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# How an innovation and IP value-chain view can transform portfolio value

While an IP portfolio built on business value chain can have strategic value, companies should take a closer look at how strong links between intellectual property and innovation can expand a portfolio's breadth and depth

By Peter Cowan

**T**he innovation pendulum is swinging back towards how patent portfolios are created and valued.

Apparent instabilities in the legal environment, licence models and the competitive space have left many ventures with little standalone intellectual property – but still a hefty legal annuity to show for it. The new enforcement markets mean that an inherent risk is now associated with filing patents: the process takes longer than it does to get some products to market and is tremendously costly. As a first reaction, there have been shifts in how pure IP portfolios are being developed.

One indication of this is that first movers are turning their attention to IP programmes that are tightly linked with innovation work. Publicly traded non-practising entities (NPEs), such as Vringo and WiLAN, have become more closely aligned to innovation-based activities. Companies such as Patent Properties – formed to remove licensing friction in the market – have pivoted towards Haystack IQ, which focuses on innovation for clients. It is no coincidence that those heavily involved in intellectual property are pushing for a greater link to tangible new innovation as part of their growth – or survival – strategy.

But is an innovation shift enough? While simply coupling intellectual property to innovation does create a higher volume of technology transfer around identified market-ready and patent-protected innovations, it fails fully to take account of how the environment has changed, where the convergence of technical products has resulted in complex systems which combine hardware, sensors, data storage, microprocessors and software, and where interconnectivity is happening in myriad ways. Merely extending intellectual property to innovation does not address the underlying issue: intellectual property and innovation need to be co-dependent for success and must be seen in relation to the market ecosystem.

David Kline's article "Extinction-level event: out of adversity, opportunity" (*LAM*, Issue 74, November/December 2015) discusses the great resurgence in innovation that is needed – specifically, how a common feature of the new innovation model involves "reconnecting patents in some fashion to invention, as well as to operating businesses with real products and services". He points out the need to "[r]estore patents' organic connection to invention and embed IP value in real products and services in the marketplace". While this is critical, we need a deeper view on how

to execute this instead of just directing innovation teams to innovate on products, while protecting them at the same time. To address this point, innovation and intellectual property need to be linked within the context of a market's value chain, which in turn will provide insights into the new business segments over what to prioritise for investment. However, this value-chain view would require ventures to rethink and retool how they develop their IP-related innovation programmes internally.

The value chain is a way of looking at a venture's competitive position, taking growth into account. Intellectual property is often a long game – with patents lasting for upwards of 20 years and other rights lasting in perpetuity. The value-chain view takes into account how a venture needs to grow over time. In particular, two dimensions of the value chain need to be considered: depth and breadth.

## Identifying depth

While the true definition of a business's value-chain depth depends on the particular situation, it refers generally to the depth of offering that the business plan has in the market and the breadth of upstream or downstream influence that it has on surrounding businesses.

Depth in the value chain can be visualised as an offering of components, products and systems. Most successful ventures understand their customer value proposition – who they are building for and what they are offering a solution for – and the offering fits into at least one of those parts (ie, component, product or system). For small ventures, one specific customer profile is likely to be looking for one component or part; for larger ventures, this scales up to cover multiple cases or customers, which could cover the entire market's value chain.

As ventures understand where they sit from the customer's view and how they can profit from this – more specifically, where their revenue and margin actually flow from – they will need to adapt their IP and innovation strategy to fit.

Ventures with market and IP protection covering greater depth in the value chain typically have a better market position. Also referred to as 'vertical integration', value-chain depth means that such companies have not only the skill to produce components required to manufacture products and the production or distribution of the products themselves, but also the intellectual property necessary to properly protect their market

position. In other words, ventures can build and execute on IP strategies independently in the components, products and systems levels – and in a linked fashion – can build a focused IP portfolio more efficiently.

Linking is key, because traditional defensive, offensive or licensing-focused patent strategies which are built around one simple market offering (eg, a component piece) may not fully protect the necessary product offering. In some cases, there may be cross-pollination between teams or groups to link strategies; but in others, the traditional strategies of filing by business group will stand alone. Often in this case, the sum of the parts does not equal the more valuable whole.

Moving a venture to cover the depth of the value chain proactively relies on common patent-strategy processes – defining the best strategy around the portfolio use (eg, defensive or offensive). However, the first critical step relates to intellectual property around the entire value chain: transform the portfolio value to outline the portions of the entire market value-chain depth, identify IP gaps and future competitive moves and then ensure that a corporate IP programme takes these into account. Simply relying on protecting one standalone product or service is not enough – protection needs to be built out. At the very least, this will result in IP landscaping across the value-chain depth as it relates to the venture's business and allow decisions to be made on actual priority or scope of coverage.

The second critical step is to bring this knowledge back into the technology innovation that the venture can actually achieve. However, a note of caution: if it does not truly understand the market, a venture will simply be laying (blanketing) intellectual property over all sub-components and variations of the product's customer system. Focusing funds and resources on filing applications for relevant IP rights for the venture is crucial for this second step. To accomplish it requires looking at the innovation happening in the R&D and overlapping it with the value-chain view.

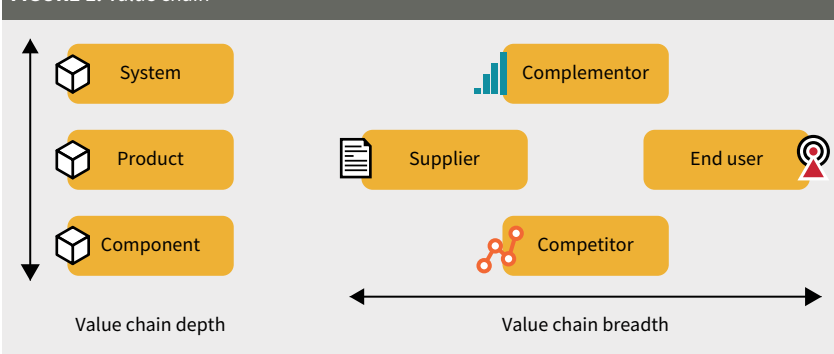
More specifically, an innovation-based decision about what to continue to invest in must be made in the context of the intellectual property and the business ecosystem. If this is carried out in conjunction with prioritising an innovation programme, it can force a venture to understand its position in the product/customer value chain and optimise the relevant intellectual property. It also allows for more discussion around the depth of portfolio required and lowers risks by highlighting any protection gaps.

### Case study: BagTrakka

In some cases, the value-chain view of intellectual property and innovation can highlight weaknesses or opportunities ahead of business growth efforts. Take BagTrakka, a UK-based venture which – if it had only understood its innovation position in the value chain and filed additional IP registrations – could have gained a deeper portfolio offering together with increased IP market value.

BagTrakka created a global positioning satellite-enabled luggage tag trackable via the Internet or text message, courtesy of a built-in global system for mobile communications modem. BagTrakka had several innovative designs, including an accelerometer and light sensor that powered down when onboard an aircraft.

FIGURE 1. Value chain



Overall, the patent portfolio contained five patents (in two families). Yet an analysis of the original patents suggests that the protection of the data communication and device identification may not have addressed the lower-value component portion of the value chain in which the venture operated. By protecting the product's communication aspect, any patents would have also covered the communication aspects of generic tracking devices – arguably the lower-margin portion of devices – and also an IP space crowded with competitors such as Panasonic, Samsung and Ericsson.

However, no patents covered the business's higher-margin aspect, particularly, to account for royalties beyond the business model of the technology component portion. As a result, when it came to sell the business, while it was possible to transfer the technology, there were difficulties with the intellectual property because of low royalties in the monetisation model. Effectively, this resulted in a technology transfer price which failed to reflect the product's value. A value-chain analysis of the intellectual property would have highlighted that the IP space was already crowded, but revealed more white space upstream at the product or general device-tracking level. This would have given the innovation team insights into where to push their IP efforts, instead of restricting them to data communications.

Key questions for a venture to ask when assessing its value-chain depth include the following:

- Capabilities – what are the realistic value-chain capabilities for the business to extend to? What is the R&D roadmap?
- Environment – where is the IP landscape now?
- Results – based on the above, what influence or priority needs to be established for the IP and innovation team to leverage?

### Identifying breadth

Looking at the venture from the perspective of the surrounding competitive space also influences the

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*“An innovation-based decision about what to continue to invest in must be made in the context of the intellectual property and the business ecosystem”*

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breadth of the value chain.

One way to visualise breadth is through the venture's competitive framework: new and existing competitors, new or existing complementors, upstream suppliers and downstream customers. Many ventures focus on building a business around direct competition and, ultimately, focus on achieving high numbers of downstream customers (or revenue). However, to capitalise on the full breadth of the business opportunity, complementor ventures and upstream suppliers should also be considered.

Ventures that have market and IP offerings in complementor and supplier sectors open up the value-chain breadth for protection. Reflecting Porter's five forces, the breadth view takes into account the competitive environment and moves to act proactively on future IP and innovation needs. As a result, addressing complementary ventures pushes IP planners into considering how protection will be affected if the company bundles complementary products together with its products or begins to integrate them into one end-customer offering. Intellectual property that surrounds how upstream suppliers are expanding also offers wider protection as suppliers grow and develop new offerings.

Looking at an IP strategy, one can see that the protection style around this broader competitive framework requires a shift. Strategy around competitors and customers may not change, but adding protection around complementors or suppliers may change the strategy equation with regard to the style and type of patents that you might be planning to develop. For example, an Internet of Things (IoT) sensor company may have the intellectual property to protect against competition from sensor companies, yet as it grows it would benefit it to be able to lock in complementor companies, which need to interact indirectly with the sensor technology.

While many people think 'patent' when looking at

the value-chain protection, other forms of intellectual property can have the same impact. Consider the smart-thermostat market. Alphabet's Nest – one of the market leaders in smart thermostats for connected homes – owns well over 100 patents covering its innovative technology. The learning thermostat was originally launched to manage a home's energy efficiently but has now become a piece of the Alphabet platform in the connected-home environment.

A review of its IP position shows that Nest is focused on protecting the smart-thermostat device using patents. However, other intellectual property can have value in its complementors' space. This is important as the smart thermostat market is not simply a device market – it has expanded to link with other home platforms and applications, such as Zonoff, or smart-home devices or appliances from companies such as Whirlpool and Philips. To account for this, Nest is seeking to leverage its intellectual property over complementors in the form of open application programming interfaces (APIs) and terms of service.

The Nest developer terms of service indicate that ownership of any content displayed or used via the API also belongs to Nest. The content upload terms of service indicates that by working with Nest "You give Nest a perpetual, irrevocable, worldwide, sublicensable, royalty-free, and non-exclusive license" for the content. From the value-chain protection view, this is key because it means that Nest is positioned if not to own, then to have royalty-free access to any complementors wanting data and content to use their API.

With a clear understanding of where the venture lies and the breadth of competitive framework around it, it is possible to define an IP strategy that takes into account the balance that complementors and suppliers may have over a venture in the future.

Key questions for a venture to ask when assessing its value-chain breadth include the following:

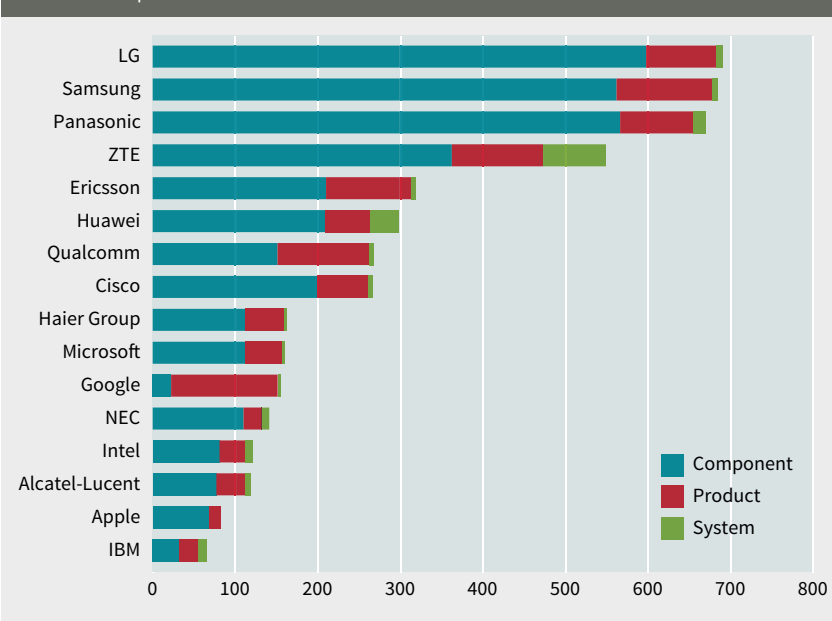
- Capabilities – in the entire competitive environment, which are the businesses to consider both now and against future plans?
- Environment – in the entire competitive environment, which are the businesses to consider both now and against future plans? Where is the IP landscape now, including patents, trademarks, trade secrets and other contractual intelligence?
- Results – based on the above and the innovation capabilities of the venture, what is the prioritisation of intellectual property and innovation to take advantage of?

### Mapping an IP value chain

Mapping out the IP value chain in a marketplace can indicate useful white space to consider. For technologies in a young and early-adopter stage, this is particularly useful as it suggests where strategic intellectual property can still be attained. Further, having intellectual property that connects a venture across the value-chain breadth raises a set of strategic options that might otherwise be missed. Visualising the data indicates how to create IP relationships and where to redefine new business partners.

The IoT market is growing at a tremendous pace. Research firms such as IDC project that it could be worth as much as \$1.7 trillion by 2020, supported by nearly 30 billion endpoints, including on connected

FIGURE 2. IoT patent volume of selected market leaders



vehicles, appliances, health monitoring and everything in between.

A patent landscape analysis with high-level IoT-based keywords on selected companies demonstrates that the ecosystem is dominated by Asia-Pacific companies (eg, LG, Samsung, Panasonic, ZTE, Huawei, Haier and NEC), followed by US companies (eg, Cisco, Microsoft, Google/Alphabet, Microsoft, Qualcomm, Apple and IBM) and European companies (eg, Ericsson and Alcatel-Lucent). While this is not an exhaustive list of the top patent owners and their portfolios in the space, it is fairly representative of the types of companies making an IoT play – from chip and software vendors to hardware and IoT service platform providers.

A deeper portfolio analysis of the data indicates that some companies have more breadth and strength, such as Microsoft and Intel. However, layering the value-chain analysis adds a new perspective. It reveals that other views of the value chain may be more relevant to the IoT view (eg, how the architectural building blocks would be viewed by an IoT expert); but generally, the component-product-system view gives a high-level view which can be understood and acted on by executives.

Splitting the depth of the IP-value chain into component, product or system level patents shows that a high proportion of the patents filed fit into the component level (eg, patents relating to communication protocols, data routing, networks, communication services (Bluetooth, RF and zigbee), sensors and component security) – although several ventures (eg, LG, Samsung, Panasonic, Cisco and ZTE) skew the patent volume towards communication-related protection. Patent leaders for the component level include companies such as LG, Panasonic and Samsung – mostly due to the volume of communication-level patents that could apply to IoT components, as well as to other general networking-level patents.

McKinsey & Company's Global Institute estimates that at least 40% of the IoT value for ventures is due to interoperability between devices. This is key for future value (seen via customer adoption), because it allows consumers to link devices (eg, a connected vehicle arriving at home and automatically turning on the house's heating and lights). This connectivity includes interaction at the device level, as well as at the level of the IoT platform or system.

Comparing the market direction to the IP view of selected technology leaders, we see that the highest proportion of patents is in the component side of the value chain. This suggests that interoperability via communications is well protected and ventures should develop an IP position accordingly. While new IoT standards and communications are being proposed, this is no different from the smartphone patent-communication scenario of the past. However, it also suggests that interoperability protection via IoT systems is extremely unbalanced, with few filings around system-level customer offerings.

With vendors pushing innovations to interoperability to achieve faster market adoption, there seems to be a disconnect with the amount of intellectual property filed at the solution end of the value chain. This view does not even fully consider the convergence of segments that will come from traditional ventures in other sectors. For example, the connected car has traditional suppliers such

TABLE 1. IoT value chain depth

Value chain	Market or technology category	
IoT components	Communication protocols, routing and networks	
	Communications interface	
	Communication services (eg, Bluetooth, RFID or ZigBee)	
	Security or encryption	
	Testing or measurements	
	Sensors	
IoT components	Building or home automation	
	Environmental monitoring	
	Infrastructure management	
	Energy management	
	Medical and healthcare	
	Security systems	
	Transportation and agriculture management	
	Home entertainment	
IoT products	IoT systems	



as Ford and Continental filing IP registrations alongside other IoT-savvy vendors such as Alphabet, Apple and other selected telecommunications companies.

Source: Thomson Reuters; Northworks IP

A full count by patent volume in a full IoT-based patent search does smooth out the ratios between component-product-system, due to the fact that a large number of small rights holders are in the long tail; but it does not change the fact that the key leaders holding strategic patent positions by volume are geared towards protection at the component level. While claims may be broad enough to cover products or systems shipped, it is clear that the taxonomies focus more heavily on components. This then provides a good starting point when building a venture's innovation strategy.

The second aspect of IoT applications varies widely. These include patents relating to building automation, home entertainment or smart home, environmental, energy management, medical, transportation, agriculture and e-commerce. Again, the patent leaders change, with companies such as Alphabet showing patent volume around the Nest thermostat and its environmental connectivity to the home. IoT product companies such as LG and Samsung, influenced by their smart-home patent volumes, also lead the way in product-focused patents. As noted earlier, this landscape view does not even fully consider the convergence of traditional suppliers which will come as the technology converges (eg, automotive, health, fitness, agriculture and energy).

Finally, IoT solutions are landscaped as a general category. As noted earlier, there may be system claims or coverage in the product patents, yet a search for specific, independent system claims yielded only a small amount – less than 5% of the search results. Those included were mainly assigned to vendors such as ZTE, Microsoft, Intel, IBM and Cisco. In the market, numerous IoT platforms positioning for adoption are steered by larger ventures, such as Apple (HomeKit), Alphabet (Thread), Amazon (2lemetry) and Intel (IoTivity). Yet the IP data



**TABLE 2.** IoT value chain depth – heat map of selected patent leaders

Company	LG	Samsung	Panasonic	ZTE	Ericsson	Huawei	Qualcomm	Cisco	Haier Group	Microsoft	Google	NEC	Intel	Alcatel-Lucent	Apple	IBM
Component	Green	Green	Green	Yellow	Orange	Orange	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Red
Product	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
System	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Total	Blue	Blue	Blue	Green	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Green	Green	Green	Green	Green	Green
Patent scale	0	75	150	225	300	375	425	500	575	625	700					

Source: Thomson Reuters; Northworks IP

for these ventures is sparse, likely due to factors such as open-source directions, early-stage adoption and the difficulty (or perhaps reluctance) of patenting in the software and platform area.

The interesting point is how mature technology vendors such as Microsoft, Intel, Panasonic and IBM, which have a deep history in the connectivity space, seem to have intellectual property that reaches back farther than other recent patenting ventures (eg, ZTE, Huawei). This can prompt new IoT start-ups to review their positions and take account of future licence payments.

For a component vendor, this view translates into ensuring that intellectual property covers the inventive nature of their IoT-based components, as well as ensuring that the depth of protection extends to cover the products and systems. For product suppliers, it is the same: extending to cover unique components (if possible), as well as the system level in which their product will be interoperable. Very few system-level vendors exist; typically, larger ventures try to take over an entire portion of the IoT marketplace, although this also includes platform as a service companies. While there may be a concern about patentability, recalling the earlier case study with the Nest Thermostat protection as partially managed via the API developer terms, it still encourages system-level IoT vendors to work out creative alternatives to protecting their overall platform.

Next, recall that the competitive framework around the breadth of the value chain means looking at new or existing complementors and competitors, upstream suppliers and downstream customers. For each venture, this position is unique. What is a competitor to one venture may be a complementor to others. IoT services integration platform company Zonoff partners with

and would be considered a complementor for both Nest and Honeywell. However, both Nest and Honeywell are competitors to each other. Similarly, upstream suppliers and downstream customers depend on the position of the venture in the business.

Consider as an example a generic smart thermostat supplier that is positioning itself to develop into the IoT space, with the smart thermostat as one piece of the offering. Companies producing smart thermostats and also indicating future IoT ambitions include Nest, Honeywell, Schneider Electric and Energate. A landscape analysis indicates that most smart-thermostat suppliers have a weak position with regard to the depth (components) and breadth (supplier) sides of the portfolio. Complementor coverage is moderate, while product positions are more heavily protected via patents. Finally, some solution protection is seen, but not in high volume, indicating – at least at the patent-protection level – that there is a gap on how the end customer integrates this into his or her full solution.

A detailed analysis specific to the venture is required; but generally, this indicates that for smart-thermostat suppliers, there is sufficient patent coverage to protect against competitors or end customers – although a detailed review should be undertaken of complementors and also suppliers. From an innovation perspective, this suggests working with the R&D team to ensure protection around unique sensors or components designs, as well as the overall product design, to block competitors from future component use – not just for thermostats, but also for other similar IoT-sensor use.

Referring to the landscape, this translates into identifying the venture of interest and the relevant companies which can influence an IP and innovation programme.

**Linking IP and innovation based on value chain**

Recall that the first critical step in transforming this landscape analysis into portfolio value is to outline the portions of the entire market value chain and identify IP gaps and future competitive moves. However, there is little value in data landscapes which contain no business relevance on which to act. To address this, the IP opportunities and threats are overlaid with the business capabilities. Larger ventures may have the luxury of funds to support multiple innovation and research programmes – overlaying the entire IP value-chain view (depth and breadth) indicates where IP resources are best allocated. Often, deep innovation programmes are built on advancing technology or future markets; thus, the IP value-chain view focuses R&D teams on which areas to protect before the followers move in.

This takes us to the second critical step in the strategy, which is to decide what technology innovation the venture can realistically achieve. In practice, this step in the value chain as IP strategy toolkit is available to everyone, from R&D leaders to investors, licence entities and IP professionals.

R&D leaders are in a position to direct innovation programmes. As such, it is crucial for them to have relevant business intelligence to validate their financial and research resource allocations. Investors can then create target accurate investment profiles or perform IP-based due diligence around the white space highlighted by IP gaps. For older market incumbents with large portfolios, it gives a proxy of sectors or taxonomies to

**TABLE 3.** IoT value chain depth – generic smart thermostat supplier

	Supplier	Complementor	Competitor	End customer	Total
Component	Red	Red	Red	n/a	Red
Product	Green	Orange	Green	Green	Green
System	n/a	Orange	Green	Red	Orange
Total position	Red	Orange	Green	Green	Orange

mine for intellectual property which can then be applied to new licence opportunities.

Steve Joroff, director of Asia-Pacific IP licensing at IBM, is continually looking for new opportunities within the IBM portfolio. The goal, he says, is “always be creative in our portfolio mining to identify and build licensing opportunities in areas we may have missed in past years. With a large portfolio, we know we have certainly not exhausted our opportunities”. With 7,355 issued US patents in 2015, IBM has been the US patent leader for the past 23 years in a row. Finding new ways to leverage previous innovations is critical to supporting and maintaining this level of patent creation.

“It is not to say we have fully identified all license areas, but rather we are constantly watching markets as they evolve and reacting accordingly with our patents,” says Joroff. “We need to link our past innovation efforts and the IP that was created from those efforts with new and emerging technologies. With tens of thousands of patents, knowing which technology segments should be a priority for our mining efforts is tremendously valuable.”

Highly trained IP professionals, such as those creating prosecution or roadmap strategies, are better able to direct client prosecution towards claims that will be market relevant to a wider, deeper use (presuming that the specification and innovation cover it).

Of course, there are always market variables to influence the breadth or depth analysis for any business leader. Outliers in the market may choose to offer up intellectual property for free to spur growth. In 2015, Panasonic announced that it would provide royalty-free access to software, patents and experiences from its ecosystem to speed the development of IoT software and services.

Tesla made a similar pledge in 2014 with its electric vehicle technology and, in 2015, Toyota followed suit for its hydrogen fuel-cell patents. Connectivity and growth are key for IoT industry expansion, so open source and royalty-free terms of service become a factor that benefits the market. For other ventures, margins vary as multiple components are assembled into products and products are built into systems, influencing the ability to rationalise innovation expenditures necessary to expand the breadth or depth of the IP coverage.

In addition, globalisation plays a factor: what may look like a challenge or innovation opportunity to protect with intellectual property may become a moot point when you take into account the countries in which the players and markets are based. In the IoT landscape, Asia-Pacific filings are dominated by ZTE, Huawei and Haier. Cisco’s protection focuses on the United States; while others such as Intel and Microsoft take a more global view. Depending on where these ventures fit into the breadth and depth of a business, the innovation and IP strategy to develop will vary. Finally, the business’s pace and maturity are key. For many of the component or product-patent segments in the IoT space, the compound annual growth rate in the past 10 years is well above 50%. The pressure is on for an IP leader to dominate the sector, but the gaps are evident. For these reasons, aligning new R&D work with the innovation gaps may be more urgent than for mature industries with stagnant growth.

Overall, looking at the value chain from the

TABLE 4. Key strategies of ventures to consider for their value-chain view

	Value-chain depth	Value-chain breadth
Capabilities	What are the realistic value-chain capabilities for the business to extend to? What is the R&D roadmap?	Which are the businesses to consider both now and against future plans in the entire competitive environment?
Environment	Where is the IP landscape now?	Where is the IP landscape now, including patents, trademarks, trade secrets and other contractual intelligence?
Results	What influence or priority needs to be given for the IP and innovation team to leverage?	Based on innovation capabilities of the venture, what is the prioritisation of intellectual property and innovation to take advantage of?

## Action plan

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The following steps allow you to map an IP value chain:

- Identify key areas in order to develop the breadth and depth of the value chain.
- Map the intellectual property and link the results to innovation being developed by the venture.
- Be realistic with regard to the scope. Simply filing intellectual property to

fill a white space does not always lead to quality intellectual property. It is crucial to prioritise the links between intellectual property and innovation within the venture’s capabilities.

- Innovate where it makes sense for the business, but prioritise or evaluate efforts and payoff in the context of the value chain.

*“Highly trained IP professionals ... are better able to direct client prosecution towards claims that will be market relevant to a wider, deeper use”*

perspective of both depth and breadth gives a more cohesive view of the landscape of the actual IP and innovation environment. This leads to the first question: are ventures ensuring that there is a link between innovation and intellectual property? The answer is yes.

For ventures linking innovation back to intellectual property, such as Finjan Holdings and WiLan, the first steps have already been taken. New innovations coupled with strong IP positions are being created. However, the better question to ask may be: are ventures ensuring that there is a link to innovation and intellectual property, which covers the depth and breadth of the market as much as possible? That answer may not be as clear. If 40% of the future IoT value for ventures is due to interoperability, yet less than 5% of the landscaped patents cover IoT systems, it suggests it may not be.

Now is clearly the time for innovation-based ventures to link R&D with intellectual property. But IP efforts need to be prioritised for quality intellectual property to result. The key is to execute this in the context of the depth and breadth of the value chain. **iam**

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