SYNAPSE

Who is Involved In

?

By
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In this third chapter, we will describe the roles involved in an IoT journey and how the IoT vast technical complexity translates to organizational challenges.

Key Takeaway

The structure of an organization typically constrains their innovation capabilities; engaging a proven innovation partner is a significant enabler for a successful connected product.

INS AND OUTS OF A CONNECTED PRODUCT

Manufactured products can be simplistically divided in 3 categories:

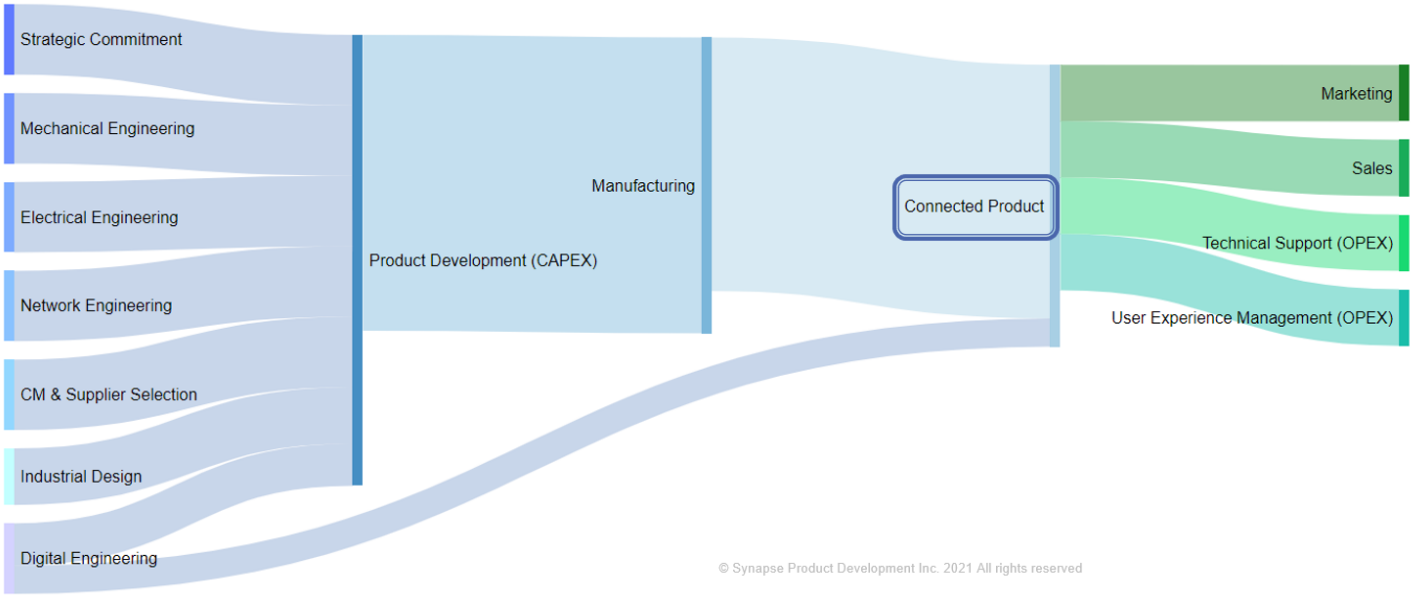
- Plain products have no built-in processing logic.
  Examples: a spoon, a chair, a drinking cup, a night light.
- Smart products are plain products with built-in processing logic, typically leveraging a microcontroller unit, but no networking protocol to transmit data.
  Examples: wired thermostat, wired motion sensor switching a light on or off, rain-sensing windshields with automated wipers.
- Connected products are smart products with at least one networking protocol to transmit data for further processing or user interfacing.

Note:
This is a simple categorization, and the reality may be more nuanced as there are ascending orders of "smartness" and of connectivity.
For example, does an electric relay switching function qualifies as basic processing logic? How similar are a transistor switching function from an electric relay switching function?
Similarly, connected products can have networking functions limited to two devices, vast but local networking, private wide area networking, or leveraging the global internet.

Connected products add a digital user experience dimension that requires ongoing management for the life of the product and possibly beyond as the ecosystem is likely to outlast a given product model.

This increases operating expenses but, as we saw in the previous chapter, this ongoing user experience management provides the opportunity to constantly engage with the customers and build a lasting relationship.

The diagram below represents the disciplines involved to bring a connected product to market (at the left of the “Connected Product” column) and the ongoing activities required for a financially successful IoT solution that brings value to the customers.



Note:
This diagram represents the disciplines involved rather than a cost model as other elements including prototyping, bill of material (BOM), cost of goods sold (COGS), cycle testing, etc., would also need to be factored in.

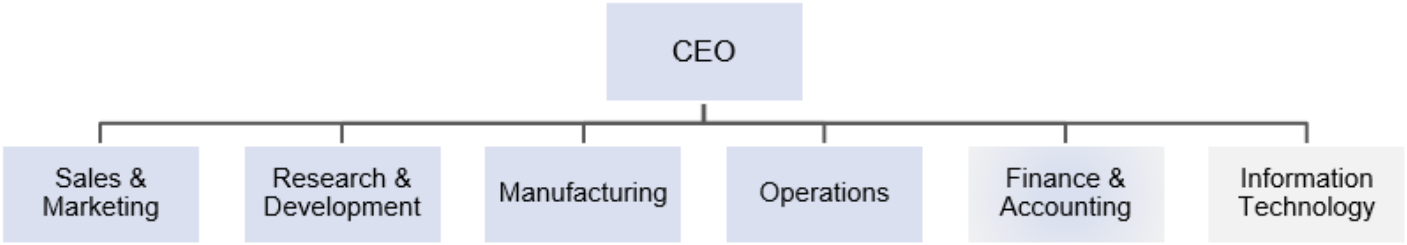
Here is a high-level description of the disciplines involved:

- Strategic Commitment from the executive sponsor is even more critical for a connected product than for a plain product as the capital investment (CAPEX) must be paired with the needed operating budget (OPEX) going forward.
- Mechanical Engineering provides the physical world components, including transducers (sensors and actuators) specifications in collaboration with Electrical Engineering.
- Electrical Engineering provides the electrical components, such as power budget, circuit board, and the microchip controller specifications in collaboration with Network and Digital Engineering.
- Network Engineering provides the wired and wireless connectivity, along with the communication protocols specifications in collaboration with Digital Engineering.
- Digital Engineering provides the data and information processing components, embedded in the product, or deployed in the back-end data center, along with the digital user interface in collaboration with Industrial Design. Note that Digital Engineering include activities tied to the manufacturing process such as firmware embedded in the product and other CAPEX activities in the back-end data center that can continue in parallel to manufacturing in order to deliver a complete ecosystem. Additionally, User Experience Management and Technical Support will require Digital Engineering OPEX activities for the life of the product.
- Industrial Design provides the look and feel of the physical product and of the digital user interface.
- Contract Manufacturing (CM) and Supplier Selection establishes the manufacturing and supply chain in collaboration with the other disciplines.

Safety, security, and compliance activities are typically considerations addressed as part of the disciplines listed above.

ORGANIZATIONAL ROLES INVOLVED IN A CONNECTED PRODUCT JOURNEY

Plain product development (i.e., not smart or connected product) typically doesn't involve the company's Information Technology department and follows a primarily capital investment budgeting cycle to which the Finance & Accounting department is well accustomed.



Typical "plain" product company organizational structure

However, as we have seen in the chapter 2 of this blog series, the value-added of a connected product comes from the use of the information gathered from the IoT system and the resulting knowledge & insight.

This requires the Finance & Accounting department to measure the investment in a product from both a CAPEX and OPEX perspectives with a different return on investment schedule than for plain products. For example, ongoing operations budgets must be allocated each year for the lifetime of the connected product ecosystem.

Additionally, the organization may look at the internal Information Technology department to fulfill the Network Engineering and Digital Engineering activities required by a connected product, propelling the Information Technology department from a back-office role to becoming integral to the success of activities performed by the Research & Development, Manufacturing, and Operations departments.

However, a traditional back-office Information Technology department rarely had to architect connected products and consequently may lack the corresponding skillsets:

- Wired and wireless connectivity using BLE, Zigbee, Thread, 4-20mA current loop, etc.
- Embedded firmware development
- Connected device security provisioning at scale and over-the-air updates
- Large volume telemetry data ingestion
- Data-driven approach to operational efficiency
- Artificial intelligence such as predictive behavior and maintenance

As a result, organizations that rely on traditional back-office Information Technology department to architect and bring to market a connected product frequently exceed their budget or fail entirely.

The organization structure constrains their innovation

"[…] the organization's governance structures, problem solving routines and communication patterns constrain the space in which it searches for new solutions."

MacCormack, Alan; Rusnak, John; Baldwin, Carliss Y. (2011). "Exploring the Duality between Product and Organizational Architectures: A Test of the Mirroring Hypothesis".

"[…] organizations which design systems are constrained to produce designs which are copies of the communication structures of these organizations."

Conway, Melvin (1968). "How do committees invent"

McKinsey has identified that the single most important factor for successful commercial product launches was team collaboration.

THE DIGITAL TRANSFORMATION ASSOCIATED WITH A CONNECTED PRODUCT

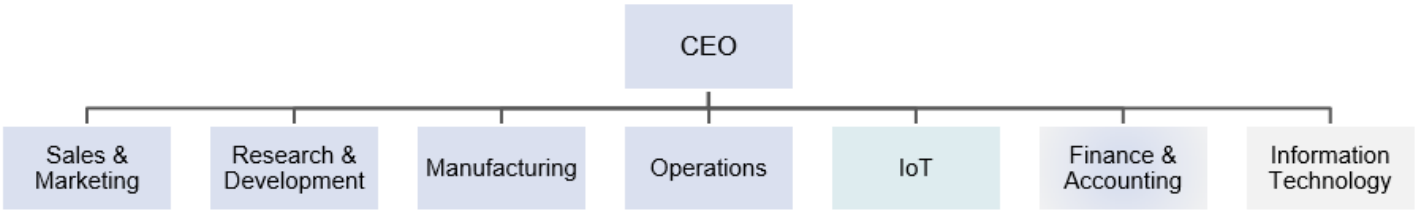
To solve the innovation limitations of their existing structure, organizations need to embark on a digital transformation journey and adapt their structure and capabilities for the required collaboration associated with a connected product.

As defined by Salesforce, Digital transformation is the process of using digital technologies to create new — or modify existing — business processes, culture, and customer experiences to meet changing business and market requirements.

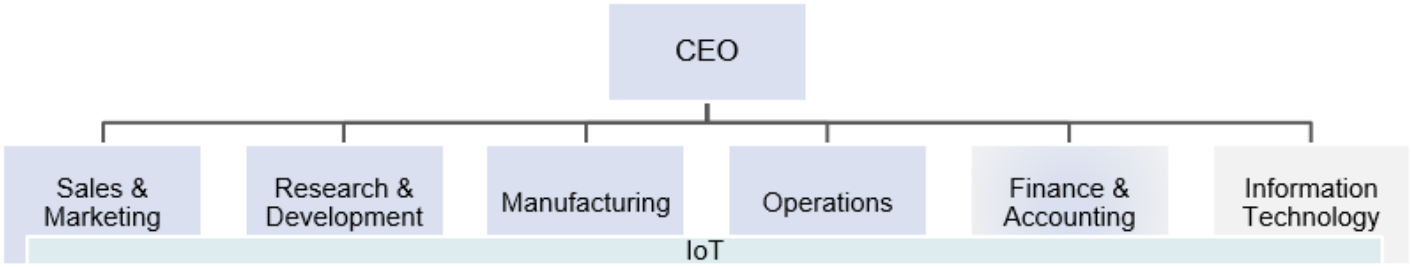
See how Disney is making magic through digital innovation with a multi-channel experience initiative, including connected products:

IoT capabilities required to support this digital transformation can be implemented with various options in the organization structure.

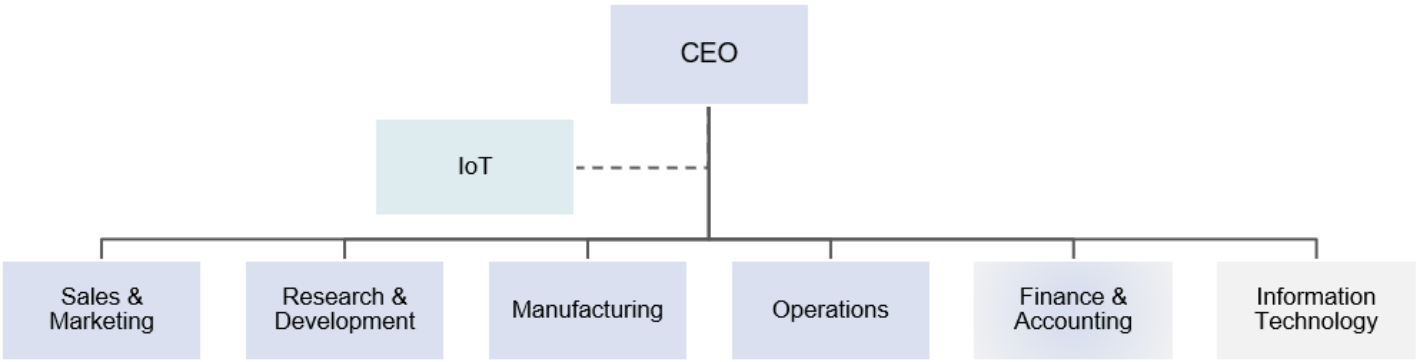
A dedicated department may be added, though that may take a year or more to build therefore delaying the connected product launch date. Additionally, the large overlap of functions with the existing departments may lead to confusion and friction.



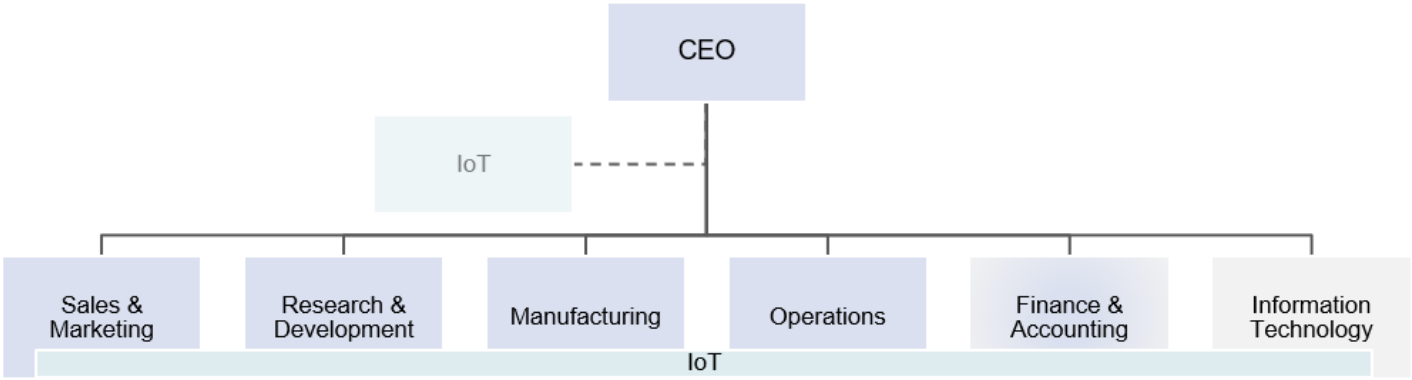
An alternate approach is to matrix the IoT capabilities into existing departments. This may alleviate the frictions associated with the approach described above but will nevertheless require some time to establish and clarify the roles & responsibilities; hence the connected product launch date may be delayed.



Outsourcing to an external partner is an efficient way to launch a new connected product by leveraging an experienced third party who can bring the needed capabilities: people, process, and technology. This partner can be attached wherever in the organization the primary sponsor is.



Over time, the organization can establish its own structure and gradually build the internal connected product capabilities to eventually release the external partner; this transition is often completed after the product launch date.



Note that establishing a new organization structure is only one facet of the digital transformation collaboration; an effective and efficient collaboration capability should also address the people, process, and technology dimensions.
As we have seen above, there are many disciplines involved in a connected product journey, and these disciplines need to share requirements, design decisions, test scenarios and results, etc. Consequently, a unified collaborative work management platform, adopted by all the involved teams and used according to defined processes, is an integral part of successful collaboration.

SELECTING A PARTNER FOR INNOVATIVE CONNECTED PRODUCT DEVELOPMENT

The cost of an innovative product is always difficult to estimate since, by definition, it has never been done before.
However, some companies have for core competency to create innovative products in partnership with client organizations. Such innovative product companies can help navigate the estimation process and ensure that the focus remains on what makes a connected product successful.

Synapse has been developing innovative hardware and connected products as a core competency over the last 20 years for client organizations of all sizes. This results in deep technical expertise along with broad experience across most market segments.

Specifically, Synapse has identified the variables impacting development scope to provide more accurate estimates and to serve as the main levers an organization can utilize to work within target budgets and schedules:

1. Clarity of the Product Purpose
2. Maturity of the Underlying Technology (technology readiness level: TRL)
3. Magnitude and Complexity of the Product Ecosystem
4. Quality, Performance, and Compliance Requirements
5. Product Cost Optimization

6. Build and Launch Volumes
7. Development Budget and Schedule Constraints
8. Risk Tolerance

Refer to our ebook Mastering Hardware Product Development: 8 Levers for Optimizing Your Product's Cost, Schedule, and Quality for a deep-dive into each of these levers.

As we have seen in the first chapter, the Internet of Things (IoT) is a complex system bridging the physical and digital worlds, generating large amounts of data. Consequently, a strong partner for an innovative connected product development must have:

- mature mechanical, electrical, networking, and digital capabilities to architect and design the connected ecosystem,
- market knowledge and relationships to establish the needed supply and manufacturing chain at the appropriate COGS and BOM targets,
- industrial design and digital operations know-how to deliver a seamless user experience to the physical and digital product ecosystem, with data modeled as a Digital Twin relevant to the user experience.

FINANCIAL BENEFIT OF END-TO-END CONNECTED ECOSYSTEM EXPERTISE

A pitfall some manufacturers of plain products encounter as they take-on their first connected product journey is to narrow down the financial analysis to the BOM and COGS of the physical devices, thus leaving out in the return on investment (ROI) calculations the costs and revenues of connected product ecosystems.

The product is the ecosystem, not just the physical device

The Ring Video Doorbell device has a $99 MSRP, however the Ring ecosystem generates up to $599 of revenue over 5 years.

That's because the Ring ecosystem includes a subscription revenue stream.

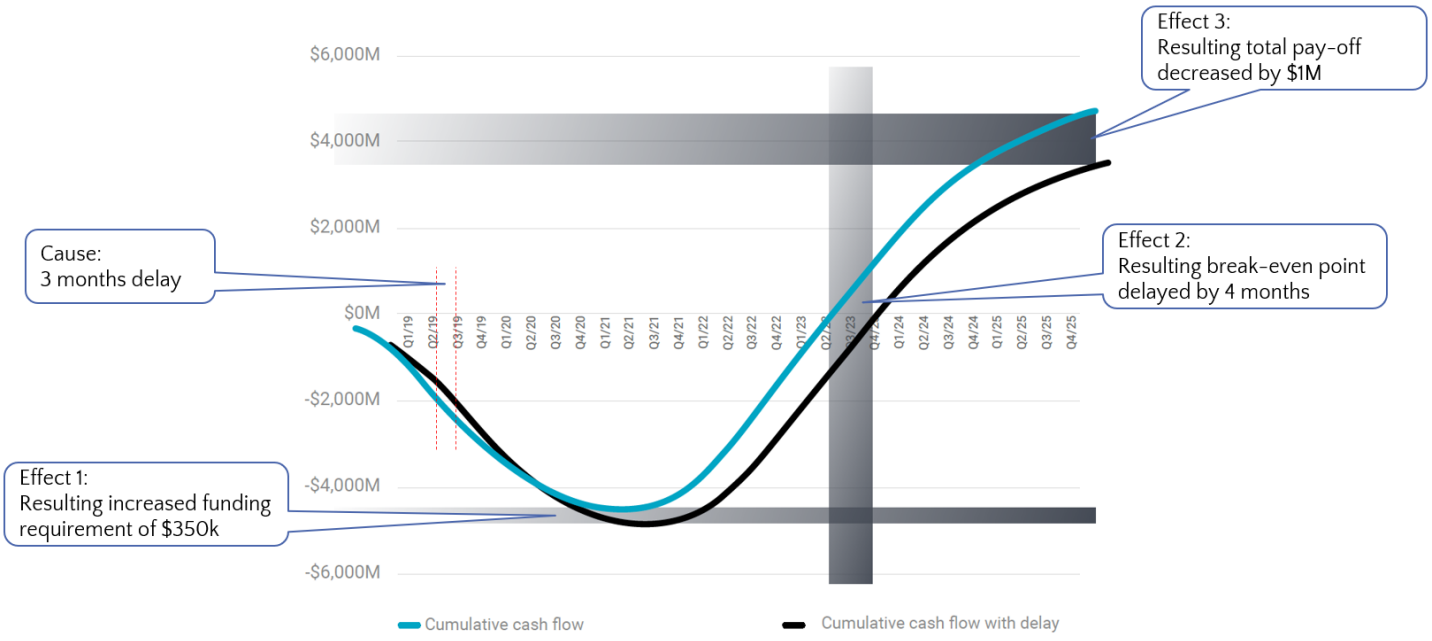
There are actually 3 plans: a free subscription with minimal features, a $30/year Basic plan, a $100/year Plus plan, and a $200/year Pros plan was recently added.

All prices as of the time of publication.

As we discussed in the post #2, the value-added of IoT comes from the use of the information gathered from the IoT system and the resulting knowledge & insight. Connected ecosystems provide a unique opportunity to build a close relationship with customers by leveraging the gathered insights to continuously enhance the value perceived by the customers.
The implication is that IoT monetization models and customer relationships should be front-and-center in all ROI analysis.

An early focus on the physical devices BOM and COGS typically leads to imbalanced financial analysis and sub-optimal technology component selections.
If an imbalanced analysis is not corrected, the ecosystem may not meet the user's value expectations and the product may fail to meet the ROI targets. An example is for an air quality ecosystem: a device-only ROI may lead to the selection of cheap and low accuracy sensor, whereas a more expensive and accurate sensor may enable information correlation with other sources and artificial intelligence inference models that would deliver significantly more value to the end-users; and a market analysis may show these end-users are willing to pay a subscription premium to access this additional value.

However, even if an imbalanced analysis is identified and corrected, the launch date may be delayed as the financial analysis and corresponding technology component selections are redone. Such delays typically translate into lost revenue. The visual below shows how much a 3-month delay can impact a hypothetical program's funding needs (up $350k), break-even point (4 months later), and total payoff ($1M less). Planning for the best and being prepared for some bumps in the road isn't just prudent, it might be the difference between success and failure.



In the next post **How** to build an IoT solution, we will explore the key architecture and design considerations required to realize the expected value of a connected product ecosystem.

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