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Industry Trends 2017

Vector Consulting Services

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Which themes, trends and technologies are relevant in 2017? Where is development of innovative products, services and IT heading? Companies and engineers need to be flexible in responding to markets and changes and adapt their competences. We have spoken with technology companies worldwide to identify where product development and IT are heading and which topics are relevant in the short-term and mid-term. Based on the survey results we have outlined five major trends and supplemented these trends with concrete recommendations. Read which trends we observed and what we recommend...

Where is Industry Heading?

2017 calls for competitiveness in terms of innovative products as well as development efficiency. Vector has talked to companies from various industries, to identify where we are and what topics are important for product development in 2017 and beyond. The result: companies will continue to invest in growth through innovation by developing new products and solutions, because this determines their market position. At the same time they are aware of the volatile market environment and thus optimize their development teams worldwide to be as cost-efficient as possible.

The year 2016 was very successful for most companies. In some areas, however, change and investments had been avoided, since business "went well" and teams had more than enough to do with daily operations. However, product portfolios must be adjusted counter-cyclic. Today perceived economic outlook appears weaker—which makes necessary adjustments not easier. Suppliers with whom we talked report price pressure of three to twelve percent for the same products over one year. But we also spoke with companies that are so well established in their market that they can charge and get more than their competitors.

Acting fast, effective and yet flexible is therefore the clear priority for development teams and business units. Electronics, software and IT are today major drivers of innovation. Products and solutions have to meet increasing quality requirements, but need also to be designed towards low cost, easily adaptable and positioned to exploit the advantages of modern platforms. New competitors are entering markets with new solutions – and no legacy. The technology landscape is increasingly complex. Companies that stagnate in this period of change and growth will fall back. However, managers are unsure whether the measures taken are sustainable, and how to control the increasing innovation pressure. They expect specifically in technology and IT proposals to reduce costs as well as setting the right priorities for new products and solutions.

In this volatile environment we conducted a survey across technology companies worldwide. Two questions were asked, namely: what are the short-term industry trends and what are the mid-term trends in your respective industry. We have been asking these questions over several years and thus also see evolution of topics. The survey targeted only these two dimensions in order to keep it simple and traceable over the years. We asked 1500 decision makers from different industries and regions worldwide and received well over 4% response rate—a significant sample. Since we asked not only Vector clients but rather representatives from various companies in the technology sector, replies are not biased towards current potential consulting themes.

The answers indicate several trends (Fig. 1):
> Efficiency and cost are the clear short-term focus to safeguard companies in the midst of economic uncertainties and immense global competition and cost pressure.
> Safety and security are most important in the mid-term since all these software-driven industries are vulnerable and know exactly that there is no business without security.
> Innovation is a stable focus as all industries depend on innovative products and would immediately disappear if there is no innovation pipeline
> Digital transformation and connectivity are on a fast growth as they impact all industries in their future business models and product innovations.

> Governance and compliance have emerged as imperatives, including traceable safety and security regulations and competences, but also complying to a growing amount of standards.

Efficiency and innovation are mandatory to survive in uncertainty and competitive markets. This pattern has been recurring in volatile environment, such as in 2008/9 (see Fig. 1 red circle on the right). In the previous year with more stable and healthy outlook the clear focus was on innovation. Today efficiency and cost again has moved forward to a clear number one short-term need. Companies continue to heavily invest in innovative solutions, such as digital transformation and e-cars. At the same time companies strive for cost reduction and efficient processes, end-to-end, such as DevOps for fast release cycles, modeling and simulation to reduce test cost, and global development teams and eco-systems for efficient load-competence balance. Safety and security are the overarching mid-term need fertilizing governance and compliance as new trend. Having asked various industries including many with embedded critical systems, such as automotive, transport and medical, it is obvious to find not only cyber security but also safety. There is no safety without cyber security, and thus we combine this pair of quality requirements.

Digital transformation and connectivity are changing all industries at a fast pace. It is the trend, which has gained most momentum (see Fig. 1 red circle in middle). Innovation as a trend remains stable and clearly demands to not only reduce cost and impose standards but after all develop and deliver new products and services. Distributed development is today a prerequisite for practically all companies so that we refer to our specific studies on this subject. Complexity management is no longer a major trend as it used to be, because companies have been implementing effective product management to manage complexity where it is created.

From this pattern of trends, we have outlined some recommendations from our recent and ongoing projects.
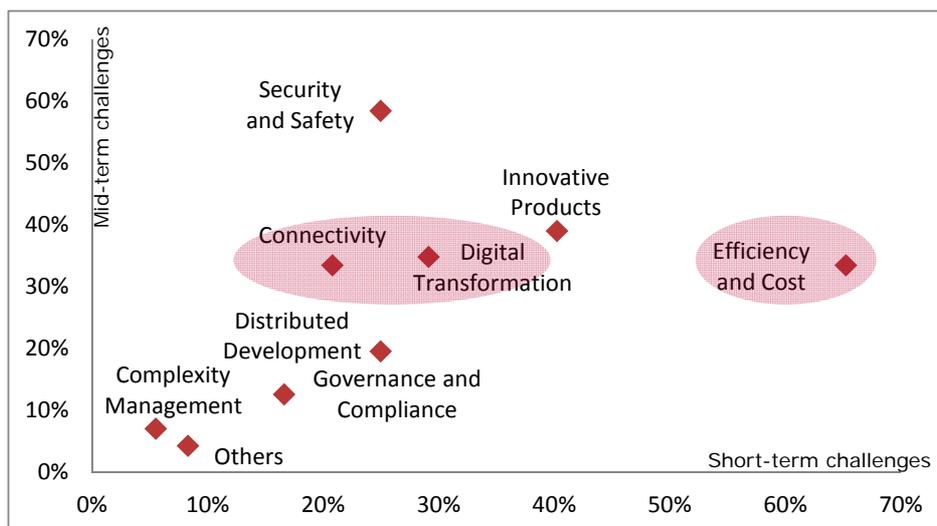

Fig. 1: Industry trends from the Vector survey. The horizontal axis shows the ranking of short-term trends and the vertical axis shows the mid-term future trends. Each person was allowed to provide 3 answers maximum, thus the sum exceeds the 100% total in both dimensions.

Efficiency: Streamline your development

In uncertain economic times those technologies and processes are in the focus with which your company will be more efficient and powerful. A current focus for all industries should be a close connection of service-driven architectures and continuous delivery models. DevOps today is the underlying paradigm to connect agile development with fast delivery cycles. Engineering and product managers must evaluate life-cycle cost and productivity. It is not enough to only look to development, because classic development is disappearing. Development, operations and service will become one continuous process. Agile development methodologies such as Scrum have penetrated the industry, however often appears more as a slogan than a sustainable way of working. Our experiences at Vector Consulting Services show that reinventing the wheel happens far too often. DevOps, value stream mapping and Scrum are proven techniques that should not be reinvented in-house with high failure rates. Nearly 90 percent of companies want to improve their efficiency this year, but only a

third of them are satisfied with their previous results. Undisciplined change management is a common reason for failing efficiency projects.

Recommendations: Check your project performance: where are the frictions, what is demotivating your teams, where do work products need rework? Streamline workflows and related tools stepwise, with an overarching strategy, incremental goals, and a service-oriented IT architecture. Migrate your classic product life-cycle towards DevOps and closely connect development with the other life-cycle activities. Optimize life-cycle cost rather than silo-based improvement. Set concrete improvement targets on a quarterly basis. Train employees in "lean development". Give each team the task of developing their own action plan for reducing waste, rework and interfaces – in line with your annual efficiency targets. Evaluate your performance, for example by sales per developer, lead-time, fault detection rates and cost drivers. Make sure that agile techniques do not lead to arbitrariness. Apply disciplined change management.

Security and safety: Consistently implement quality

Across industries, cyber security threats have almost exploded in the past twelve months. Attacks happen on a daily base, and no software-driven product is inherently secure. With ubiquitous usage of products safety, concerns increasingly affect the development of software intensive systems. Quality assurance techniques must be implemented to develop and demonstrate compliance with regulations and standards. Depending on the industry, the principles must be translated into end-to-end usage. Yet, often competences are insufficient . Neither safety nor security are designed once and then guaranteed. Instead, all functions along the development and supply chain, with special attention on services and maintenance cycles are impacted. Our customers face challenges primarily in a more efficient and consistent implementation. A culture change and competence growth for all engineers and managers is the order of the day. Competence checks become current practice in supplier evaluations. Inadequate cyber security impacts functions and safety. Since safety allows no exceptions, integrated concepts for robustness need to be set up early and consistently. But what measures are effective and efficient at the same time? How can new standards be implemented in a lean yet effective format? Security is currently a major push to fundamentally improve and modernize the development processes. But the road is still long to connect quality and efficiency. Many companies are lacking basic skills such as discipline requirements engineering and lean quality management. Too often the system context and the harmonization of requirements across the lifecycle are missing. Given the threat of product liability risks this is a dangerous carelessness.

Recommendations: Develop cyber security and safety early and consistently from a system point of view. Use risk-based security engineering to address multiple modes of operation from normal to attack and emergency. Break quality requirements down only to components and functions, after the architecture impacts have been analyzed. Move your legacy architectures towards fault-tolerant systems with prevailing fail-operational modes. Integrate suppliers and customers into your overall concept of functional safety. Apply rigorous static code analysis tools with their inherent security checks, such as null pointer dereferences, memory access beyond allocated area, reads of uninitialized objects, buffer and array underflows, resource leaks, etc. Use modified condition/decision coverage (MC/DC) to detect backdoors. Reduce the cost of security and safety validation through integrated modeling, early defect detection and reuse. Focus on lean quality. Do not copy the methods from the standards, but rather use the wide experiences across industries to efficiently implementing cyber security and safety.

Innovation: Focus on technology and cost

Companies today need to be innovative in two areas, namely technology and cost. The ability to successfully implement innovations in a short time is now the key competitive factor. Innovations determine new products and optimized processes, but also completely new basic technologies, such as we currently observe in digital transformation, new transportation solutions, connected devices, and the intelligent use of energy. Inadequate roadmapping, unmanaged complexity and cost savings in the wrong places, however mean that a considerable proportion of the expenditures in research and development does not lead to successful innovations. Decision makers from different industries complain about overly long cycle times from idea to market introduction. Innovations in development continue to have a much greater leverage than in production. In various companies we have identified some 20-40% of the engineering effort, which can be addressed by techniques such as "Lean Innovation". There is an enormous savings potential that can be raised in a targeted manner. It is

not the number of features in a product which drives success, but a few features that make it distinguishable from others.

Recommendations: Invest in new technologies and the necessary competences. Develop innovative services for your products, by linking products with company IT to intelligent services and business models. Examples include predictive maintenance, adaptive configurations, and multi-sensor fusion for enhanced functionality and user experience. Invest in new eco systems that connect your entire value chain from suppliers to end-users. Stimulate customers, vendors and their own employees with creative methods to develop the few but crucial value features that make your product different. Simplify your product portfolio, reduce product complexity and streamline operations. Focus on cost innovation over the entire life cycle. Use targeted benchmarks and continuously learn from other companies. Live clear innovation processes with stringent guided ideas, very short decision-making phases and faster development of solutions.

Connectivity and Digital Transformation: Stepwise Evolution, Starting Now

Based on our findings, the current ongoing digital transformation has five major drivers which we see recurring, namely (Fig. 2):

> Collaboration, i.e. consumer internet, social network interaction, single customer segmentation, configurators for products and services, digital money, computer-assisted collaboration tools, crowdsourcing
> Comprehension, i.e. augmented reality, semantic search, big data handling, smart data, data analytics, data economy, online data validation, data quality
> Connectivity, i.e. ubiquitous mobile computing, mobile services, cyber-physical systems, industry 4.0, machine to machine (m2m) communication, sensor networks, multi-sensor fusion
> Cloud, i.e. applications and services in the cloud, location-based networks, new license models for software and application, sustainability, energy efficiency
> Convergence, i.e. mobile-enterprise, bio-informatics, internet of things, pervasive sensing, autonomous systems

Digital business processes such as enhanced customer interaction, fluid delivery processes, predictive maintenance, fleet management, data analytics for code quality etc. demand fully new IT and software solutions based upon new computing paradigms and infrastructure. Examples include scalable IT architectures that facilitate seamless connectivity, robust infrastructures for cyber-physical systems in safety-critical environments, or data analytics to predict choices and behaviors to improve overall customer experience. Such software-driven solutions can create non-traditional market entry points and consequently entirely new mechanisms to address a single customer with time-specific and location-specific services.
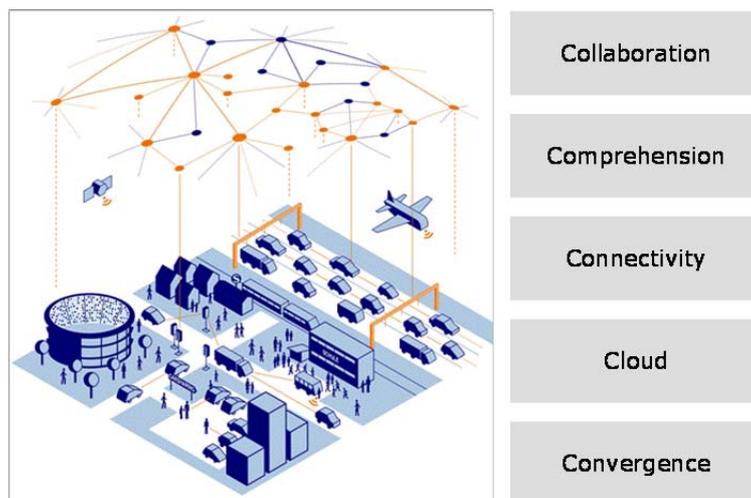

Fig. 2: Five major drivers for effective digital transformation.

Connectivity introduces new challenges, with respect to information security, robustness and usability. Security and robustness have tremendous impact on business decisions. The more we share and network, the more we are exposed to attacks of all kinds. The exploding need for secure software and protection schemes for our business processes, end-to-end, indicate this impact. Imagine automotive suppliers working on multi-sensor fusion connected to GPS and vehicle-to-vehicle communication to predict critical situations and foresee appropriate measures at situations where even the driver might not even be aware of what will happen. Another example are service companies who leverage their sales channels to flexibly provide related services such as door-to-door transportation, or firms that offer a single service card for identification, payment, and access to services of various providers both physical and in the cloud. Complexity and scale demand focus on usability. Increasingly users without adequate training operate systems, and thus cannot meaningfully assess risks and stay in control even across normal day-to-day scenarios. Insufficient usability today is a major source of critical failures caused by humans in healthcare, transportation and production plants.

Recommendations: Stepwise extend business models towards user integration and eco-systems. Do not exaggerate with the Big Data hype and let it grow incrementally with a clear vision which data to use and how to extend your business. Move from classic functional split towards integrated business processes. Model business processes, functionality and architecture from a systems perspective, while ensuring robustness and security. Use novel technologies for innovative and appealing services and more agile service delivery models, such as predictive maintenance and individual user interaction. Examples include systems modeling and simulation, DevOps, micro-services, augmented reality and cloud solutions for innovative products and for engineering. Enhance with the relevant design and testing approaches. Focus on horizontal integration of embedded systems complementary to vertical integration to active IoT solutions of networked embedded systems. Do not primarily rely on tools, but rather on integrated processes and a systematic methodology.

Governance and Compliance: Ensure Privacy and Data Transparency

Companies increasingly leverage massive volumes of consumer data to monitor the health of their products and services, deliver more customized user experiences, targeted marketing and customer support. The digital transformation based on Industrial Internet (aka Industry 4.0 in Europe) along with IoT (Internet of Things) create entirely new business models with data being shared across devices and processes in unknown and sometimes undesired formats. Governments and trade agencies are thus imposing new regulations on how and when data can be collected, stored and used. Key drivers obviously are cyber security and privacy based upon ISO 27001 and functional safety based upon standards such as ISO 26262. Both are increasingly restrictive and difficult to apply in practice. We observe in many client projects the need for high traceability such as a minimum competence set which is reliably available across engineering and their management. Regulations such as EU-US Privacy Shield, EU Model Clauses, Government Clouds, FISMA (Federal Information Security Management) and related regional variants along with numerous local laws add to this complexity in compliance. Violations of these regulations can result in stiff penalties or measures, including revenue forfeiture, imprisonment, data audits and service shutdown. A minimum baseline should be mini-trainings which we currently develop and provision for clients in eLearning formats to ensure traceability and continuous updates on these important yet complex fields.

Recommendations: Provide traceable trainings for all engineers and their management on safety and security to comply with the given standards. Create a senior role of chief data officer to stay current on rapidly evolving compliance requirements and to proactively define the company strategy and priorities for addressing gaps and capabilities. Implement data solutions to address gaps in an automated process of continuous improvement. Enhance requirements engineering towards security and safety requirements end-to-end. Implement data classification and dynamic data collection settings, geography and domain specific data collection and containment capabilities. Enhance user interfaces with easy to use "zero-exhaust", "kill-switch" and opt-out capabilities, together with necessary data provenance, access control, audit and tracking mechanisms.

Take Action

As for the future, it is not your task to foresee it, but to enable it. This remark was made almost hundred years ago by famous aviator and poet Antoine de Saint-Exupery—and is still valid today. You should build upon industry trends the same way. Topic rankings are not relevant as long as you translate few selected themes into

your own improvements. The difficult part is to escape the hamster wheel and take action for innovation in technology, products and efficiency.

A focus on efficiency and innovation is mandatory to survive in competitive markets. Process or technology alone will not make the change. Reducing R&D or IT budgets will even be counter-productive. Efficiency must be improved in parallel to innovative products and services and technology adoptions. Assess the level of evolution and competence of the engineering and IT teams and lift-up your organization. Performance, competences, capabilities and effectiveness heavily correlate with the evolutionary stage of an organization.

Classic development is disappearing. Development, operations, and service will become one continuous process. Look to value chains. Today we see a wealth of innovative eco-systems and delivery models in systems engineering and IT-driven services. The digital transformation is pushing for innovative delivery and operations models. Small start-ups team up with established big players to reinvent entire industries. Take a fresh look at your value chain. Ask which core-competencies you need or have to grow, what to outsource, and how to reduce or innovate saturated products. Look for strategic partners who challenge your current situation and help to successfully master your necessary transformations.

Acknowledgments

About Vector Consulting Services

Vector Consulting Services is a globally active consulting firm with focus on development of technical products and IT, change processes and interim management. Renowned companies from automotive, information technology, healthcare, transport and aerospace rely on the professional solutions and pragmatic implementation. A subsidiary of the Vector Group with over 1750 employees, VCS supports its clients worldwide with sustainable consulting solutions covering the entire life cycle and the related infrastructure. To ensure independent and customer-oriented consulting the firm is managed by partners.

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Topic: Connectivity
With presentations of BMW, Bosch etc.
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