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Consumer IoT Product Development: Managing Costs, Optimizing Revenues

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Consumer IoT Product Development: Managing Costs, Optimizing Revenues

The smart home market is maturing, and consumers are accustomed to a new reliance on connectivity and various connected devices in their daily routines. Nearly half of US Internet households now own a smart home device, and buyers are increasingly mainstream consumers looking for practical products and services to fit their lifestyles. A long tail of competitors continues to enter the market, while early players are on their third or later generation of flagship products and working to build out their product ecosystems.

At this stage, companies must prove out the financial viability of their smart home businesses and move beyond venture-fueled trial and error. This starts with product development and strategic business planning. Consumer IoT and smart home businesses must understand their product development and ongoing operational costs and have a clear plan for revenue generation to see a reasonable ROI on the investment.

This white paper evaluates the primary product and ongoing costs associated with smart home products and services. It highlights pain points in the product development process and shares strategies for minimizing costs. It also assesses the primary monetization models in the smart home with examples of how solution providers can use one or more models to produce value for customers and other ecosystem players.

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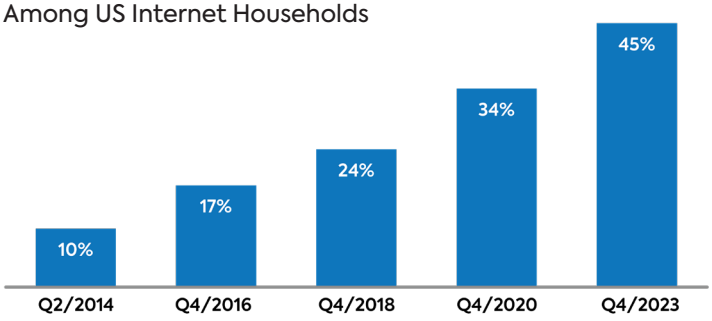
Business Development in a Maturing Smart Home Market

The consumer IoT landscape, and the smart home specifically, has grown tremendously over the past decade. Parks Associates' research finds 45%, or 54 million US internet households, own at least one smart home device, up from 10% in 2014. The number of devices owned has nearly doubled as well: on average, smart home device owners have 6.5 devices, up from 3.5 in 2016.[1]

Smart Home Device Ownership

Among US Internet Households



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Parks Associates projects that unit sales of 12 core smart home devices will total more than $15B in the US by 2029, up from $8.5B in 2021.

Surveyed Smart Home Devices

1. Thermostats
2. Door locks
3. Video doorbells
4. Smart cameras
5. Smart lights, lighting control system
6. Outdoor light fixtures with cameras
7. Outlets/switches/dimmers
8. Smart plugs/power strips
9. Sprinkler system
10. Garage door openers
11. Smoke/CO detectors
12. Water leak detectors
13. Water shut-off valves
14. Robotic vacuum cleaners
15. Smart appliances
16. Smart home control hub

A new type of buyer comes with the evolution and maturity of the market. The profile of the smart home adopter is shifting from a very tech-forward buyer, an "Innovator," to a more mainstream user.

Just 11% of smart home device owners identify as "Innovators" today, down from 63% in 2018. At the same time, 37% of smart home device owners identify as "Early Majority" today, compared with just 20% in 2018.

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Consumers are gravitating towards technology that makes sense. Marketing and product design strategies must be adjusted when transitioning from targeting "Early Adopters" to reaching the "Early Majority". This shift is critical for "Crossing the Chasm" into mainstream adoption, as these two segments have distinctly different expectations and needs. Consumers are not looking for technology because it is cool; they seek practical benefits, a clear ROI for their spend, and will be far less tolerant of bugs and friction in the user experience.

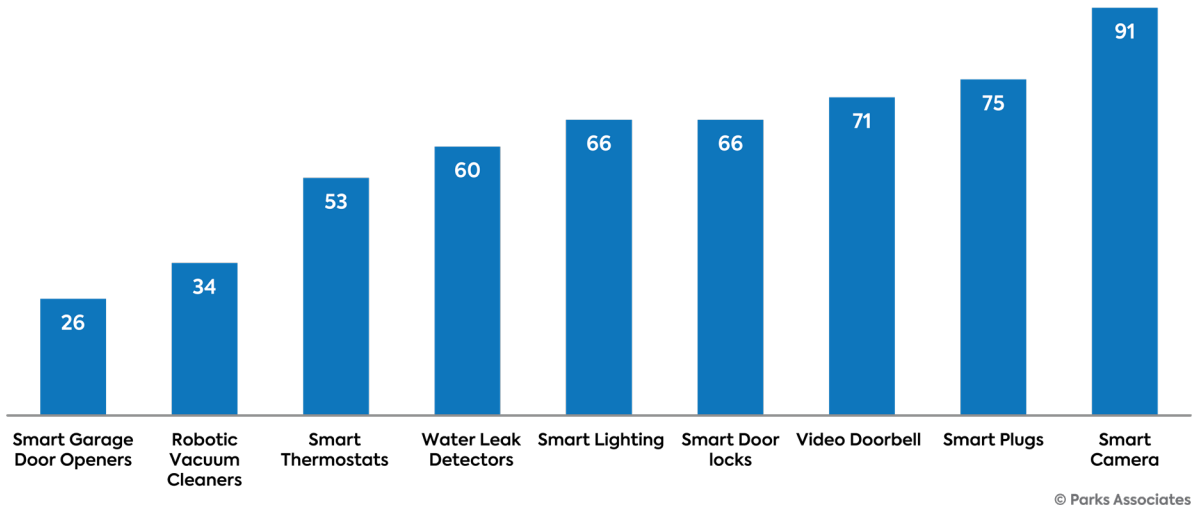
The "Early Majority" segment of smart home buyers has these characteristics:

- Pragmatists looking for practical value in their lives
- Buy for marginal improvement over what they use today
- Can relate to new tech, but don't seek it out
- Need proof of value before spending

The competitive landscape is also evolving. Early movers like ADT and Alarm.com and hero brands like Nest and Ring have staked out market share, offering a portfolio of devices with varying feature levels and price points, while a variety of brands offer entry level products. In many categories, more than 50 brands are active in the US market. Businesses must find ways to differentiate and earn premium prices and ongoing service revenues and/or contain costs to operate profitably among competitors offering similar value.

Number of Brands Active per Category, in US Market

Source: Parks Associates Smart Home & Security Tracker

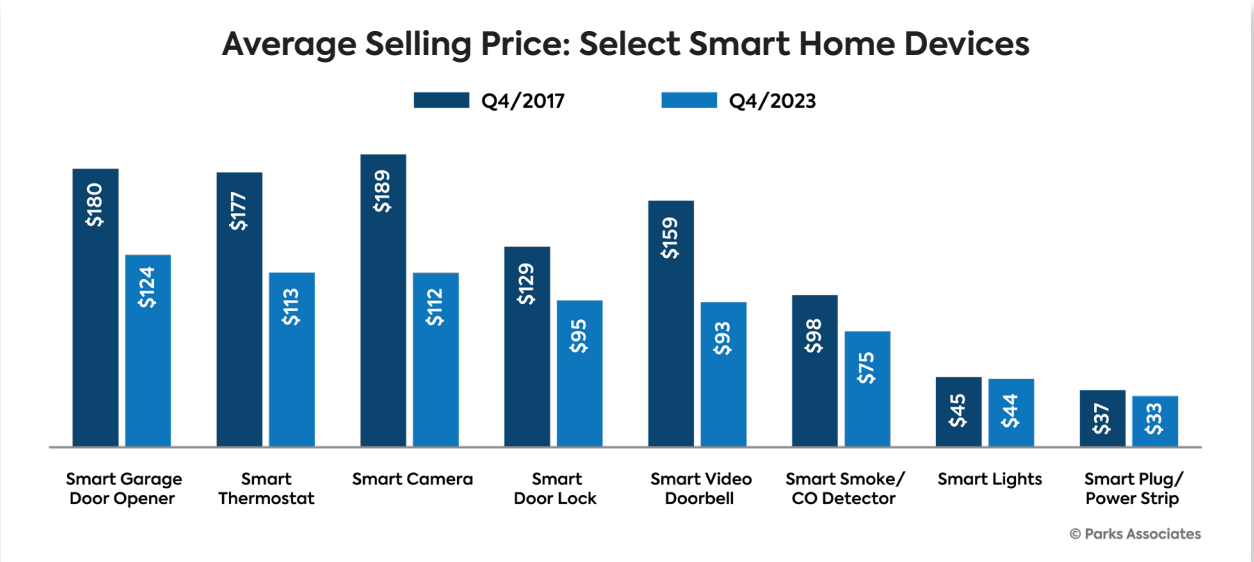


The Cost of Doing Business

The costs that go into making and supporting a smart home product must be planned against realistic sales volume and market pricing trends. In the smart home market, annual sales volume is impacted by macro-economic factors including the health of the housing market, which impacts consumer moving behavior and investments in home products and technologies. It is also impacted by inflation, which impacts overall consumer spending, among other macro-economic factors.

Average product pricing has generally followed a downward trend over time, typical of consumer technology products that become more affordable as increased competition drives down prices and expanding adoption drives efficiencies of scale:

> The average price paid for a smart door lock in Q4 2023 was $95, down from $129 in Q4 2017.
>
> For a smart thermostat, average purchase price was $113 in Q4 2023, down from $177 in Q4 2017.



In addition to projecting expected sales volume and long-term pricing trends, companies bringing products to market in the smart home or consumer IoT sectors must think differently about costs compared with traditional, non-connected product development. The sensors, networking, and ongoing connectivity required for smart home products require a long-term view that accounts for ongoing development, cloud connectivity and support. Companies employ a variety of business models to recoup their ongoing costs, in many cases offering subscription services to create a recurring revenue stream and seeking economic benefits from the value of the data internally and for others in the ecosystem.

Smart Home Device Design and Production Costs

Material and Manufacturing: The direct costs of the physical components of the product including chipsets, sensors, wireless modules, casing materials, and battery or other power sources, plus the costs of production and labor in manufacturing. These costs of the physical components scale per unit.

Non-Recurring Engineering (NRE): The one-time costs associated with the initial design and engineering costs for creating the product. NRE costs should be amortized across the total number of devices expected to sell. Dividing total development by the lifetime production volume provides a development costs/device view.

Device development: Design, development and testing of the physical device and embedded software along with any manufacturing test equipment and/or tooling. Typically the development and testing of the embedded software is the single largest development cost as it controls the operation of the device providing both the physical controls to the user and bi-directional communications with the cloud backend.

Cloud backend system development: Costs related to creating and maintaining the server software. Typically, the cloud software creates and manages user accounts, allocates devices to accounts, acts as the digital twin, pushes OTA firmware updates to devices, and provides the conduit for remote access. The cloud software provides dashboards for various stakeholders, such as the Operations, Engineering, and Marketing teams. As the cloud software manages user accounts, it is integral with the strategy of staying in touch with the client outside of using the device, such as training materials or special offers, etc. The cloud software is often linked to CRM systems.

Mobile app development: Costs associated with developing and maintaining the mobile app that users interact with to control their smart home devices. This includes both iOS and Android development, and development for other interface types that the brand chooses to support, such as smart watches, smart speakers/displays, and smart TVs.

Smart Home Device Operational Costs

Landed device costs: The costs of shipment, transportation, customs fees, taxes, and product insurance.

Cloud operational costs: The costs of computing, networking, and storing data remotely. There are different models of assessing fees, but most models depend on the type of compute resources used, the volume of data transferred in and out of the cloud platform, the number of messages in and out of the cloud system, and the amount of data storage needed. All of these may depend on how frequently, and for what purposes, the end customer actually uses the device and its various features.

Cloud costs can be calculated by multiplying the per device cloud costs over the lifetime of the device. Calculating cloud costs when evaluating a business model is challenging as the costs depend strongly on which cloud services are used which depends on the specific design. Companies will benefit from an experienced IoT team to estimate cloud costs prior to development; the same team can advise on a design that minimizes operational costs.

Sustaining engineering: By virtue of their connectivity, smart home devices both can, and need to be, updated with OTA (over-the-air) updates. This enables product developers to evolve the product and continue to add value even after the purchase. It is also necessary to ensure the product stays secure, functioning, and in alignment with any requirements from cloud or app store providers. Unfortunately, annual sustaining engineering costs associated with security and compatibility with platform changes (cloud, iOS, Android) are the same whether you have 1 deployed unit or a million deployed units.

Help desk costs: Consumers face difficulties at install and throughout the lifecycle of the product. For instance, more than 50% of those who attempted to self-install water leak detectors have difficulty, as do more than a third of those who self-installed their smart lights, door locks, and garage door openers. Beyond install, one-third of smart home device owners report having at least one technical support issue with a smart home device in the prior 12 months. The number one issue is loss of wireless connectivity. Help desk costs will scale along with the number of customers – more resources are needed as more customers come on board.

68% of those experiencing difficulties with their smart home products during installation seek professional help, most commonly contacting the manufacturer for help.

ROI: Generating Value and Getting to Profit

Smart home providers employ various strategies to generate value and reach profitability. This involves looking beyond the initial sale to produce long-term revenue streams through subscriptions, cross-selling and upselling, and multi-sided value propositions that leverage the value of the data and benefit multiple stakeholders.

Premium Hardware Sales

Hardware sales form the basis of recouping product development and manufacturing costs, and companies set a higher price point for smart products than similar non-connected products on market, or in their portfolio. For example, the price difference between a traditional garage door opener and the entry-level smart garage door opener from Chamberlain is $40. A smart thermostat from Honeywell retails anywhere from $70 to $239, whereas its non-communicating programmable thermostats retail from $30 to $109.

Providers of higher-priced products and systems may offer financing or may choose to allow buyers to amortize the hardware costs across the term of a subscription. This is common when selling devices as part of a home security or automation system, where upfront equipment costs may reach or exceed $1,000. ADT's reported average revenue for systems sold plus installation costs totaled $1,400 at the end of 2023, up from $975 in 2021.

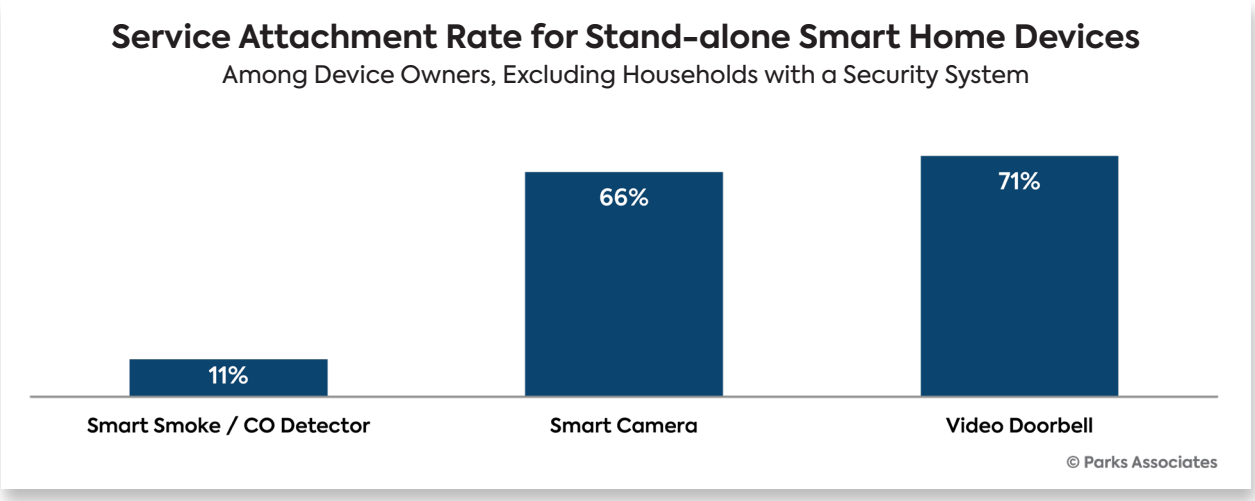
For stand-alone devices, declining prices will make products more accessible to more buyers and may spur broader adoption. However, they also make it more difficult for individual brands to succeed with sustainable revenues. Plus, brands must plan to cover ongoing operational costs. Some manufacturers account for ongoing costs in the price premium charged for connected product lines. Chamberlain's garage door openers, Honeywell's smart thermostats, Moen's Flo smart water shut-off valve, Rachio's smart irrigation system, Eufy's cameras, and GE's smart lights are all examples of products sold as premium devices, without attached services.

However, there is risk that ongoing costs prove more costly than anticipated or competitive factors force price cuts to the connected product line. As a result, subscription services on top of hardware fees are critical for many businesses in the consumer IoT market.

Product-Attached Subscription Services

Video storage, professional monitoring, and safety services are leading areas of subscription revenue.

- 71% of video doorbell owners pay a recurring fee for service, which may include alerts/remote monitoring, video storage, and/or professional monitoring.
- The service attach rate for smart cameras is slightly lower at 66%. Both service attach rates have grown from 2022 to 2023.
- 53% of smart smoke/CO detectors have a service plan, mostly delivered as part of a security system.
- 11% of smart smoke/CO detector owners whose devices are not part of a security system also pay for a service, which may include alerts of smoke/CO detectors, professional fire monitoring, battery level notifications, among others.



Beyond safety and security, other smart home device OEMs offer device-attached services as well. Networking equipment manufacturers like Netgear and Amazon (Eero) offer advanced Wi-Fi monitoring and cybersecurity services. Amazon has plans to launch a subscription-tier AI service for its Alexa voice assistants in 2025. For products without video, an attach rate of about 10% is a realistic benchmark for product-attached services.

Cross-Selling and Upselling

Product leaders commonly include ecommerce capabilities within the app for consumers to add more devices of the same kind or other device types from across the brands' portfolio directly within the app. This is also a path for selling consumables and other associated items. Examples include water filters for smart refrigerators, air filters through a smart thermostat app, coffee pods with a smart brewer, or interchangeable product faceplates to update a product's look/design. Category leaders demonstrate this approach:

ring

Ring's app includes a "devices" tab that highlights other products in its portfolio with examples of how the devices might work well together. The user can then click through to buy the devices from Amazon, parent company of Ring.

myQ®

Chamberlain's MyQ app includes a Discover tab with a shopping experience highlighting additional MyQ products to purchase directly through the app.

LG ThinQ®

Through the LG ThinQ app, smart refrigerator owners can buy water filters or subscribe to a water filter replacement service. The app also includes a recipe service through LG's partnership with SideChef. Users can find recipes, add needed ingredients to a cart, and checkout online with their preferred local grocery store.

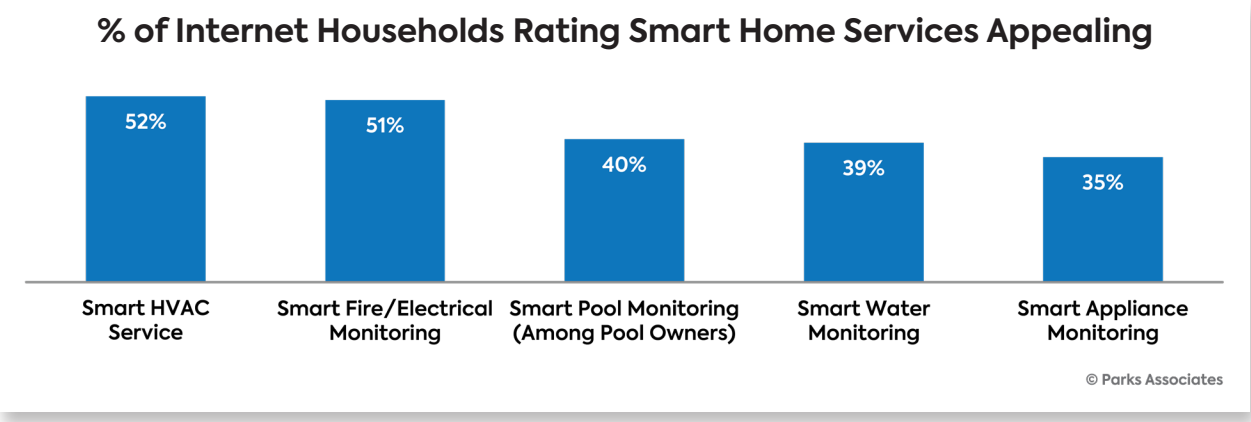
Cross-selling and upselling allow companies to gather valuable consumer data that gives insight into consumer preferences, purchase decisions, and use cases. By understanding which products are commonly purchased together, brands can continue to update their offerings and customize recommendations more effectively.

Double-Sided Business Model

A double-sided business model allows companies to enhance revenues by providing value to multiple stakeholders within the ecosystem, generating income streams from both sides.

- Water leak detectors not only save homeowners costly water damage expenses, but they also offer significant value to insurers by reducing claims and payouts.
- Smart door locks for multidwelling units (MDUs) benefit both property management companies and residents. Property managers experience more efficient unit turnover and maintenance operations, while residents benefit from the added convenience and security.
- Smart thermostats help homeowners save on energy costs by optimizing energy use. They can also benefit utility companies through demand response programs, and they may even form partnerships to subsidize hardware costs.

There is an opportunity for smart home products to become lead-generation or customer-management touch points for the skilled trades and other home service providers. Smart devices can often detect when a device or system is performing sub-optimally and can alert the user's preferred service provider that maintenance is needed – a valuable lead-generation activity.



Between a third and half of single-family homeowners are interested in home services that leverage smart home devices and systems as part of the service offering.

Internal Strategic Value Driven by Data

Beyond revenue generation, the data generated by connected product lines can offer strategic value to the organization. Smart products create an ongoing connection between the brand and the user and so provide a wealth of insight into how customers use the products, who uses the products, and what features are left unused. Learning how users integrate the product with others in the ecosystem can set up strategic partnerships for marketing, bundles, or distribution deals.

These types of deals are common purchase triggers in the smart home.

Behavioral insights can be leveraged for next-generation product updates and to mitigate churn out of subscription services. Smart home solution providers with add-on services need to think about customer retention, as managing churn is critical to a sustainable business strategy. For example, residential security system providers can expect roughly 11-14% of monitoring subscribers to cancel their subscriptions each quarter, and more new subscribers must be added than ones lost to achieve growth. Providers work hard to retain existing subscribers as adding new subscribers to cover exiting ones is expensive.

Services based on emerging technologies can expect an even more difficult path in customer retention, as customers trial new services that have yet to prove their value. Customers move in and out of services that meet their needs, and deeply understanding user engagement with the product and associated services gives product teams ammunition to make quick adjustments to retain subscribers and earn repeat product buyers.

Implications and Best Practices

Assessing Performance & Profit

The path and timetable to profitability requires careful planning and consideration of all solution costs and revenue sources. The following provides a sample method for calculating return on investment. The solution's profitability results from considering the total value of the solution in excess of total costs.

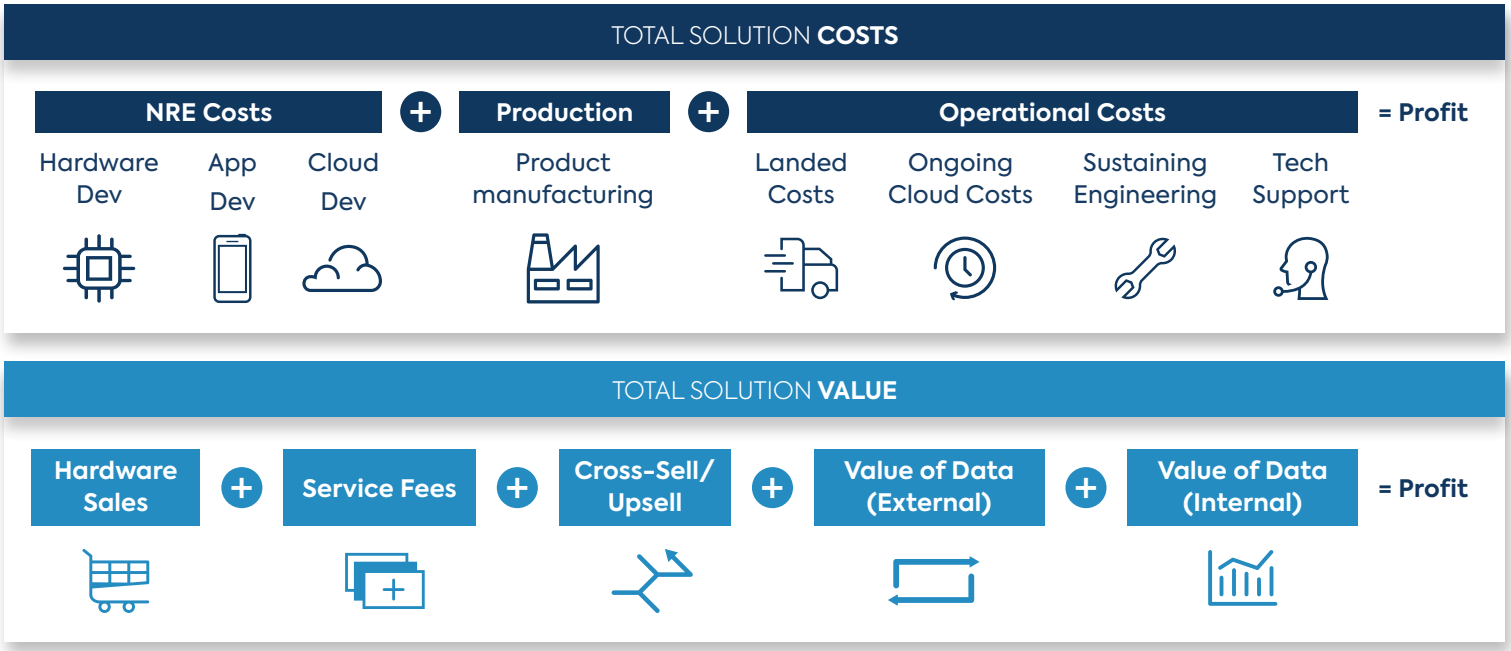
Summarizing Solution Costs:

- Non-recurring engineering: product development costs for hardware and embedded software, mobile application development, and cloud application development
- Production: the manufacturing of the units
- Operational Costs: landed costs (shopping, tariffs/taxes, insurance, etc.), ongoing cloud costs, sustaining engineering and technical support

Summarizing Solution Value:

- One-time revenues generated by hardware sales
- Recurring revenues generated by service fees
- Revenues realized from cross-selling/upselling consumables, or other products/services in the corporate portfolio
- Revenues generated from third-party use of data/insights or value provided third party through risk avoidance, operating efficiencies, or customer acquisition
- Savings on R&D spend from insights gained through internal data generation and analysis

Assessing Profitability in Consumer IoT



Modeling Profitability

The following model is one example of how to calculate costs and value for a consumer IoT solution, such as a smart home product, considering all lifetime costs and the value generated by the solution over its lifetime. Similar calculations can be broken down annually for business planning.

Performance Model over Solution's Lifetime

COST CALCULATIONS

Total Solution Costs =

Non-Recurring Engineering Costs + **Production** + **Cloud Costs** + **Landed Costs** + **Sustaining Engineering** + **Help Desk**

Non-Recurring Engineering Costs

NRE Costs amortized across expected lifetime sales volume

I.E.

Hardware, App, & Cloud Dev

Production

Product materials, manufacturing across expected lifetime sales volume

Cloud Costs

Cloud fees per device x connected device volume over device lifetime

Landed Costs

Manufacturing, shipment, tariff costs, across expected sales volume

Sustaining Engineering

Annual costs x expected solution lifetime

Help Desk

Cost scales with customer base

VALUE CALCULATIONS

Total Solution Value =

Core Revenue Generation + **Cross/Up Sell** + **Data (External)** + **Data (Internal)**

Core Revenue Generation

Customer lifetime value

I.E.

Hardware Sales
Sales price x estimated device volume - distribution/channel fees

Service Fees
Subscription price x estimated % of customers subscribing x subscription lifetime

Cross/Up Sell

% of customers taking cross-sell/upsell opportunity x customer acquisition savings

Data (External)

Value to partner of customer insights, per customer

Data (Internal)

Savings on R&D/ market research spend from internal insights

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Evaluating Development Strategies

As companies seek long-term value and revenue from smart home devices, they must weigh the advantages and risks associated with their development strategies, and benefits offered by different types of partners. Each strategic approach offers unique benefits and challenges, and understanding these is critical to building a sustainable business model.

Turnkey Development: With this strategy, companies white-label a smart home product or use a platform-as-a-service (PaaS). This strategy requires little in-house expertise in building or operating an IoT system; the vendor handles most of the technical details. While turn-key solutions are convenient, they often limit a company's ability to differentiate from competitors. Companies may also find themselves locked into a specific vendor's ecosystem, making it difficult to pivot or adapt.

Bespoke Development: With this strategy, a company builds a custom solution from scratch. This approach offers maximum flexibility and differentiation, allowing companies to customize nearly every aspect of the smart home product. However, the upfront costs are high and carries additional risk if the product line doesn't make it to market or fails to achieve widespread adoption. In these cases, the company may face significant financial losses.

Hybrid Development: A hybrid approach offers a balance between the turn-key and bespoke development strategies. With this strategy, companies may start with a pre-built template or platform and focus engineering costs on differentiating their product or app. This allows for customization while keeping costs and risks lower than a fully bespoke solution.

Evaluating partners for product development, application development, and cloud support, among other needs, is also critical. Ensure the team understands answers to the following key questions before committing to a development plan.

Critical Questions to Ask Development Partners

What are the ongoing cloud costs associated with connectivity, and how are the fees assessed?	Ask vendor to model a best- and worst-case scenario based on how customers use the cloud-enabled-features, and how much they use them.
What are the ongoing support costs, and who provides the support?	Know who is responsible for maintaining and supporting the smart home product including providing direct customer support as well as ongoing security patches and other key application updates.
Can my solution be customized, and can new features be upgraded or enhanced after launch?	Expect that the product will need updates or new features after launch to meet evolving customer needs and to stay competitive. Explore the most likely Phase II features and what the costs of developing those would be.
What is the vendor's expertise in developing IoT products, and how many clients or devices do they actively support?	A vendor's experience with IoT and smart home products goes a long way in giving you confidence that they can provide you with the expertise and tools to support your product development, pre- and post-product launch.
What is the country of origin for development and support, and what data security processes are in place?	Data security and privacy regulations vary from country to country, along with the consequences for non-compliance. It is critical, then, to understand the specific regulations to ensure compliance and protect user data.

The smart home market is maturing, and competitors must plan for the full cycle of costs connected product business lines bear across the solution's full lifecycle. Smart home players need to carefully align resources to let differentiating features stand out, while optimizing all possible revenue streams.

A successful business plan starts with product development and selecting the right development model and partner.

About Parks Associates

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Parks Associates, a woman-founded and certified business, is an internationally recognized market research and consulting company specializing in emerging consumer technology products and services. Founded in 1986, Parks Associates creates research capital for companies ranging from Fortune 500 to small start-ups through market reports, primary studies, consumer research, custom research, workshops, executive conferences, and annual service subscriptions.

The company's expertise includes new media, digital entertainment and gaming, home networks, internet and television services, digital health, mobile applications and services, consumer apps, advanced advertising, consumer electronics, energy management, and home control systems and security.

About Cardinal Peak

Cardinal Peak develops and operates IoT products on behalf of our clients. From initial minimum viable product design through continuous feature innovation, we help clients with all their IoT product needs, so their devices stand out in the market. As a wholly owned subsidiary of the leading global technology and IT services provider FPT Software, we have the talent your unique product requires — more than 100 engineers in Colorado and 30,000 employees worldwide — with proven expertise in smart home, automotive and health care. Learn more at https://www.cardinalpeak.com/

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