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Smart Factories Require Smart Investments — a Different Way to Invest in Transformation

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Transformative smart factory projects can be capital-intensive and myopic in vision and execution. Manufacturing CIOs must reinvent how they fund advanced technologies that favor operating expenses and take an enterprisewide approach to drive adoption at the speed and agility these projects demand.

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Published 24 January 2023 — ID G00769180

Overview

Key challenges

- A new way of funding is required to support the speed and scale of smart factory optimization and transformation. Manufacturers are shifting away from traditional capital expenditure (capex), when acquiring technologies (IT/OT).
- Traditional project-based funding models are too disconnected and archaic to support and facilitate the strategic outcomes of smart factory initiatives.
- Despite the common knowledge that operational excellence is a guaranteed payback on investments, operational excellence does not attract support and buy-in from CIOs and lines of business (LOBs) that are seeking transformative enterprise approaches to modernization.

Recommendations

Manufacturing CIOs seeking to scale smart factory in a transformative approach should:

- Influence CFOs and LOBs to discourage capex investments by shifting investment planning to an agile (opex) model that favors technology flexibility, lowered total cost of ownership and financial scalability.
- Create a fast, effective outcome for smart factory efforts by adopting composable business techniques such as operation expenditure (opex) and agile investing, thereby reducing pressure on CFOs, LOBs and plant managers to deliver on ROI.
- Overcome skepticism related to speed, to scale smart factories by establishing incentives and metrics that favor nonconventional investment methods to accommodate smart factory journeys.

Strategic Planning Assumption

By 2025, asset intensive manufacturers will decrease their capex investments focused on smart factory technologies by at least 25%.

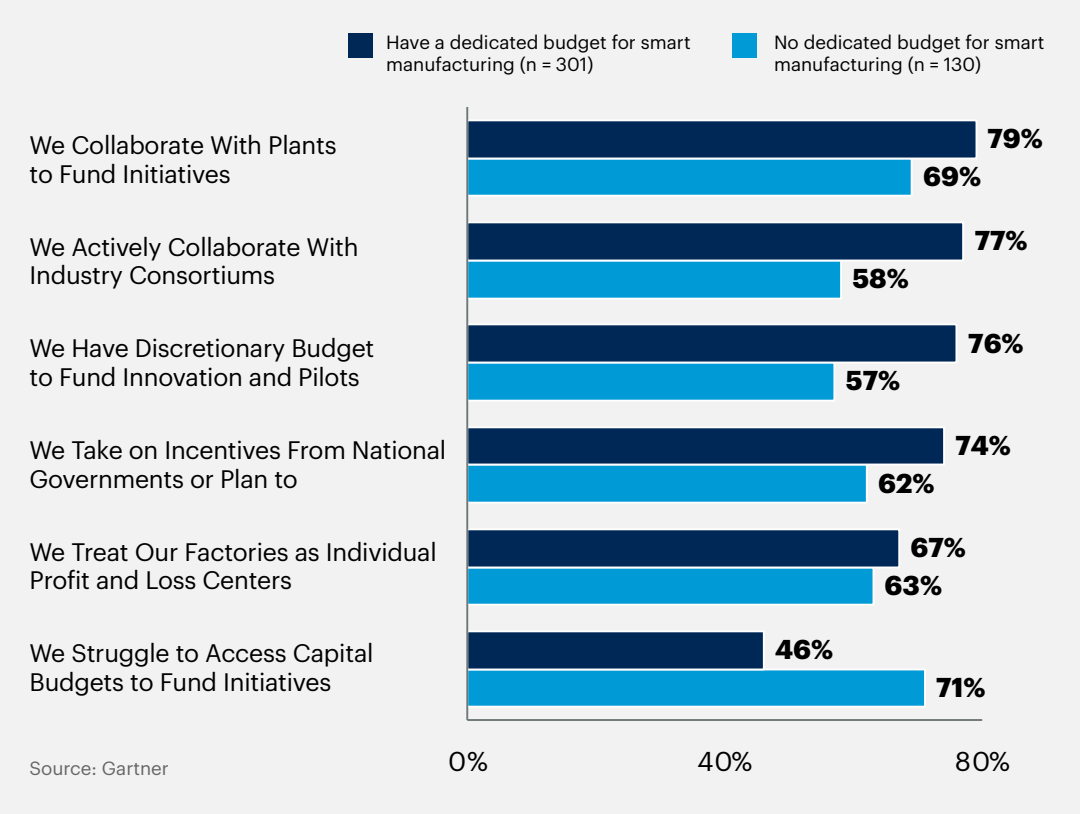
Introduction

Manufacturing CIOs and their counterparts in the supply chain agree that smart factories have the potential to do much more than improve how operations are managed. This can be done through technologies such as artificial intelligence (AI), Industrial Internet of Things (IIoT), digital twins/threads, flexible automation and cloud-based analytics. For this to happen, transformation must extend beyond site production processes and optimization. Also, as smart factory technologies are becoming sophisticated, so too are the funding models.

Funding of smart factories needs to change to smart investing to accelerate transformation of current and new smart factories. The traditional way of factory-level investments (both IT- or operational-technology-related) being subjected to a lengthy and rigid capex-based procurement process is not compatible with the speed and scale needed to make smart factory strategies work.

The 2020 Gartner Smart Manufacturing Strategy and Implementation Trends Survey found that 76% of manufacturers that have a smart manufacturing strategy — or plan to deploy one — anticipate that their organizations will increase investments in technologies to support smart factories over the next four years. Some smart factory technologies can be utilized as inflation resisters — like investments in energy/green efficient technologies — to reduce energy consumption. Yet, only seven in 10 organizations have a dedicated budget for smart factories, resulting in significant differences in investment strategies (see Figure 1).

Figure 1: Smart Manufacturing Investment Strategies



Source: Gartner

Whether or not their enterprises have a dedicated smart factory budget, manufacturing CIOs need to navigate a range of obstacles when it comes to influencing CEOs and LOBs to justify investments. The obstacles they face include clarity on supply chain alignment, organizational complexity, scalability and internal politics. Manufacturing CIOs must also break the vicious cycle of continuous and predictable, heavy, upfront investments, as well as localized investment and (often financial ROI-based) value realization.

To make the business case for smart and new funding models, manufacturing CIOs will need to:

- Shift investment planning to an agile model that rebalances the capex/opex ratios.
- Leverage composable thinking and composable business architectures to limit traditional project-based approaches and drive scale.
- Accelerate buy-in from C-level executives and/or LOBs by using early adopter incentives and risk-adjusted metrics.

Analysis

Shift the Investment Planning to an Agile Model That Favors Leveraging Operating Budgets

High-performing smart organizations have shifted to a flexible funding model for smart factories with a dedicated fund and resourcing stream and have it available on an as-needed basis. This is with the understanding that the shifts in ratios will differ by technology and outcome. For example, they:

- Prioritize opex investments when agility is a more important objective than cost. Meaning that when procuring IT/OT integrated technologies, CIOs should prioritize vendors that offer a subscription and flexibly expandable/scalable as-a-service models such as SaaS, IaaS or PaaS. This may include hardware, software, preconfigured applications and/or maintenance.
- Prioritize opex more for noncore activities and for those where there is less ability to add value internally. Examples would be off-loading testing and validation historians to cloud-based analytics or databases so IT does not require on-premises administration and software updates.
- Prioritize capex when there is a strong desire for OT control or to tightly project and limit downstream costs or when regulatory and security concerns outweigh flexibility.

These rules of thumb are not all-encompassing or universal. However, they should form the basis for initial conversations across all stakeholders on how to weigh the potential costs and benefits between capex and opex investment options. Key tactics for manufacturing CIOs to influence this shift are:

- Highlighting the operational and strategic benefits of funding smart factories with opex spend as a means for greater agility and flexibility.
- Partnering with sites on an as-needed basis (often during the piloting phase of a technology) to jointly identify needs and requirements against current operating plans. This determines if it is “the right time” to invest in an opportunity.

Too often, the pool of innovative ideas outweighs the available budget, and investment timing cannot wait for an annual basis. Digital-focused investments outpace annual budget cycles, and the traditional model of acquiring assets and creating products and services on them internally is growing out of favor. CIOs report increasing opex versus capex ratios over the last three years and expect that trend to continue over the next two years (see Balancing Capex and Opex Funding for Digital Investments).

Changing the balance will not come easy. There is still a significant amount of heavy capex expenditure that will always be embedded, given the inextricable links between IT and OT in factories, and that legacy will be hard to shed. However, a flexible investment model that is not completely built on capex is now a necessity and is driven by:

- The increasingly pervasive nature of SaaS-based pricing models and the ever-growing adoption of cloud computing to support edge AI and other IoT-enabled applications
- Equipment as a service (EaaS) and other OT-centric leasing models for capital equipment and various forms of robotics that lower the capital-intensive burden of entry

Readjusting the ratios of capital spend to operating expense will need to be prioritized based on contribution to the broader business objectives, logical dependencies, available resource budgets and skills to add the funding agility needed for scale. Also, over time, as outcomes change, this helps evolve the business case and site readiness requirements.

Use Composability to Shift Investments From IT Projects to Capability Building

Scaling smart factories requires manufacturing CIOs to leverage composability (see Note 1 for the definition of composability). Composability provides the advantages of scale and elasticity, the speed of innovation, and the deployment agility needed. Manufacturing CIOs should leverage composability in the following ways:

- Balance short-term investments with long-term investment plans, and help facilitate communication between different stakeholders by promoting the fastest, most flexible path to achieving outcomes.

- Leverage a modular, “LEGO block” approach that in an iterative roadmap-based fashion connects capability building and technology acquisition (see Focus on Capabilities Instead of Technology When Defining Smart Manufacturing Use Cases). This promotes reconfigurability and reuse with standard integration. Specific use cases are accessible through repositories (akin to marketplaces and app stores).
- Provide affordable access to smart factory technologies as transformational-based funding that is distributed, reviewed and reallocated on a quarterly or more frequent basis to ensure continuous alignment with business outcomes. This limits the risks of budget overruns, failed ROI or other delays that have brought even the most promising of lucrative initiatives to a grinding halt.

Composability contravenes traditional project-based funding models, which lack the flexibility and resource allocation — let alone the capacity to cope with uncertainty — that digital investments need. Instead, composability, which is more than underlying technology, emphasizes the assembly and reassembly of components.

Connecting composable thinking and capability building gives clear details on process changes, skills requirements, implementation costs and time frames, and guidance to maximize the investment. This includes financial (tangible) and nonfinancial (intangible) benefits to ensure each investment has a connection to strategic outcomes, making it easier for sites to fund initiatives as an operating expense on an as-needed basis. For example:

- Investing in video-based work instructions as part of a connected worker initiative has an intangible benefit of improved access to job-related content. However, when connected to the 10% to 15% reduction in setup time attributed to new methods and standard operating procedures (SOPs), the case is clearer.
- IIoT platforms are foundational to smart factories (see Innovation Insight for Smart Factory). They have interchangeable building blocks such as endpoint integration, edge gateway computing and data fabric that can ingest production and manufacturing data regardless of which OT system protocol or device the data is coming from. As capabilities are built, the shift from the capital-intensive nature of integration to OT directly gives way to opex-based funding for new use cases.

Composability does not eliminate complexity. Not only must complex landscapes of monolithic legacy systems (to which the economic argument for “rip and replace” does not exist) be considered, but also production models and asset structures, because they vary from site to site, too.

This is important to keep top of mind since the value of a smart factory comes when site capabilities are integrated with other supply chain functions and business objectives. Organizations can avoid setting themselves up for failure before an initiative starts by removing responsibility for ROI from site leaders and elevating it to a business unit or regional level. Doing so alleviates pressure on site leadership to align site-level performance, with the synchronization of networkwide operations and decisions that are beyond their control.

Overcome Resistance With Early Adopter Incentives That Limit Skepticism and Risk

Improving operational excellence delivers the initial value for a smart factory. The smart manufacturing strategy and implementation trends survey revealed that 66% of respondents cited "improvements in cost, lowered downtime, and zero defects/losses" among the most important factors used when generating a business case for smart factories (see Note 2 for the other factors). The returns that come from eliminating variability are attractive and easy to measure and they improve how the business is run. They are often enough to buy the credibility needed for an initiative.

Even when leveraging a "perfect day scenario"— the ideal outcome that a technology should enable — to justify the business case and funding for an initiative, buy-in is not guaranteed. Even the most disciplined of organizations must navigate competing priorities, short-term focuses, "technophobia" or other experiential bias from past project failures. Furthermore, they may face external obstacles and events like currency devaluation, inflation and supply chain bottlenecks.

To mitigate these risks and attain success with transformation-oriented business cases, manufacturing CIOs should take these actions to engage resistant site leaders:

- Reframe the discussion with sites by shifting from the perfect day to emphasizing the downside of not buying-in. Have sites that are resisting a new solution demonstrate how it will continue to meet or exceed certain performance requirements and standards without new investments. This, in a very tactful fashion, will help expose the risk of not adopting or moving in the right direction.
- Promote "first adopter" incentives that encourage risk taking and exploration by adjusting performance targets and co-funding innovations. A steady, even if small, results stream is key to demonstrating proof of value and showing that the next 1% to 3% of cost improvements can have a high impact. When the approach to a commonly desired outcome is appropriately disrupted, the ROI will follow.
- Safeguard predictability of results by aligning technology-delivered outcomes with the production automation objectives. Making the connection between technology innovation and core processes, metrics, skills requirements, and behaviors ensures site readiness. In addition to available budgets, transparency of the business case and investment justification are key strategic challenges in our smart manufacturing survey (see Smart Manufacturing Challenges Every Industrial Manufacturing CIOs Must Resolve).
- Involve the CIO and other critical IT, OT and engineering technology (ET) stakeholders in the dialogue to ensure there is mutual understanding of costs and risks tied to the business value that these technology investments will deliver. Similar to including cost, value discussions should include the risks to the organization from technology dependencies. For this conversation to be meaningful for all stakeholders, the risks must be articulated in the form of business impact (see Include Cost and Risk to Complete Business Value of IT Conversations).

This does not mean the focus on operational excellence fades. Hidden costs include application and hardware upgrades, integration, security and training. Without a clear understanding of the magnitude of change management, even the most promising of initiatives can be derailed.

Evidence

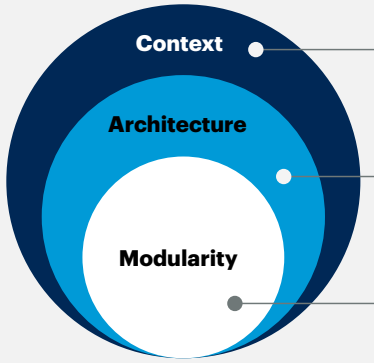
2020 Gartner Smart Manufacturing Strategy and Implementation Trends Survey: This study was conducted online from 23 October through 3 December 2020 to help develop and ratify roadmaps, assess organizations' strategies against a collective market perspective, and ensure their strategies for recovery and renewal are as future-proof as possible. In total, 439 respondents were interviewed in their native language across North America (n = 160, including the U.S. and Canada), Western Europe (n = 184, including the U.K., France, Germany and Sweden) and Asia/Pacific (n = 95, including Australia, New Zealand and Singapore). Qualifying organizations operate in the manufacturing industries and report enterprisewide annual revenue for fiscal 2019 of at least $500 million (at least$1 billion in the U.S.) or equivalent. Companies must have a smart manufacturing strategy or plans to deploy. Qualified participants have a role tied to a supply chain function and are in director or above roles. All respondents are involved in their company's decisions regarding manufacturing operations and/or overall manufacturing strategy. Disclaimer: Results of this study do not represent global findings or the market as a whole, but do reflect the sentiments of the respondents and companies surveyed.

Note 1: Three Principles of Composability

A composable digital business applies the core principles of composability (modularity, autonomy, orchestration and discovery) to the foundations of its business architecture (the business model, enterprise operations and strategy). This is done to reduce the risk of change and reach untapped business value.

Composability has three building blocks that are flexible and interchangeable when it comes to enabling manufacturing outcomes (see Figure 2). For more information on the three building blocks, see A Technical Guide to Composable Application Architecture.

Figure 2: Three Principles of Composability



Context: Business models or desired business outcomes shape what form of architecture emerges and is relevant.

Architecture: Modules are defined, based on three properties — **autonomy, orchestration** and **discovery**.

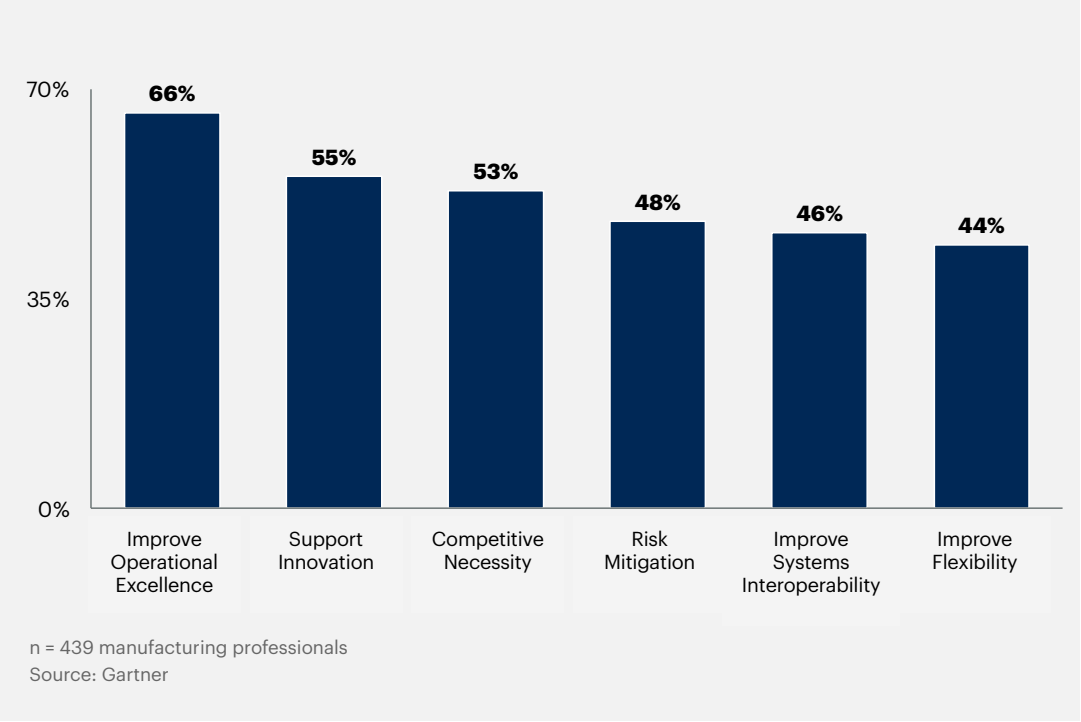
Modularity: Business entities (business capabilities, products, services, etc.) are partitioned into a system of building blocks.

Source: Gartner

Note 2: Improving Operational Excellence

Improving operational excellence — that is, improvements in cost, lowered downtime and zero defects and/or losses — is, for two-thirds of organizations, the most important factor used, when generating a business case for smart manufacturing. The other factors cited as most important when generating the smart manufacturing business case are shown in Figure 3.

Figure 3: Most Important Factors Used When Generating the Smart Factory Business Case



n = 439 manufacturing professionals
Source: Gartner

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