



Innovation: Is Global the Way Forward?

A joint study by Booz Allen Hamilton and INSEAD

Survey Results

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In May 2005, we conducted a survey on **Configuring and Managing Global Innovation Networks** to investigate the following: **Current and future levels and drivers of innovation R&D dispersion; if and how this dispersion was leveraged in multi-site projects; approaches to finding new knowledge; the extent to which external partners play a role in innovation; the organisational structures and processes that support dispersed innovation and the barriers to global innovation. The survey was completed by 186 companies, from 19 countries, and 17 sectors, with a combined R&D spend in 2004 of more than U.S. \$76 billion.**

The survey asked two types of questions: **Those which required companies to provide specific answers (i.e., ‘If you were trying to build an optimally configured innovation network, where would you open new or scale up existing innovation / R&D centres over the next five years?’); and those which provided statements or options against which the respondent ranked their opinion or situation using a seven point scoring system (i.e., ‘indicate the level of collaboration you have undertaken with customers over the last three years’, 1 being no collaboration, and 7 being high level). With the seven point scoring systems we are taking a mean as significant if it is five or over. In looking at trends and comparisons between subsets, we also look at the differences between means, even if the means themselves are not statistically significant.**

For many years, innovation and R&D centres (referred to as ‘R&D sites’ throughout this report) have been largely the preserve of the developed world. European, U.S., and Japanese companies have focused these high-end activities in their home markets and other key markets in which products need to be adapted to meet local requirements. But over the last few decades, the logic of R&D internationalisation has been changing in two ways: Firstly, as companies have fanned out across the globe to access the potential of new markets, the footprints of their R&D activities have become more international or dispersed in

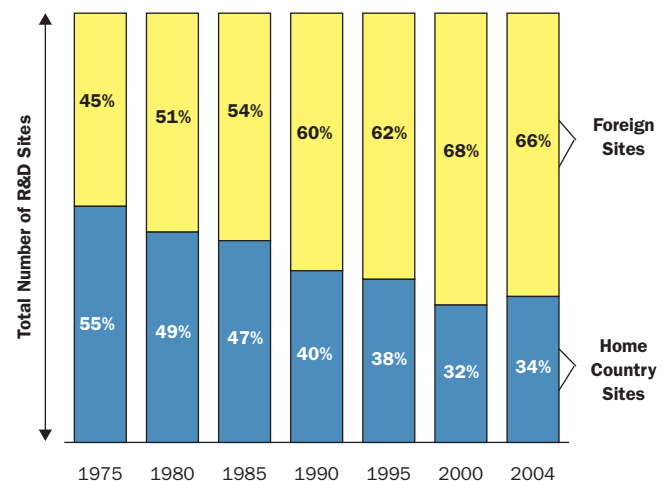
character. And in the last five years, with the rapid economic emergence of India and China, the rate of R&D internationalisation has increased and looks set to continue to grow significantly. Secondly, in tandem with the shift in footprint, the drivers behind R&D internationalisation have been changing in response to the increasing dispersion of knowledge (with new centres of competence emerging in what were previously unlikely places) and industry convergence. These changes to the R&D/innovation landscape have a significant impact on a wide set of capabilities which organisations will need to develop in order to manage and get value from their innovation activities. The survey reveals that whilst many companies are building more international R&D networks, few have really begun to build the internal capabilities to run these networks effectively and efficiently.

The Internationalisation of R&D

Even though the footprint and drivers of global R&D have been changing noticeably over the last five to ten years, the underlying trend towards greater dispersion has been in progress for three decades, during which time the share of foreign R&D sites has increased from 45 percent to 66 percent of all R&D sites (see Exhibit 1).

Exhibit 1

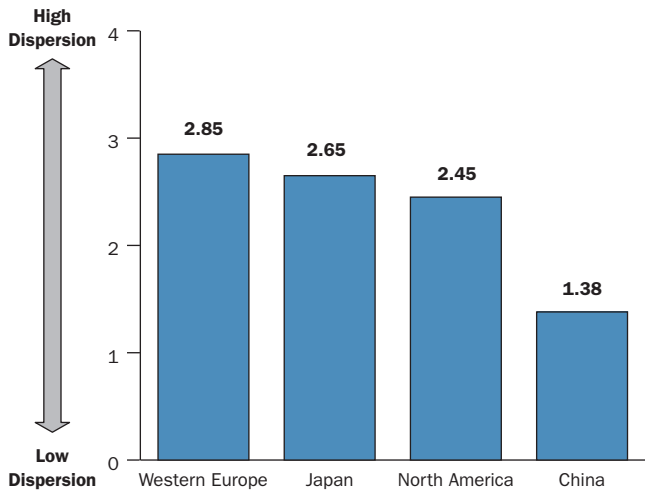
Growth In Foreign Research & Development Sites



The R&D footprint of most companies is becoming more global, with China and India seeing significant growth

Levels of dispersion vary by both home country region and sector (see Exhibit 2) although neither company size nor intent to follow an aggressive innovation strategy play a role in differentiating levels of dispersion. Based on our ‘globalisation index’¹ companies based in Western Europe are the most dispersed, with an average index score of 2.85. On the whole, this dispersion has a very regional flavour with around 80 percent of all R&D sites located in other European countries. Japanese companies scored 2.65 while their Chinese neighbours are still very localised, scoring only 1.38. North American companies scored 2.45 with less than half of their total R&D sites being based outside the U.S. However, the R&D activities of U.S. companies are becoming more international: Over the last decade, the share of R&D sites based in the U.S. has decreased from 59 percent to 52 percent, and at the same time, the number of sites based in Western Europe has also fallen from 24 percent to 22 percent of total R&D sites. These shortfalls are made up by growth in China, from 4 percent to 11 percent and India from 4 percent to 7 percent of sites.

Exhibit 2
Globalisation Index By Company Home Region and Sector

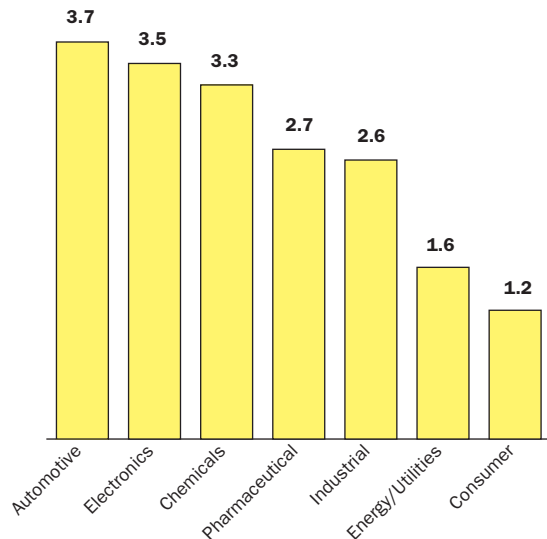


Combined, China and India are on the brink of overtaking Western Europe as the most important locations for foreign R&D for U.S. companies.

By sector, automotive was the most dispersed. However, our sample of companies in this sector was heavily weighed towards suppliers, with OEMs making up only one quarter of the subset. It is therefore not surprising to see the automotive sector ranking so highly on the dispersion index, as supplier footprints are determined by the locations of the OEMs with whom they work. Electrical Engineering and Electronics and Chemicals also rated as dispersed. In both of these sectors, dispersion can be partially ascribed to high levels M&A activity over the last twenty years.

Sectors that rely more heavily on complex knowledge that is difficult to move had less dispersed innovation footprints

Although there may be another factor which facilitates a more distributed approach to R&D: In both of these sectors, the primary knowledge base is codified. Because codified knowledge travels well, provided the people both sending and receiving it have a scientific or semi-scientific lexicon in common, a more dispersed approach to R&D becomes much easier. In support of this argument, we found that sectors that rely more heavily on complex knowledge² that is difficult to move

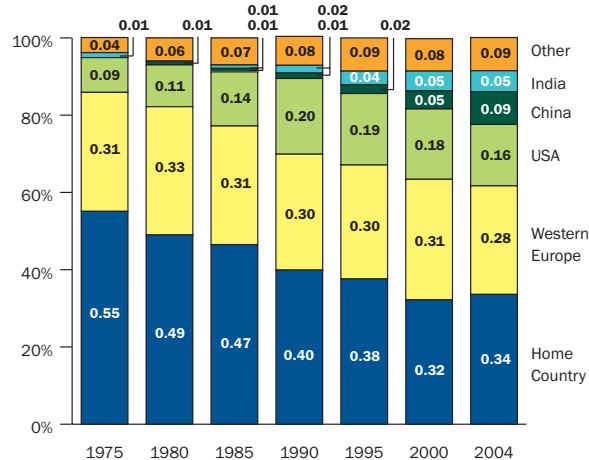


¹ This measures dispersion, weighting R&D sites in foreign continents significantly higher than sites in other countries but within same region. It is based on a scale of 1 to 4, with ‘1’ indicating a non dispersed company and ‘3’ or above a dispersed company.
² By Complex knowledge we refer to knowledge that is embedded in a local context. To transfer this type of knowledge requires a level of ‘seeing and doing’ as it is very difficult to articulate

had less dispersed innovation footprints: Pharmaceuticals and Healthcare, Industrial Manufacturing, Energy and Utilities, and Consumer goods all produced low scores.

Exhibit 3

Changing Distribution of R&D Sites



As depicted in Exhibit 3, the relative share of R&D sites by location has been shifting towards China and India, who together accounted for 3.4 percent of foreign sites in 1990 increasing to 13.9 percent by 2004. Over the same period the share of foreign R&D in the U.S. fell from 19.6 percent to 15.9 percent, while in Western Europe it fell from 30.0 percent to 28.1 percent.

Future Growth Patterns

Planned Growth

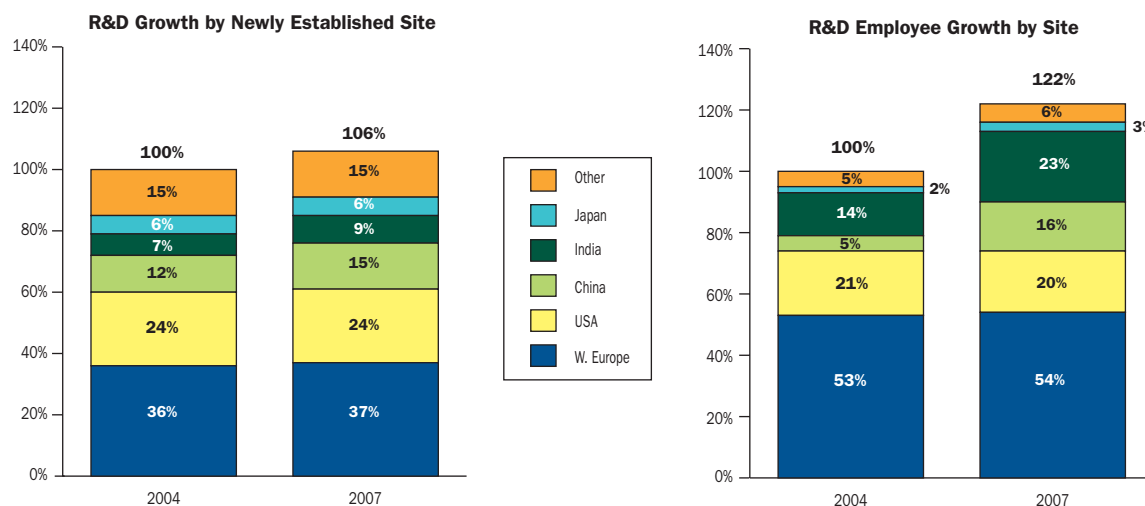
Based on data about plans over the next three years for current R&D networks of the companies surveyed, the migration trend eastwards looks set to continue. Over this period almost all planned growth in foreign R&D will be in China and India. However, the number of new sites being established will only show a slight increase, with growth in staff numbers increasing significantly over the period (see Exhibit 4). By the end of 2007, China and India will account for 31 percent of global R&D staff, up from 19 percent in 2004. The number of R&D sites and staff in Western Europe and the U.S. will remain constant.

Ideal Growth

In addition to building a picture of where actual R&D growth will be focused over the next three years, we were interested in seeing what patterns of growth would look like if companies were given free rein to build an 'optimally configured' R&D network over the next five years. In this ideal growth scenario the shift to the developing markets of the East is even more striking. We asked companies where they would open new or scale up existing R&D sites over this period and found that 22 percent of all new R&D sites would be in China and 19 percent in India (see Exhibit 5). These patterns of migration were common across all subsets³ within the sample.

Exhibit 4

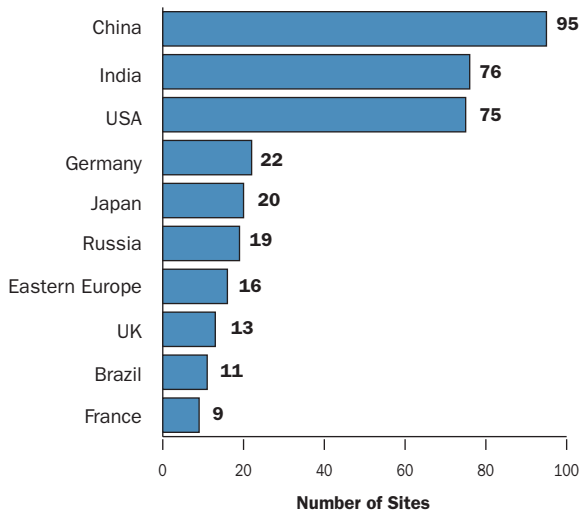
Projected Growth in R&D



³ We conducted statistical analysis for the following subsets: Sector; home country; highly dispersed vs less dispersed companies; users of complex vs non-complex knowledge; and 'technology innovators' (those companies that follow an aggressive innovation strategy and strive to be technology leaders.) vs rest.

Exhibit 5

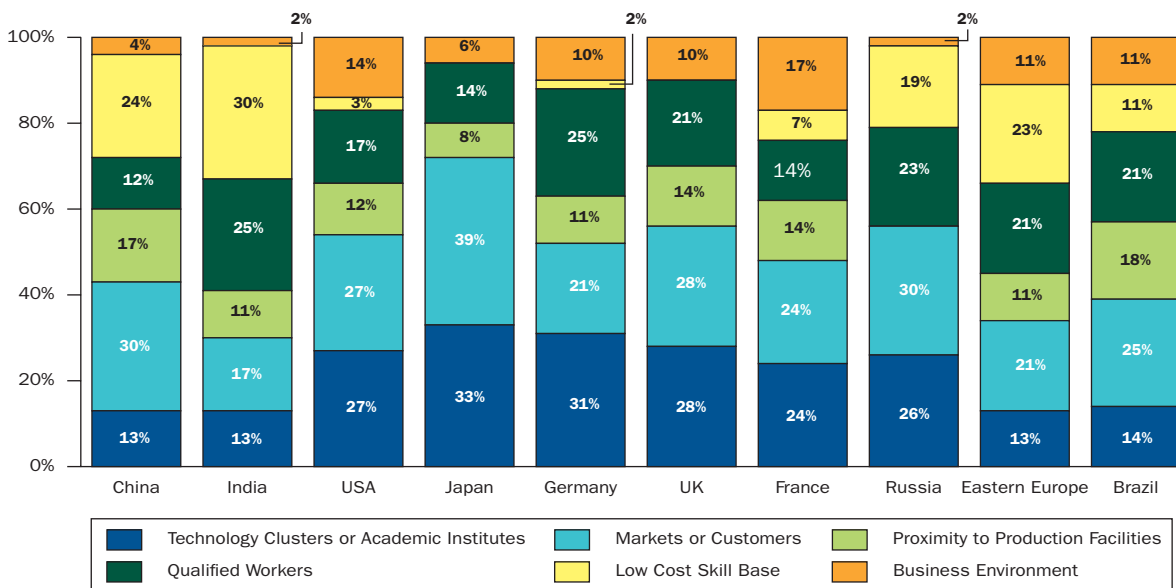
Locations Of New R&D Sites In Optimally Configured Network



The U.S. also had a strong showing attracting 19 percent of new sites. However, a large amount of this was accounted for by just three sectors Defence, Chemicals, and Pharmaceuticals. If these sectors are removed, then the U.S. share drops to 10 percent. Only 13 percent of growth would be in Western Europe, with Eastern Europe close on its heels with 12 percent of new sites. Asia (excluding China) accounted for 8 percent of new sites and South America would see a 5 percent share.

Exhibit 6

Drivers Of Future R&D Sites



Changing Drivers of R&D Globalisation

The most cited reason for establishing a new foreign site was access to qualified staff

Along with the adjustment in R&D footprint, is a change in location drivers. While the more traditional drivers of accessing markets and having proximity to production facilities still rank amongst the most important reasons for establishing a new foreign site, the most cited reason was to access qualified staff. Factors including ‘access to a low cost skills base’, ‘local subsidies and incentives’, and ‘local regulations’ ranked very low.

Drivers are highly differentiated by region (see Exhibit 6) leading to R&D dispersion structured around a network of unique skills and capabilities across the globe. Future R&D sites in the developed world of Western Europe, the U.S. and Japan will be based primarily on ‘access to technology or research clusters’, ‘access to markets or customers’ and ‘access to qualified workforce’. Growth in the developing world will be motivated by quite a different set of drivers: In all developing regions, access to a ‘low cost skills base’ and access to markets and customers are important factors for establishing new sites. However, in India and Eastern Europe, companies are also attracted by highly qualified staff. In China, the low cost skills base is paired with a need for market

and customer access, which implies companies are focusing lower on the innovation value chain in China than in India or Eastern Europe.

Less than a quarter of companies limit their foreign R&D sites to customisation for local markets

How the division of work will be organised when R&D footprints evolve to reflect a need to access new markets and skills isn't clear. Currently, there is a very distinct allocation of activities between home markets and foreign sites (see Exhibit 7): Around 75 percent of companies have complete capabilities in research and development in their home markets, as opposed to only 45 percent of foreign sites with full capabilities. However, foreign sites are currently more likely to focus on specific areas of expertise within the development process. And not surprisingly, these sites are also very much more likely to focus on customisation for local markets.

The Challenges of Global Innovation

As R&D and innovation become more dispersed, we would expect companies to face a new set of challenges. Global innovation presents opportunities for companies to widen their net of knowledge inputs and access new skills, technologies, and customers. But managing and integrating these activities requires new organisational structures, processes, and

Exhibit 8
Challenges of Global Innovation

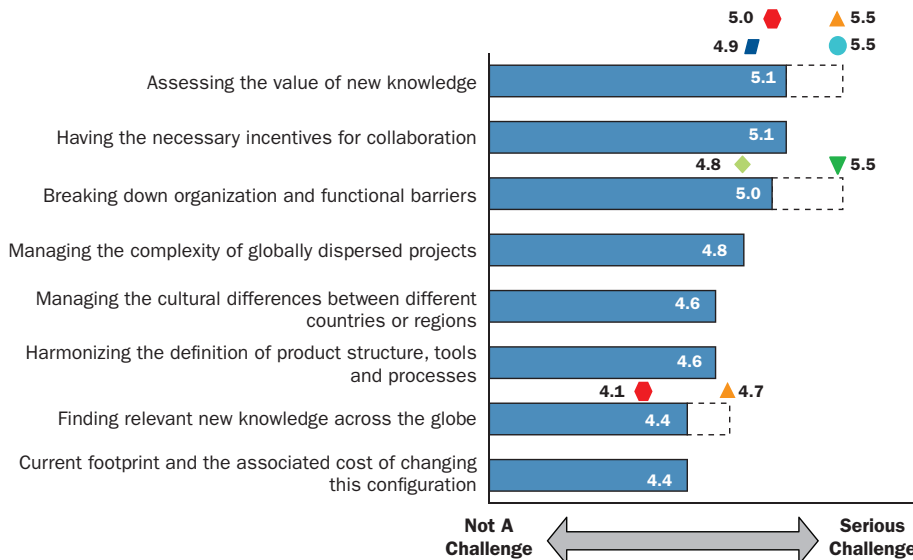
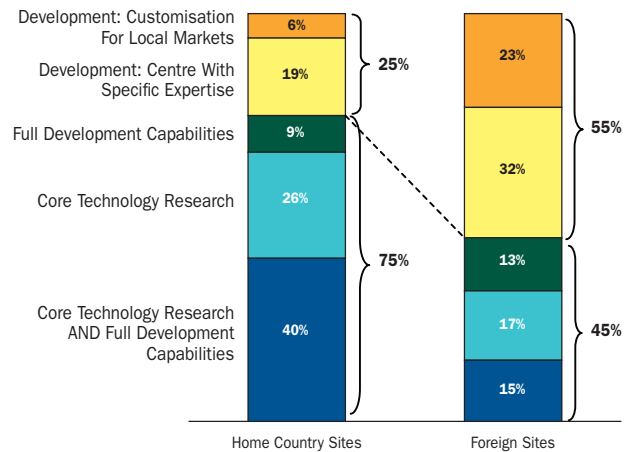


Exhibit 7
Activities Of Home-Base and Foreign R&D Sites



capabilities with which most companies still seem to be struggling.

Companies face serious difficulties assessing the value of new knowledge

Overall, whilst finding new knowledge is not seen as a significant challenge, companies face serious difficulties in assessing the value of new knowledge. This would certainly make sense for complex new market or customer knowledge which is embedded in an unfamiliar context. Indeed, we found that companies dealing in complex knowledge rated this challenge as more serious than those companies who focus on codified knowledge (see Exhibit 8).

Dispersion brings with it greater costs and therefore leveraging dispersion in global projects and sharing and re-using knowledge across the network is key to efficient and effective global innovation.

Few companies have enough experience of managing dispersed projects to fully appreciate the challenges they pose

Yet, we found that having incentives to encourage collaboration, such as achieving management buy-in and overcoming 'not invented here syndrome' posed a significant challenge across the board. Similarly, organisational and functional barriers, including internal competition and local P&Ls, were also deemed a significant barrier to global innovation.

Managing global projects wasn't seen as a significant barrier to global innovation. However, both the literature and our own field research show that global project management is an area fraught with difficulty and complexity. The discrepancy between conventional wisdom and the survey results can most likely be explained by the low level of dispersed projects undertaken by the companies in our sample, which accounted for only around one third of all projects. The real level of cross country collaboration is likely to be much lower than this, as within the one third figure, we have to take into account that some projects are dispersed across different sites in the same country. We can assume that companies that do not have experience in managing complex globally dispersed projects would not see this as a challenge to innovation.

Opportunities For Network Improvements

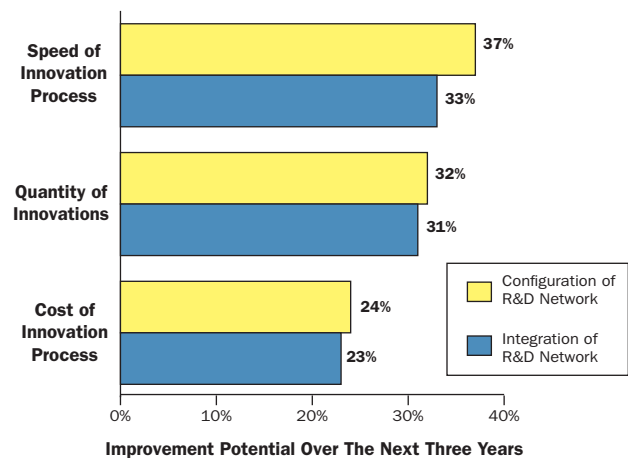
The biggest benefit from optimising the configuration and integration of R&D networks is improving the speed of innovation

There is a common myth that cost issues drive changes in the configuration and integration of R&D networks. Contrary to this, we found that out of three factors, cost, quantity and speed of the innovation process, cost was seen to have the least potential for improvement through the optimisation of either

configuration or integration (see Exhibit 9). The biggest beneficiary of changes was seen to be the speed of the innovation process, which could be improved by 37 percent through optimising configuration and by 33 percent by improving a network's integration. There was seen to be potential for improvement in the quantity of innovations of 32 percent through configuration and 31 percent by integration optimisation.

Exhibit 9

Potential Improvements From Optimising The Configuration and Integration of R&D Networks



External Collaboration Partners

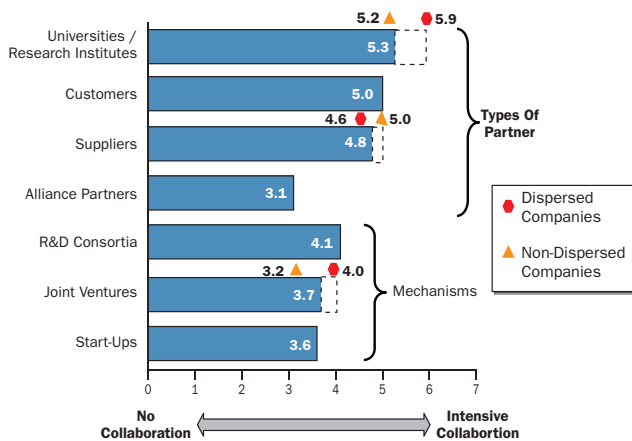
The knowledge and capabilities required to innovate are not only becoming more dispersed across geography but due to the trend of industry convergence, vital knowledge is also increasingly spread across industries. Yet, we found few signs that companies are tapping a broad range of external partners, with collaboration firmly rooted in relationships with research institutes/universities and customers (see Exhibit 10 on next page). Levels of collaboration with suppliers, alliance partners, R&D consortia and start-ups were not significant.

There are few signs that companies are tapping a broad range of external partners. Collaboration is firmly rooted in relationships with universities and customers

Dispersion played a small role in the levels of collaboration with certain types of partner. Highly dispersed companies had higher levels of collaboration with research institutes and universities. They also

Exhibit 10

Levels Of External Collaboration By Type Of Partner



had more joint ventures with local companies. There doesn't seem to be any obvious reason for the difference in these two areas only. We would have expected highly dispersed companies to have greater levels of collaboration with most types of partner, as collaboration is easier to manage and therefore a more attractive option when you have close physical proximity to your partner. This would give dispersed companies an advantage over their non-dispersed peers.

The type of collaboration by sector, revealed some patterns of behaviour that differ from the average. Lower levels of collaboration with customers than average were seen in the Electronics and Electrical Engineering, Chemicals and Pharmaceutical, and Healthcare sectors. However the former two, together with Energy and Utilities were much more inclined to collaborate significantly with suppliers. And the Electronics and Electrical Engineering sector was also more likely to work with alliance partners. This is most likely because of the exponential rate of technology development in this sector combined with very high levels of convergence creating an environment in which long-term, deep collaborations are a necessity for survival.

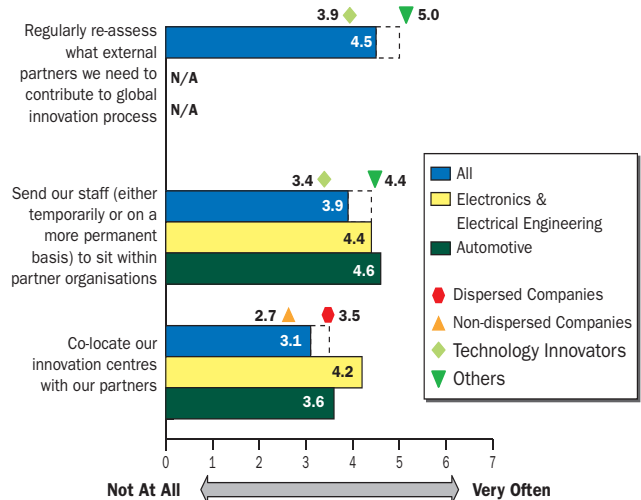
Managing External Collaboration

The findings relating to the strategy and management of external collaborations reveal potential for a more focused approach. The number of companies who regularly re-assessed what external partners

were needed to contribute to their global innovation activities was not significant (see Exhibit 11). However, the technology innovator subset, were more likely to do this than the rest.

Exhibit 11

Managing Collaboration Strategies

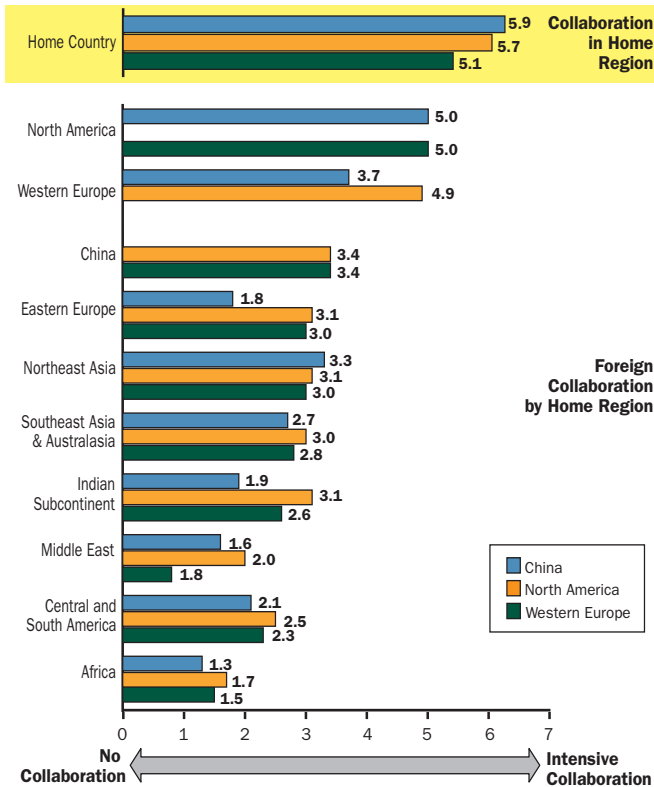


In terms of the type of relationship with external collaborators, the findings lead us to assume that for the most part, collaboration is dealing with codified and modular knowledge: There were low levels of temporary co-location in partner organisations, although the Automotive and Electronics and Electrical Engineering were much more likely to send staff to sit in partner organisations. In the automotive sector this makes sense as there is a supplier bias in our sample. With the Electronics and Electrical Engineering sector, convergence and the complexity of product and service architectures necessitate temporary co-location as a mechanism to transfer complex and unfamiliar knowledge from adjacent industries.

Collaboration Footprints**R&D collaboration is still primarily transatlantic**

In terms of footprint, collaboration was much more likely to take place in an organisation's home region than any other location. Due to the Western European and North American bias in our sample, collaboration was strongest in these regions (see Exhibit 12 on the next page).

Exhibit 12
Intensity Of External Collaboration By Region



Outside their home region, companies from Western Europe are most likely to collaborate in North America, followed by China, Eastern Europe, and North East Asia, but levels in these latter three regions are extremely low. For North American companies

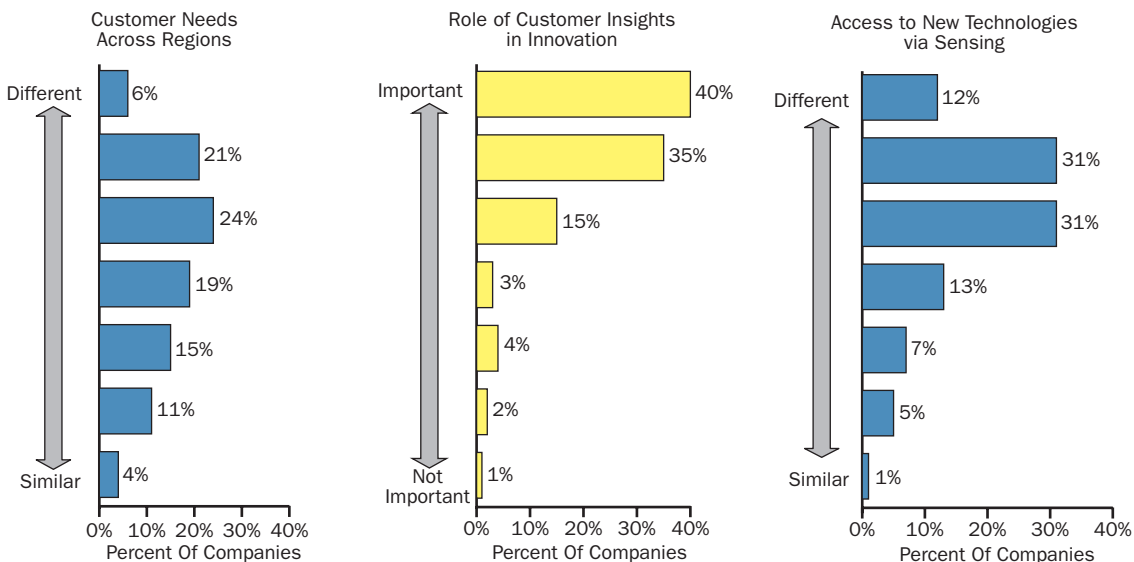
collaboration outside their home region is most intense in Western Europe followed by the same patterns and levels as for Western European companies. The significant level of collaboration in China has two explanations: Firstly, there was a very high level of collaboration by Chinese companies in China. And secondly for non-Chinese companies collaboration was significant with customers, and the primary reason companies cited for opening or scaling up new sites in China was to be closer to their customers. Collaboration in Eastern Europe was also high, but as with China, this significantly lagged the levels of collaboration in locations in which companies have long-established R&D sites.

Sensing - Finding New Knowledge

Over half the sample saw customer needs as very different across regions and 90 percent felt deep customer insights played a vital role in identifying the potential for new products and services. Yet only technology innovators placed a strong emphasis on gaining deep customer insights

The dispersion of knowledge away from traditional markets or specialist clusters implies a greater need for companies to engage in proactively finding new sources of knowledge. In fact, the data confirms this (see Exhibit 13): Over half of the companies saw customer needs as being very different across regions; 90 percent felt that deep customer insights played a

Exhibit 13
Importance Of Dispersed Knowledge



vital role in identifying the potential for new products and services; and 75 percent of companies said they believed that external sensing (looking for new knowledge) provided faster and more exclusive access to new technologies.

Despite these positive sentiments, on the whole there seems to be a gap between what companies believe to be valuable practice, and their actual behaviour. The data on collaboration indicated a preference for 'local' relationships. Yet 64 percent of the sample rated the scope of their sensing activities as 'global'. An explanation for this discrepancy could be that much of the knowledge companies 'sense' is codified and therefore transferable to R&D sites without the need for the type of deep contextual understanding that on the ground collaboration would bring.

It seems clear that companies believe sensing plays a vital role in their innovation activities, and yet it is unclear how sensing is managed and its outcomes assessed (recall that 'assessing the value of new knowledge' was rated as the greatest challenge to global innovation). Only 19 percent of companies used any type of incentives or rewards to encourage and build a sensing capability.

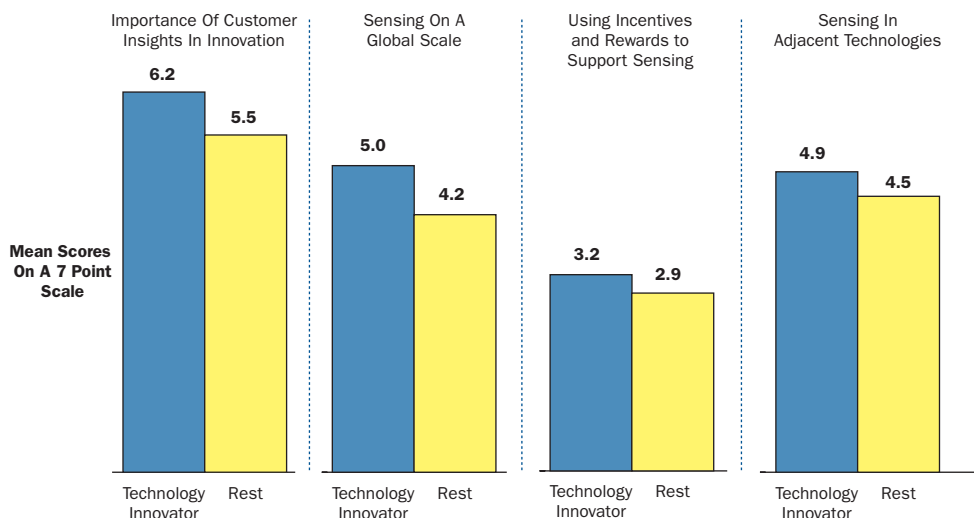
Although the mean scores of the entire sample were generally low in relation to sensing activities, there

were indications that building these capabilities will become more important over time. If we make an assumption that the technology innovator group are ahead of their competitors in terms of innovation-related practice, we can use their behaviour as a proxy for future trends. The technology innovator group however placed a much stronger emphasis on the importance of gaining deep customer insights (see Exhibit 14). They were significantly more likely than average to sense on a global basis and were much more likely to use incentives to support sensing activities. Having recognised the important role convergence is playing in innovation across most sectors, they were also more likely to sense in adjacent technologies.

Although there seems to be a general trend towards external knowledge, many companies are overlooking the potential value of knowledge they have internally. Only around half of companies said they proactively seek out dispersed internal knowledge. Although, once again, the technology innovator group are very much more likely to do this, with a significant mean score of 5.1 in comparison to 3.8 for the rest.

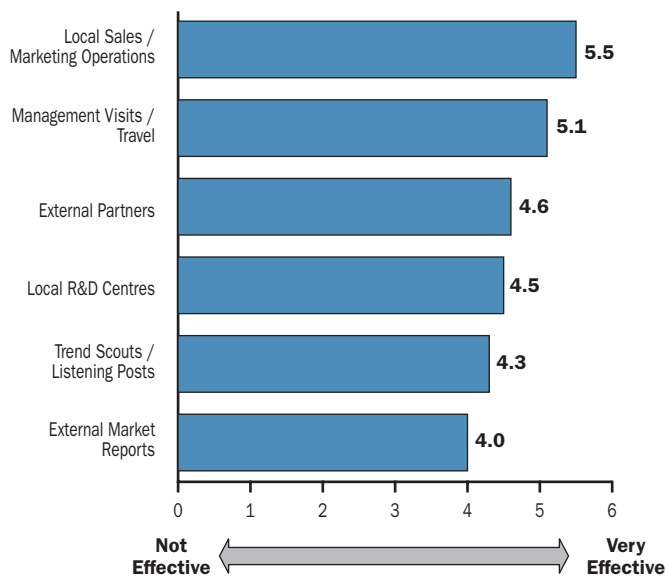
Only half of companies said they proactively seek out internal dispersed knowledge - although technology innovators are much more likely to do this

Exhibit 14
Differing Approaches To Sensing



Across the board, companies were largely consistent in their perception of the effectiveness of various channels for capturing local customer and market knowledge (see Exhibit 15). Both local sales and marketing operations and management visits were seen to be effective. Local R&D centres, external partners, trend scouts / listening posts and external market reports were deemed to be less effective. Of course, highly dispersed companies were more likely to value local R&D centres than the rest.

Exhibit 15
Channels For Capturing Local Market and Customer Insights



Leveraging Dispersed Knowledge

While R&D networks are becoming more international and external partners are beginning to play a stronger role, dispersed knowledge is only being leveraged in specific areas of innovation projects: Most companies use market and customer knowledge from multiple locations for idea generation and most use technical knowledge from multiple locations in research and advanced development.

However, the ‘Technology Innovator’ group are very much more likely to leverage dispersed knowledge than the rest: They had a mean score of 5.7 in relation to using dispersed knowledge in ideation activities, the rest scored a mean 4.9, and their mean for using dispersed knowledge in R&D projects was 5.8, against 4.8 for the rest. The ‘Technology Innovators’ were also

the only group to access project-related and functional knowledge from multiple sites, and they, together with highly dispersed companies, are more likely to have different phases of an innovation project being carried out at different sites.

Working Across Borders

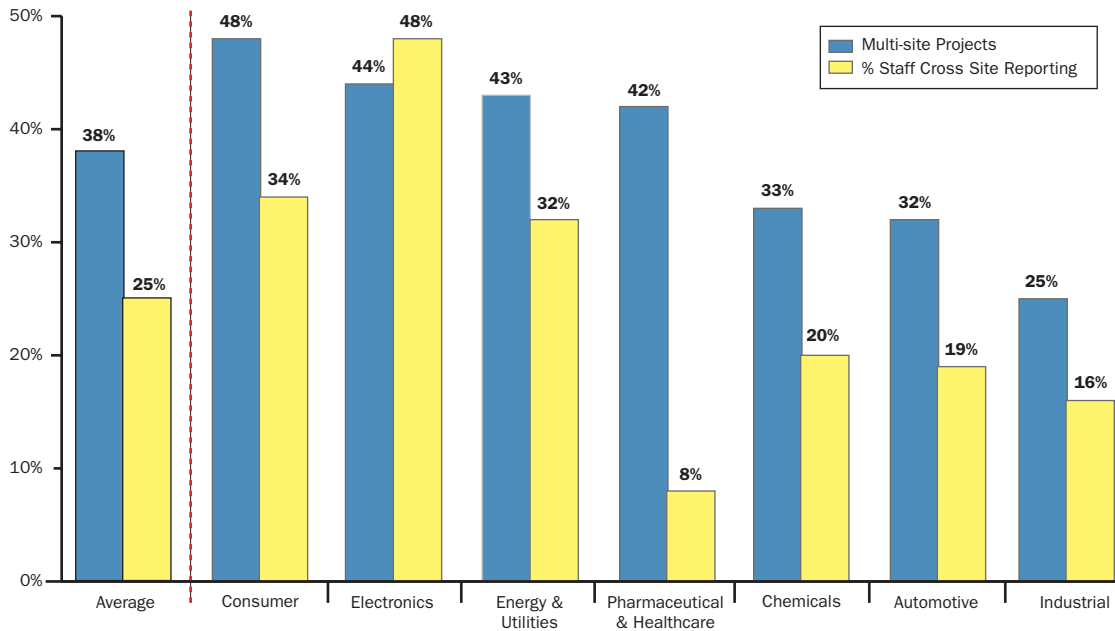
The survey has illustrated a trend towards global innovation, with the growth of foreign R&D sites based on access to differentiated knowledge and capabilities, a recognition of the importance of sensing for new knowledge from a wide range of locations and the important role played by external collaboration. But although innovation is becoming more global in these areas, the actual percentage of projects undertaken over multiple sites is relatively low, at an average of 36% of all projects and less than one third of companies conducting at least half of their innovation projects across two or more sites. While we would have expected there to be a high degree of multi-site projects in sectors which rely on a lot of codified knowledge that can be more easily shared and transferred across sites, this wasn’t always the case (see Exhibit 16, on next page). The Consumer sector had the highest level of dispersed projects, 48 percent, followed by Electronics and Electrical Engineering 44 percent and Energy and Utilities 43 percent. These higher levels of dispersed projects were underpinned by organisational structures, with an average of one third of staff in these sectors reporting to someone in a different location.

Generally there was a mapping of cross location reporting to the level of dispersed projects undertaken. However the Pharmaceutical and Healthcare sector bucked this trend, with a relatively high level of multi-site projects at 38 percent and an extremely low level of cross locational reporting structures at 8 percent.

Integrative Processes and Systems

A global approach to innovation can bring enormous advantages in the speed to market, quality and uniqueness of new products and services. Innovations based on differentiated knowledge sourced from a global canvas can deliver real competitive advantage. However, there is a trade-off between the level of diversity gained from dispersion and the cost and

Exhibit 16
Levels of Multi-Site Projects By Sector



complexity of managing a dispersed network. Part of getting that trade-off right and as a result getting value from increasingly dispersed innovation sites is dependent upon a set of organisational capabilities to manage the entire innovation process across geographies, cultures and often organisations. Very few companies seem to be developing the necessary capabilities.

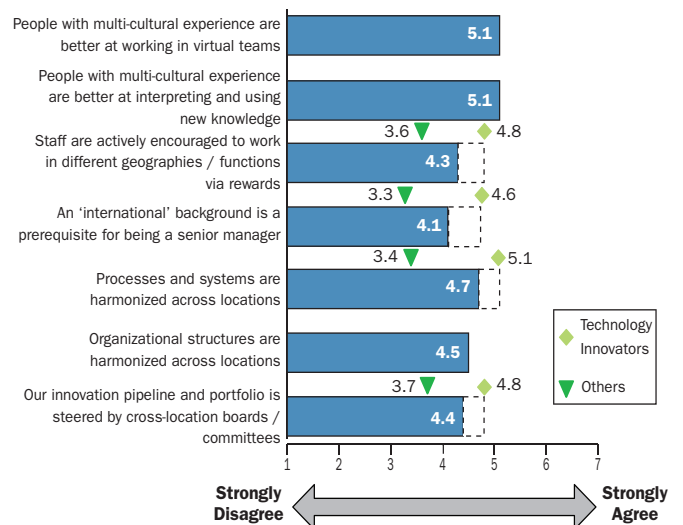
Getting value from dispersed innovation sites is dependent upon organisational capabilities to manage the process across geographies, cultures, and often organisations

Only the ‘technology innovator’ group have created processes and systems that are harmonised across locations (see Exhibit 17). And this group are more likely to have dispersed boards or committees to steer the innovation pipeline and project portfolio. Overall, companies have made more progress in harmonising processes and systems, with a mean score of 4.8 than with harmonising organisational structure, which scored 4.4.

HR Implications

As well as having the right processes, systems and structures in place to support global innovation, having people with the right experience and capabilities is vital. Most companies firmly believe that people with multi-cultural experience perform better in virtual teams and have a greater ability to absorb, interpret and utilise new knowledge. However, despite this

Exhibit 17
Building Organisational Capabilities To Support Global Innovation



recognition, few seemed to be building a cadre of such people. The ‘technology innovators’ were more likely to offer career or remuneration rewards to encourage people to work in different geographies and functions than the rest and were also more likely to deem an international background a prerequisite for senior managers (see Exhibit 17).

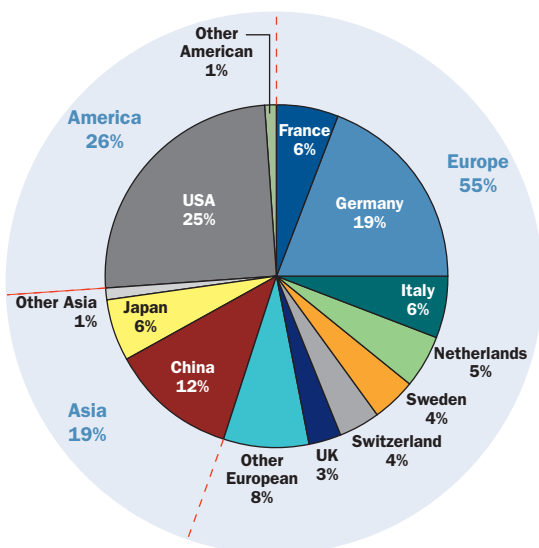
Most companies believe people with multi-cultural experience perform better in virtual teams and are better at absorbing, interpreting, and utilising new knowledge

Conclusions

The Knowledge inputs required for innovation in most sectors are increasingly dispersed. In reaction to this, innovation and R&D activities are mirroring this trend with sites being opened or scaled up in locations which will give companies access to differentiated knowledge through accessing internal and external capabilities as well as markets and customers. However few companies are currently reaping the gains from this globalisation: Co-ordination across sites is weak; harmonised processes and systems are lacking; and the need for a cadre of people with international experience to work in this new environment is being largely overlooked. There are also significant opportunities for companies to optimise the diversity of their external network by looking further a field (in terms of geography, type of partner and technology) for collaborators and to improve their internal knowledge mobility by proactively encouraging internal knowledge sensing and knowledge re-use.

Exhibit 18

Survey Respondents By Organisation's Home Country

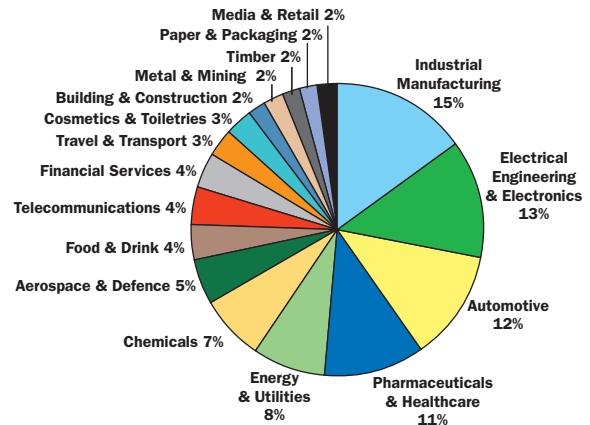


Survey Sample Composition

Companies from nineteen different countries are represented in the survey. The largest proportion of these, at 55 percent are from Europe, 26 percent are from North America and 19 percent from Northeast Asia (see Exhibit 18).

Exhibit 19

Survey Respondents By Sector



A wide spectrum of seventeen different industries are represented (see Exhibit 19). By size these are Industrial Manufacturing 15%, Electrical Engineering & Electronics 13%, Automotive 12%, Pharmaceuticals & Healthcare 11%, Energy & Utilities 8%, Chemicals 7%, Aerospace & Defence 5%, Food & Drink 4%, Telecommunications 4%, Financial Services 4%, Travel & Transport 3%, Cosmetics & Toiletries 3% and Building & Construction, Metals & Mining, Timber, Paper & Packaging, Media and Retail all at 2%.

The survey was designed to be completed by senior managers. A cross section of senior managers from different functional areas responded (see Exhibit 20): Heads of R&D 25 percent, Chief Technology Officers 25 percent, Heads of Business Development 14 percent, Business Unit General Managers 13 percent, Chief Executive Officers 6 percent and others 4 percent.

Exhibit 20

Survey Respondents By Role

