insight emerged from the initial misconception regarding material development. Initially, HP believed it could easily develop and tune all 3D printing powders and chemical agents **internally**. However, facing strict regulatory burdens and immense development costs, the company had to **pivot**.

HP realized that succeeding in industrial manufacturing **required an open platform orchestration**.

By opening its ecosystem to external chemical giants like **Evonik** and **BASF**, HP accelerated material availability, proving that **even a $50 billion company cannot innovate in isolation**.

CUSTOMERS AS THE MAIN KEY TO MARKET DEVELOPMENT

While MJF started as a pure **Technology-Push**, the actual market development heavily relied on an unexpected asset: **existing customers**.

HP utilized **"service bureaus"** and early adopters as living references. Instead of HP pushing the sales, satisfied customers demonstrated the **tangible value** to other potential clients, effectively generating an "*artificial*" **Market-Pull** effect.

6.2 The Link between Leadership and Innovation

The MJF case illustrates a profound interdependence between leadership and innovation. In this context, leadership was not merely a supervisory function, but the **structural enabler** of the innovation itself. Simultaneously, the extreme complexity of the technological leap forced leadership practices to **evolve and adapt** to different conditions throughout the process.

INNOVATION ENABLED BY A "FAIL FAST AND PIVOT" CULTURE

From an external perspective, a multinational giant like HP might appear as a rigid, highly procedural, and bureaucratic environment. However, the unexpected link between leadership and innovation in this case was the creation of a **protected space for experimentation**. In this context, **Intellectual Stimulation** - fundamental for radical innovation - was ensured by **normalizing and even encouraging failure**, in order to teach engineers to detach their egos from their ideas. This psychological safe environment prevented the "*analysis paralysis*" typical of large corporations and allowed the teams to find the disruptive MJF path without sticking to ineffective solutions.

ADAPTIVE LEADERSHIP & STRATEGIC TALENT ORCHESTRATION

The innovation journey proved that leadership cannot be a fixed trait when driving radical change. It requires **continuous adaptation** based on the project's development stage, the specific business function, and individual readiness. However, leadership in this case went beyond merely adjusting styles; it acted as **contextual talent design**. True innovation leadership meant *assigning the right cognitive profiles to the right phases* - placing visionary, exploratory individuals at the front end of ideation, and bringing in fact-based, rigorous engineers during the convergence and industrialization stages.

Finally, as the innovation generated structural friction across departments with conflicting priorities (e.g., R&D vs. Sales), leaders utilized **radical transparency** as the ultimate alignment tool. By openly sharing the business constraints and the "why" behind strategic shifts, leadership maintained team motivation and cohesion throughout the entire product lifecycle, establishing **mutual trust** as the company's foundations.

In conclusion, this case stands as a powerful testament that, in the modern industrial landscape:

the ultimate competitive advantage lies at the exact intersection of systemic innovation and visionary leadership.

07

TEAM ASSESSMENT

7.1 Reflection on Team Dynamics

During the development of the project, the team followed a **collaborative approach** that gradually evolved week by week. In the initial phase, the group members focused on getting to know one another both personally and professionally. The team was highly heterogeneous in terms of nationality, personality, and academic background, and everyone showed genuine interest in understanding the others. This helped us identify each member's skills and competencies and allocate tasks more effectively.

The group then moved on to **defining objectives**, **planning activities**, and establishing shared **ways of working and communicating:** we defined the structure of the team and roles, partitioning equally a manageble workload for everyone. We scheduled regular meetings and used shared digital tools, which supported coordination and helped us monitor deadlines. We kept each other constantly updated through our WhatsApp group and shared project files on OneDrive. Collaboration was strengthened by a climate of **mutual trust** and openness to discussion. We created an environment of psycological safety within the team, which helped maintain high motivation and group cohesion.

One challenge was **managing time** effectively and coordinating the different ideas that emerged during the project. However, this did not slow down our work; rather, it allowed us to structure the process more clearly. Overall, the development of the project enabled a smooth transition across the different phases of teamwork.

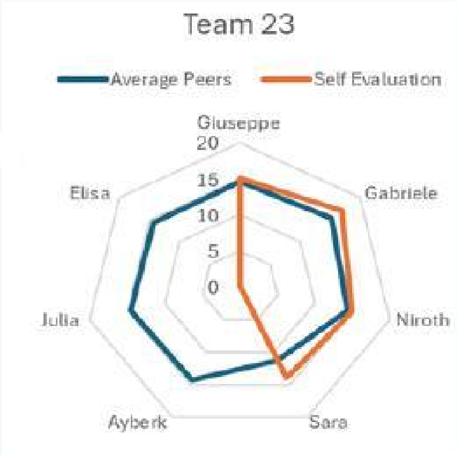
Tuckman's Team & Gruop Developement Model

From a theoretical perspective, the team's evolution can be interpreted through Tuckman's model of **group development**. After an initial "***forming***" stage, characterized by orientation, mutual understanding, and goal definition, the group entered a "***storming***" phase, in which different approaches, priorities, and perspectives emerged. Since each member had a different cultural and academic background, this diversity initially seemed like a **potential obstacle**.

However, it progressively became one of the **group's main strengths**. Through effective communication and collaboration, we learned how to combine our knowledge and perspectives. The team then moved into the "***norming***" stage, developing shared working methods, clearer roles, and stronger interpersonal relationships. Finally, during the "***performing***" stage, the group worked with greater autonomy and efficiency, successfully completing the project within the established deadlines.

7.2 .2 Peer-to-Peer (P2P) Assessment

The tool proved useful, although only to a certain extent. Fortunately, we were able to create a positive working environment, and each meeting was supported by **constructive feedback** and **open discussion**. Some members forgot to complete the first peer-to-peer evaluation, primarily because we had already discussed our impressions within the group and felt that the feedback had been shared informally. In fact, the results of the "partial" peer evaluation were very homogeneous, and we interpreted this "lack" not as a problem, but as a sign of mutual trust.



Overall, the P2P process increased individual **awareness** and reinforced the sense of **shared responsibility** within the group, confirming that we were aligned.

08

ANNEXES

8.1 Interview protocols

Jesus López - Global Head of Services & Operations at HP AM

Introduction

- Can you briefly introduce yourself and describe your current role at HP?
- You've had a long journey within HP's R&D, more specifically connected to the 3D

printing sector, can you tell us about what it has been like to drive innovation in this industry and how your perspective has evolved over the years?

- How would you describe yourself as a leader?

Leadership

- During your years in R&D, how did you manage to inspire your team to overcome the toughest challenges: did you rely more on an inspiring and challenging vision, or did you mainly rely on strict goals and metrics?
- In a tech environment, highly methodical and analytical engineers often work alongside more creative and visionary individuals. How have you managed and leveraged these cognitive differences within your teams to get the most out of them? How do you adapt your leadership style when managing individuals versus teams?
- How do you coordinate the R&D, operations and external partners to enhance cross-functional performance as a team? How do you align the different functions when they have conflicting priorities?
- Can you describe a situation where you had to make a difficult decision that impacted your team, and how you handled it from a leadership perspective?
- Can you describe a situation where, as a team leader, a decision you made had a negative impact on your team and ultimately on the final outcome? What went wrong, what did you learn from that experience, and how did you address or correct it afterwards?
- How do you balance the need for structure such as deadlines and targets with the flexibility required for innovation?

Innovation

- As Multi Jet Fusion has evolved from a disruptive innovation into a global standard

for industrial production over the past ten years, what has been the biggest shift in how innovation is executed today compared to the early development stages of this technology?

- Beyond the technical improvement itself, what new value or meaning did this innovation create for customers or partners that was not there before?
- Did the initial development of the MJF stem primarily from a specific and stated customer need, or was it an approach driven by HP's historic technological expertise (such as the thermal inkjet) that you "pushed" into a new market to change its logic?

- How do you deal with the tension between driving innovation and maintaining operational efficiency within resource-limited settings? Specifically, does the integration of sustainability serve as a driver for new solutions, or does it primarily act as a constraint on development?
- In the evolution of MJF, what were the most critical stages and where did the project face the biggest technical or organizational turning points?

Davide Ferrulli - Regional Manager (EMEA)

Introduction

- Could you briefly introduce yourself, tell us about your career at HP and what the main challenges are in selling a disruptive technology like 3D printing in a market made up largely of small and medium-sized manufacturing companies?
- How would you describe yourself as a leader?
- HP announced MJF in 2014 but the first commercial machines only arrived in 2016, exactly when you joined. What was it like to enter HP at that precise moment, with a technology that had no real commercial track record yet?

Leadership

- Selling MJF means changing the traditional way customers think about manufacturing. How do you act as a “transformational leader” not only for your team, but for customers themselves, inspiring them and challenging the status quo to bring them to a more dynamic view of the supply chain?
- Looking at your journey from country-level roles to leading an entire region, how has your leadership approach evolved over time?
- How do you adapt your leadership style when managing teams across different countries and cultures within Europe?
- Your role requires coordinating sales teams, partners, and customers across multiple industries and different countries. How do you ensure alignment between all these stakeholders when their priorities may different?
- Unlike traditional products,3D printing often requires changing the customer’s mindset. How do you lead teams to not just sell a product, but to drive this kind of transformation?
- Can you describe a situation where you had to make a difficult decision that impacted your team or market strategy negatively, and how you handled it from a leadership perspective? What did you learn from it?
- Can you describe a situation where a customer or internal stakeholder resisted adopting a new solution? How did you handle it?
- When you were building the HP 3D printing business in Italy from scratch, how did you inspire your team to push through the hardest moments - did you rely more on a compelling vision of where the market was going, or did you focus on concrete goals and short-term results?

Innovation

- In many innovative projects there is a big gap between having a promising idea and turning it into something reliable, scalable, and commercially viable. How did MJF evolve from an initial idea into a scalable industrial solution, and how did HP navigate that change? What were the biggest challenges faced during that period?
- Beyond the technical advantages, what kind of strategic or business value does MJF create for customers that makes them adopt it over traditional manufacturing methods?
- What do you think differentiates HP's approach to innovation in additive manufauring compared to other players in the industry that makes it advantageous for the customers?
- Among the different industries where MJF is used, is there one application or sector that you find particularly representative or impactful, and could you walk us through how the technology creates value in that specific context?
- Where do you see the biggest gap today between the promise of 3D printing and the actual value customers experience?

Sascha de Peña - Distinguished Technologist

Introduction

- Can you briefly introduce yourself and describe what your current role at HP looks like on a day-to-day basis?
- Before we dive into the specifics, we'd like to understand the person behind the role: what originally drew you into this field, and what continues to motivate you today?
- You've been involved in HP's 3D printing journey essentially since its early stages: can you walk us through that evolution? How has your role changed as technology matured?

Leadership

- Which are the main lessons that your leaders have taught you, and how did you implement them when you became the leader yourself?
- In highly technical environments, influence does not always come only from formal authority. In your experience, what makes people trust and follow a technical leader?
- As a Distinguished Technologist, how do you influence decision making without always having direct authority over teams?
- When you're pushing your team into uncharted scientific territory, what tends to drive them more — a big inspiring vision of where the technology could go, or clear targets and experimental milestones?
- Inside a group, you have the role of managing different ideas, personalities, and emotions from each member. How do you deal with these differences? How do you balance a more conservative person with someone who is more innovation-oriented?

- In case of failure, how do you manage to regain the trust of your team, rebuild it, and move forward?
- From your perspective, how aligned are leadership expectations with the realities of technical development? Where do you typically see friction?

Innovation

- Would you say the evolution of MJF materials has been more of a radical or incremental process?
- Looking back at the early stages of MJF development, how has your approach to materials innovation changed over the years — in terms of process, mindset, or the questions you ask?
- To develop the architecture of the MJF technology, how crucial was it to leverage HP's internal complementary assets (like the historic expertise in thermal inkjet) to push this technology to the market?
- How do you approach competitive analysis in the additive manufacturing space, and how does it influence your innovation strategy?
- How do you prioritize which new technologies or ideas to invest in, given limited resources and high uncertainty?
- What fundamentally changes in how you work and what you prioritise when a technology moves from a promising laboratory result to something that must perform reliably and consistently at full industrial scale?
- How important is it, while designing a product, to project it into the future and anticipate whether it will still be innovative in the long term?

8.2 Secondary sources

- https://www.hp.com/us-en/printers/3d-printers.html
- https://www.hp.com/us-en/newsroom/press-kits/2019/barcelona-3d-printing-and-digital-manufacturing-center-of-excellence.html
- https://s203.q4cdn.com/918857832/files/doc_financials/2024/ar/2024-Form-10-K.pdf
- https://s203.q4cdn.com/918857832/files/doc_financials/2025/ar/Combined-2025-Annual-Report-and-2026-Proxy-Statement.pdf
- https://www.grandviewresearch.com/industry-analysis/additive-manufacturing-market
- https://link.epo.org/web/service-support/publications/en-additive-manufacturing-study-2023-full-study.pdf
- https://cimquest-inc.com/wp-content/uploads/2018/04/HP-MJF-Technology-Technical-White-Paper.pdf
- https://h20195.www2.hp.com/v2/getpdf.aspx/4AA6-4892ENE.pdf
- https://www.hp.com/us-en/printers/3d-printers/resources/case-studies-resources.html
- https://h20195.www2.hp.com/v2/getpdf.aspx/4AA8-5103ENW.pdf
- https://www.sciencedirect.com/science/article/pii/S2214860424003774

Lead23

Leadership&
Innovation