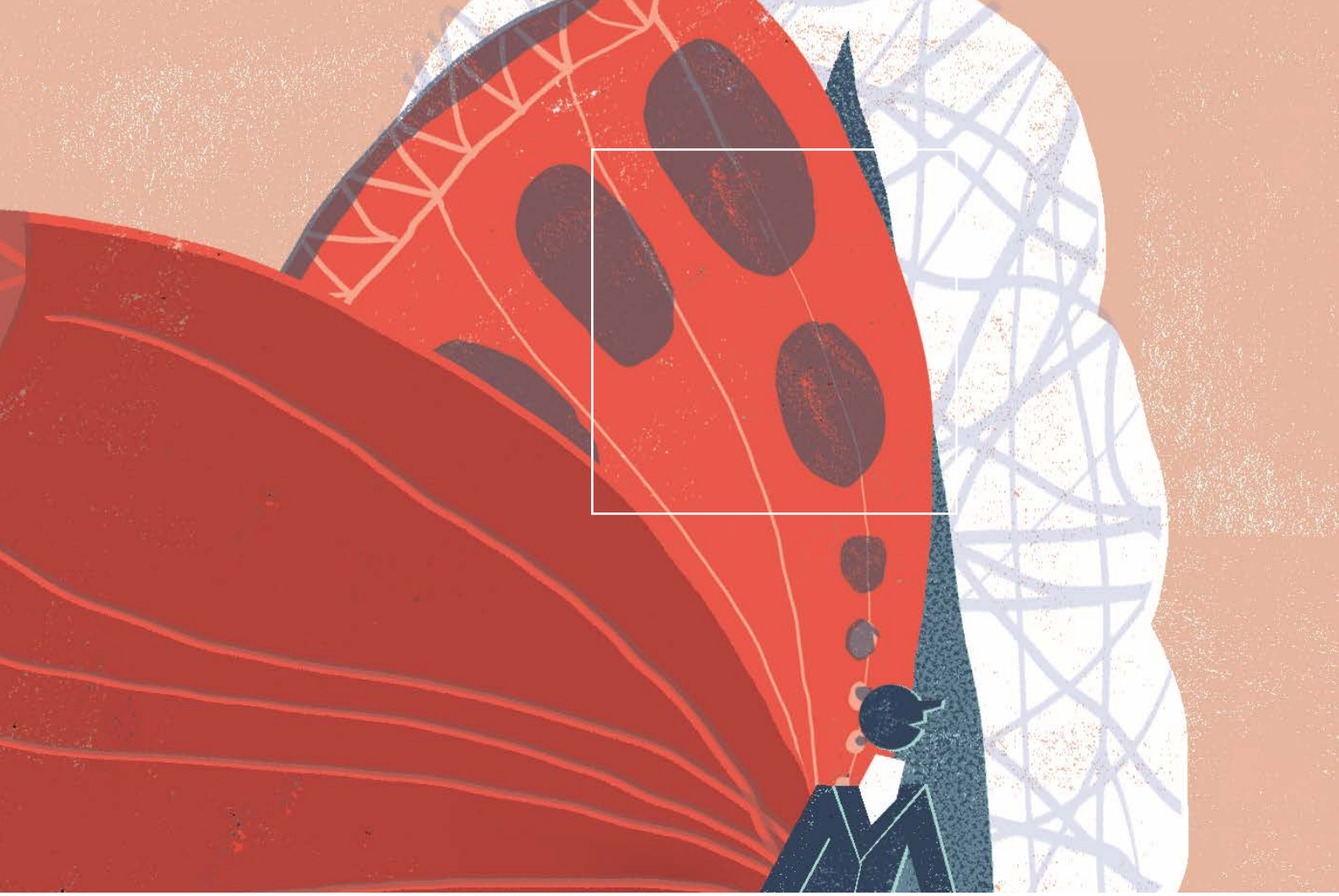

The Future of Healthcare

How to embrace the opportunity?

Arthur D Little

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Content

Nils Bohlin
bohlin.nils@adlittle.com
Kungsgatan 12-14
107 25 Stockholm
Sweden

Marc Herlant
herlant.marc@adlittle.com
42 avenue du Bourget
1130 Brussels
Belgium

François Deneux
Deneux.francois@adlittle.com
7, Place d'léna
75116 Paris
France

Ulrica Sehlstedt
sehlstedt.ulrica@adlittle.com
Kungsgatan 12-14
107 25 Stockholm
Sweden

Foreword

Dear Reader,

"It is not the strongest or the most intelligent who will survive, but those who can best manage change." – Leon C. Megginson

We're living in exciting times!

Unprecedented changes are ahead of us: artificial intelligence, the internet of things, big data, and social and commercial networks are radically changing the way we live and do business, and the impact of these changes will go above and beyond the 1990s experiments with the "dot-com" wave.

The life sciences Industry is well positioned to take advantage of these changes, as leading companies have successfully overcome patent cliffs with innovative products, and new generations of drugs are being profiled to address unmet needs in a variety of disease areas. An invaluable set of opportunities lies ahead:

- Much more than a buzzword, digital health is developing at an incredible speed. The obvious starting point is the next generation of patient-support programs (e.g. in diabetes), which will seamlessly integrate patient parameters to adapt and optimize drug treatment, along with the development of i-health through individual (micro-) devices.
- "Therapy integration platforms" will incorporate multiple suppliers and formats of care, improve diagnostics, objectivize and structure longitudinal patient data, and ultimately predict and prevent the evolution of diseases: disease-modifying therapies are at our doorstep.
- Science is sizzling and innovation accelerates: pipelines' NPV's are promising and an agile ecosystem of discovery, research and development has been cultivated within the industry. New medicines and platform technologies arrive on the market, providing essential therapeutic improvements and addressing unmet needs in numerous disease areas, including numerous orphan conditions.
- While healthcare financing remains a point of attention, new pricing and reimbursement models emerge, e.g. indication-based or outcome-based, allowing for more systematic and legitimate value pricing.
- Rising standards of living in emerging markets and aging and empowered patients are driving the need for more and better care: an ever-growing pool of individuals are accessing improved care and ultimately a better life, which will result in new opportunities for the industry, provided it can leverage its scale and adapt its economics.

Success increasingly depends on innovation and speed

Yet, surfing the wave of digital and innovation will also require the Industry to address a number of challenges, some of which have endured over the last decades. Tomorrow's leaders need to successfully:

- Discern new impactful science, identifying assets and their likelihood of success at early stages of development. Many avenues are open, such as stem cells, regenerative medicine, gene therapies, device/drug convergence, combination therapies and individualized medicine. But in many cases the promised El Dorado has been lingering, and the case for investing is not obvious.
- Develop alternative clinical development models (e.g. adaptive clinical trial design, integration of IT and real world data) to address both the ever-increasing development times and the limits of the current processes. (notably in slow progression diseases and orphan diseases)
- Further develop their ability to deal with increasingly diversified and demanding quality and regulatory requirements, along with technologically complex products.
- Transform operations and industrial models inherited from high-cost, blockbuster models that have failed to integrate the latest technologies and best practices.
- Attract and develop the right skilled resources and develop motivation and a sense of purpose in the workforce a.o. by addressing a poor and persistent image in the public opinion
- Reflect and act in terms of ecosystems and services instead of products, and be extremely agile in developing and managing deals, partnerships, JVs and collaboration networks across the health value chain.
- Develop a capability to use a variety of commercial models and roads to market to improve access and, ultimately, value creation.

… In essence leverage the digital society to offer a comprehensive, patient-centric and economically meaningful set of therapies

Innovation, growth, and science are at the heart of Arthur D. Little's DNA. In the last decades ADL has advised dozens of life sciences companies on strategic opportunities, with special focus on innovation, growth, and addressing functional issues in a creative way. In the following pages, we share our perspective on some of these opportunities and their associated challenges. We hope you will find these stimulating, and look forward to discussing our experience further with you.

Your European Healthcare team

Nils Bohlin, François Deneux, Marc Herlant, Ulrica Sehlstedt

Arthur D. Little

Notes

Illustration by Sylvia Neuner

Anticipating the future in healthcare

New technologies as key drivers for change

On one hand the outlook for the healthcare industry is broadly positive: revenues and profits will increase around the world. But the current model is not sustainable, meaning that healthcare providers have to change if they are to overcome significant future challenges. Innovation is the only way forward. In this article the authors examine the trends driving the healthcare ecosystem, the role of technological innovation and how it will change the way healthcare is delivered, along with the business models of market participants.

The key players in the global healthcare ecosystem all have high expectations for the future: the industry believes that revenues and profits will increase, governments and funders expect more job opportunities and higher standards of welfare delivered at a lower cost, while patients are looking for improved care and treatment methods. However, there are massive challenges to overcome in order to meet these growing demands whilst maintaining affordability. Today's healthcare model is simply not sustainable and the pressure to find new ways of tackling challenges will only increase. Innovation seems to be the only way forward, and this provides significant opportunities for market participants.

In this article we examine the trends driving the healthcare ecosystem, the role of technological innovation and how it will change the way healthcare is delivered, along with the business models of market participants. Three case studies demonstrate how players from three different geographies have introduced innovations that fundamentally change the way healthcare is organized. All these examples have one thing in common – they show that technology-driven innovations have the potential to enable positive change in the healthcare ecosystem.

Challenges ahead

Healthcare systems are fundamentally challenged by:

- Demographics: According to the United Nations, the number of people aged 60 and above tripled between 1950 and 2000. By 2050 it will have tripled again. Although the elderly today live in an era of better health conditions, demographic change will provide a challenge to many healthcare systems.
- Societal demand: Healthcare suppliers are rapidly introducing new, but costly, technological advances. Patients are increasingly demanding access to these, irrespective of cost.
- Chronic disease: There is an increasing burden from chronic diseases that require life-long treatment and regular follow-up. According to the World Health Organization (WHO), chronic diseases account for about 45% of global diseases, and are expected to increase to 57% by 2020. Cardiovascular diseases account for nearly half of this total.

The resulting budget pressure on the healthcare system is huge. Healthcare expenditure as a share of GDP has increased over the last couple of decades, today reaching 10% of global GDP. There is much variance – with extremes such as the USA at 18% of national GDP and Indonesia at 3%. Divided into three groups using macroeconomic dynamics, countries show the following characteristics:

Growth segment (g):

Despite economic development, growing countries tend to spend below 6% of GDP on healthcare, significantly below the level of mature countries.

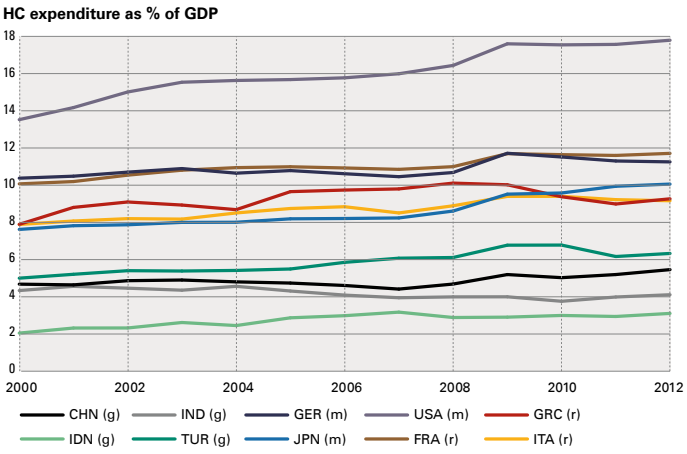
Mature segment (m):

Most markets in this segment target a spend of 9-10% of GDP. Consequently, it is evident that healthcare in the USA is far more expensive than in comparable rich countries.

Decline/ slight recovery segment (r):

All countries in this group had to cut healthcare expenditure in relative terms during the financial crisis. Levels are kept at a minimum of 8% of GDP.

Table 1: The rising cost of healthcare



Source: The WorldBank "World Development Indicators" 09/2014; Arthur D. Little

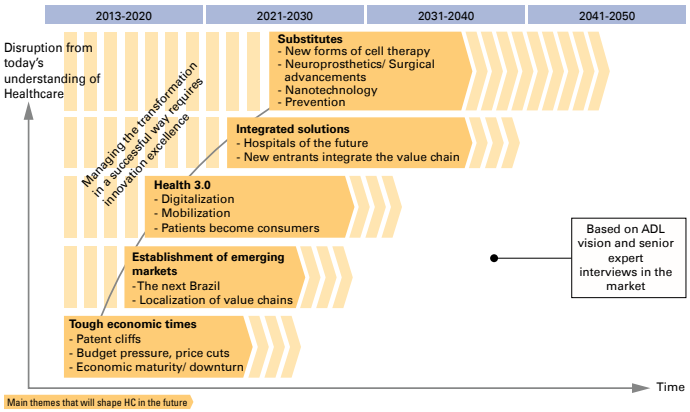
In short this graph shows that governments tend to limit the natural growth of healthcare spending to a level they feel appropriate for economic conditions.

Key trends shaping the future healthcare ecosystem

Against this backdrop we have identified a number of key, interconnected trends that we see shaping the future of healthcare towards 2030, as shown in Table 2. We have further illustrated these trends with three current examples of innovation systems that have the potential to serve as role models for implementing smart solutions around integrated care, digital health and new treatment technologies.

Budget pressure and emerging markets: The slowing of GDP growth in established markets and the continued budget pressure have led international healthcare companies to search for opportunities in emerging markets. By adapting their portfolio to create lower priced, simple and easy-to-use versions of products originally developed for use in mature markets, as well as delivering identical products at lower price points, companies are addressing some of the needs of these emerging healthcare markets. Resources in public healthcare will always be limited, so providers of services and treatments will have to fight for market share in a modestly growing environment. Additionally, they can reach consumers directly through smart solutions that drive a willingness to pay for treatments and services privately.

Table 2: Five key trends shaping the future of healthcare ecosystems



Source: Arthur D. Little

Digital transformation: Digital health innovation has helped support growth in emerging markets while also supplementing existing medical infrastructure in markets such as India. Digital health technologies allow disruptive innovation. Whether it is instantly crossing distances and connecting medical doctors in urban centers to rural patients, or providing lifesaving health information through simple techniques such as short messaging service (SMS) or digital patient visits, the use of digital health technologies is growing rapidly. Case study 1 illustrates a good example of this.

Case Study 1: How digital health helps to address budget needs in India

The Indian healthcare sector is one of the largest markets in Asia, as well as being the fastest growing. It is expected to grow at a CAGR of almost 15% to $158bn by 2017. Rising income levels, an aging population, increasing health awareness and changing attitudes towards preventive healthcare are expected to continue to boost growth. Lower medical service costs, infrastructure development, and a burgeoning private sector with high quality standards have fuelled the growth of medical tourism in the country. Moreover, India has emerged as a R&D hub for many international healthcare and life-sciences players due to its lower costs for technical research. All of this has been supported by government policies which have encouraged foreign direct investment and provided tax benefits, both for consumers and providers.

In the wake of this growth, a number of new service providers and players have emerged, offering innovative solutions targeting both the consumer and corporate sector. Hyjyia, an ICT platform provider for Electronic Medical Records (EMR) has been working with the Indian Health Organization (IHO) to create the Digital Wellness Program – an eco-system of providers, payers and corporate consumers to build a new generation of corporate wellness programs on a subscription-based model.

The platform creates a one-stop-shop that brings together basic services around health content and reminders for personal wellness. A number of primary healthcare provider networks have joined the platform to offer first level consultation services including appointments, tele-consultations and second opinions, all underpinned by electronic medical record sharing. The platform also provides options for chronic healthcare monitoring with the ability to buy popular gadgets, including sensors and trackers that can be used to measure progress in fitness activities. More importantly, over time, it creates an online platform for storing digital health records, enabling the development of an online and mobile hub for wellness and personal health access.

With a business model built on corporate wellness programs, it allows corporate buyers to tap into an ecosystem of smart and relevant digital health services, including access to doctors, risk assessments, online health content, wearable gadgets, remote monitoring and health apps. Through its integrated model, the platform allows corporates to use primary healthcare providers, executive health screening, online health assessments and awareness programs, corporate health audits and reports, group counselling services, lifestyle management talks, and personalized health and wellness advice.
Overall, the model allows corporate buyers to reduce medical costs for staff, enhance ROI by formulating more precise health benefit programs, and improve their overall image as an employer. It also creates a unique opportunity to amass personal health records on an online platform, sharing not only through corporate wellness programs, but also across the network of providers and payers, thereby creating efficiencies in the provisioning and delivery of health services through corporate health benefit schemes.
In the past, where electronic health portals were focused on integrated providers, payers and patients, the model adopted by IHO and Hyjyia in India is bringing together corporate employers to reduce the costs within the system.

Integrated solutions: Providers will always have to navigate between the willingness to offer the best services and technologies and meeting budget constraints. An innovative way forward is to connect to those developing cutting edge technologies in order to find smart solutions that integrate their innovations into clinical practice in a commercially viable way. This case study outlines how the county of Stockholm has managed to connect integrated care and supplier concepts to a smart innovation sourcing model.

Case Study 2: How integrated care and supplier concepts help Stockholm council to keep up with innovation, regardless of budget pressure

The county council of Stockholm in Sweden is facing substantial challenges, with a growing remit for care, increasing costs, an aging population and the need for considerable investments in new medical technology. Additionally, its population is expected to increase significantly in the coming years, reaching almost 2.5 million in 2020, according the most recent forecasts. Karolinska University Hospital, one of the world's leading academic hospitals, plays a central role in meeting these challenges, providing highly specialized care, conducting basic research, and delivering patient-focused clinical research and education.

With the aim of creating a more efficient and safe healthcare structure in Stockholm, a ten-year investment and transformation plan has been developed. An important part of the plan is the creation of the state-of-the-art New Karolinska Solna (NKS) hospital facility, which will open its doors to its first patients at the beginning of 2017.

To ensure that the new hospital is state-of-the art not only when it is commissioned but also in the coming decades, innovative ways of working are required. A high pace of innovation is necessary to drive these new ways of working, meaning that Karolinska University Hospital has decided to invite healthcare industry players to collaborate to develop cost efficient care production that provides the highest possible benefits for patients.

A means of achieving this is through the current procurement of medical equipment, and information and communications technology for the new facility. Arthur D. Little has supported Stockholm County Council and Karolinska University Hospital since late 2011 in the procurement of medical technology for NKS. Identifying innovative ways of integrating the competence of future equipment suppliers and developing new business models have been key to procurement.

Karolinska's clearly stated ambition of taking a truly patient-centric approach to healthcare by developing new and improved care pathways in close collaboration with industry and academia, has attracted lots of attention from global medtech suppliers. They have strong incentives to partner with Karolinska, as it will provide daily interactions with clinicians along the various care pathways. This will enable them to achieve a true understanding of unmet needs, and how their own solutions need to be integrated to enable both increased efficiency and greater patient benefits.

In the procurement of most of the medical imaging equipment to NKS, the three major global suppliers - GE Healthcare, Philips Healthcare and Siemens Healthcare – were all among the bidders. The contract is for a

managed equipment partnership (MES) that provides continuous medical imaging functionality. It initially covers more than 170 different devices, of which almost 50 are heavy modalities such as CT, MR and angio equipment. The agreement also defines a framework and aims for an overarching innovation partnership that looks to improve healthcare solutions over time.

Following a public European tendering process, Philips Healthcare was recently awarded the contract, signing a 14-year partnership agreement with the hospital. As part of the agreement, Philips will establish a research and innovation hub at the new hospital with the aim of bringing together clinicians and researchers from industry and academia to facilitate idea generation and exchange. By developing innovations in partnership with clinicians, Philips hopes to generate substantial value to transform healthcare in Stockholm. When announcing the agreement, Karen Sørensen, CEO Philips Nordic, said: "For Philips, this agreement fits perfectly in our strategy to become a solutions company in healthcare, where we partner with our customers to transform healthcare in multi-year engagements, with performance-based revenue models."

New technologies: New technologies are entering the market, for example, smart neuroprosthetics enable patients with spinal cord injuries to walk again. Gene therapies have been shown to heal genetic disorders through a single series of interventions, while cell therapies that can replace destroyed functional tissue are having a significant impact on how we treat diabetes or vascular diseases. Sector limits will merge and value creation will change. For example, homologous stem cell treatments require cell material to be collected from the patient in order to produce the medicine which will then be given to them. This will change the whole supply chain for the manufacturing and delivery of such treatments, leading to a much closer integration of healthcare provision and medicine creation and delivery. Case study 3 provides a good illustration of this.

Case Study 3: An unexpected pioneer in new technologies provides access to gene and stem cell therapies

In November 2012, the European Medical Agency granted approval for Glybera, the first gene therapy for patients with exceptional cases of lipoprotein lipase deficiency (LPLD). The technology was licensed from the Dutch bio company uniQure BV by Chiesi, a midsized, family-owned, pharma company based in Parma Italy.

In addition to Glybera, uniQure is developing another gene therapy agent targeting Hemophilia B (severe orphan blood clotting disorder). This is currently in Phase I/II development.

Through its agreement, signed in April 2013, Chiesi has exclusive rights to commercialize both products in Europe and selected other countries such as Brazil, Mexico, Pakistan, Turkey, Russia, and the CIS, as well as Glybera in China.

As a gene therapy, Glybera is injected through a one-time course of up to 60 consecutive intramuscular injections. Several follow-up appointments with specialists are necessary to control the efficacy and safety of the healing process. However, compared to the life-long substitution therapy which is the current method of care, which also has significant dietary restrictions, this therapy delivers a paradigm shift in medical benefits, quality of life and potentially lower cost per patient.

Chiesi is also investing in another break-through innovation: stem cell technologies. The company is involved with Holostem, a spin-off company from the University of Modena. Paolo Chiesi, chairman of the board of directors, and Andrea Chiesi, CEO of of Chiesi Farmaceutici are part of Holostem's management team.

The JV is currently developing a stem cell treatment for corneal regeneration and the restoration of visual acuity in patients with severe corneal chemical and thermal burns associated to total unilateral or severe bilateral limbal stem cells deficiency. The cell therapy is based on the use of autologous cultures of limbal stem cells. This means that cell samples are collected from the patients in order to be cultivated and then applied in line with medical procedures.

The introduction of therapies such as Glybera and Holostem will have significant implications on the healthcare ecosystem. Pharma companies will change their revenue model from repetitive treatment cycles of chronic disease to one-time interventions, and consequently need to build a new type of agreement with budget holders. Providers need to interact more closely or even enter new partnerships with pharma companies to ensure the proper application and monitoring of treatments. Routine diagnostics around treatments also need to be established.

For payers and healthcare systems these new technologies represent the opportunity to offer patients therapies that have the potential to cure diseases outright rather than facing lifelong, ongoing treatments.

Tomorrow's healthcare ecosystem

To fuel the continuous growth of new technologies, governments around the world are making strong, concerted efforts to promote research and entrepreneurship in healthcare, life sciences and ICT through significant investments in academic research and the creation of life sciences and technology clusters. These catalyze the work required to translate good science into innovative solutions through the skills of entrepreneurs who understand how to create value for the overall system. Today we are also seeing a continued progression in the quality of science that is produced, along with an enormous growth in the volume of scientific know-how. This flow of new, advanced science into the upstream parts of the innovation funnel indicates a bright future for new technology innovation.

Tomorrow's healthcare ecosystem will be driven by a combination of breakthrough technologies, forward-looking regulatory frameworks, astute entrepreneurship and the availability of risk capital for bold innovations, all linked to a willingness to pay for innovation that will drive progress within the overall ecosystem. The willingness-to-pay dimension will need to be strengthened by progress within the system itself in order to appreciate, quantify and measure the value of innovation. An enhanced ability to appreciate the value of innovation will therefore be a key success factor in ensuring a strong flow of innovation.

Implications for players in the healthcare ecosystem

The impact on the different stakeholders will be significant. Pharma and medical technology companies will need to review their value chain and business model and transform themselves, to thrive in this new world of healthcare. Providers and payers will seek new partnerships with suppliers. In some cases, segments will merge and we will see the rise of more integrated healthcare companies that serve several lines of business, including healthcare provision, creation of medical treatments and the application of digital care models. Each individual player needs to redefine its position within the ecosystem and CEOs will need to initiate journeys of transformation if their companies are to succeed in this changed ecosystem. Based on these trends, the case studies and our view of the future of healthcare, every stakeholder has to take action. Since each player in the healthcare ecosystem has a different position in terms of strengths and weaknesses, how they transform has to be assessed individually.

However, some overarching directions can already be observed across each group:

Budget holders should start to capitalize on their deep access to patient data and use prospective data models to better structure patient pathways. They could use the data and the direct interactions with those they insure to customize these pathways in order to give adequate care to each person during his or her insurance life cycle. In collaboration with providers and suppliers, with their data access and contracting power, payers can take a leading role in establishing structured, integrated care programs. Additionally, it is already clear that budget holders are looking into the next level of evidence-based medicine, with outcome-related reimbursement of treatments. Through digital health and Big Data, they will be able to turn this idea into reality, and increasingly connect payments to outcomes that have been measured by real-life data generated at the point of care. For budget holders to accomplish this, however, they need to take responsibility and ensure funding for the development of the necessary technology infrastructure.

Providers need to rethink the way they structure care pathways and their approach to innovation sourcing. A cost-cutting approach may work in commodity segments, but those aiming to provide state-of-the-art healthcare services must strive to offer a premium product. For this segment at least, the power of digital health can be used to provide transparency and guidance on the patient journey, structuring pathways to avoid duplication and the under- or over-supply of healthcare, thus achieving the best outcomes at an affordable price. Innovation sourcing approaches based on integration will unleash the energy and competence of suppliers and allow them to play an important role in these systems, following the same, rather than differing, objectives compared to their contractual partners.

Medical technology suppliers will have to identify where they want to position themselves within these integrated systems in order to determine the gap and the transformation needed from where they are today. The core competence of many of these companies is a thorough understanding of the detailed needs of healthcare professionals. Enabled by digital health technologies, they could consequently integrate themselves into care processes and build a role supporting budget holders in structuring, and providers in executing, future patient pathways. A particular opportunity for medtech is to support healthcare professionals in improving their services through smart technologies such as navigation guided instruments for surgery that connect to the operating room environment or through workflow management systems.

Pharmaceutical companies can build on their strong knowledge of current and future standards of care, the attached disease and patient pathways and their understanding of the physician's point of view on a particular disease. Within the last decade they have developed a strong competence in health economics to cope with the new requirements of market access authorities. Based on this knowledge they can support each of their customers with targeted information and services. Again, with the use of digital technologies, many companies have already developed smart solutions for health insurance products, patient compliance models, health professional diagnostics and treatment decision support.

As the trend analysis and case studies show, transformation in healthcare has already begun, driven by technology innovation and changes in healthcare organization. Understanding this vision of the future healthcare ecosystem should form the basis for the operating models of the future, making it critical for future success.

Illustration by Sylvia Neuner

Innovation in the healthcare space

How new technologies are driving fundamental changes in the pharmaceutical business model

The business model of the pharmaceutical industry is changing fast: The era of blockbuster medications with big margins is over. Instead, patient-centric medication is the way forward. While the industry is still grappling with these facts competition from another side is entering the field: tech companies are currently investing heavily to reap large profits from e-health concepts. In the article the authors discuss how pharma companies can react in order to survive in this new environment.

The global pharmaceutical market is expected to reach a size of 1 trillion USD by 2014[1], with continued high profitability between 28% - 46% EBITDA[2]. For many years the market has been driven by innovation, and scientific advancements have made drugs ever more targeted. With the new generation of diagnostics technology, those few individuals that will benefit most from a given therapy can now be selected from large populations. This means that after many decades of running a successful "blockbuster" model for new drugs, the business model for companies has evolved much more towards Specialty Pharma, targeting diseases with a low incidence and a more limited number of patients with a high medical need. In this environment, small and midsized pharmaceuticals companies are now in a stronger position to efficiently commercialize their drugs towards small, focused, target groups. In order to maintain their innovation leadership in the Specialty Pharma arena, established large companies have therefore had to buy access to high performance diagnostics and targeted therapies.

In parallel, advancements in IT have proceeded apace and are about to have a revolutionary impact on pharmaceutical business models. Driven by the Internet, mobile devices and cloud technologies, along with increased processing speed and capacity, complex individual diagnostic data and therapeutic patient records can now be analyzed against a background of massive amounts of population data, with the results then made available to almost anyone, at any time, everywhere in the world.

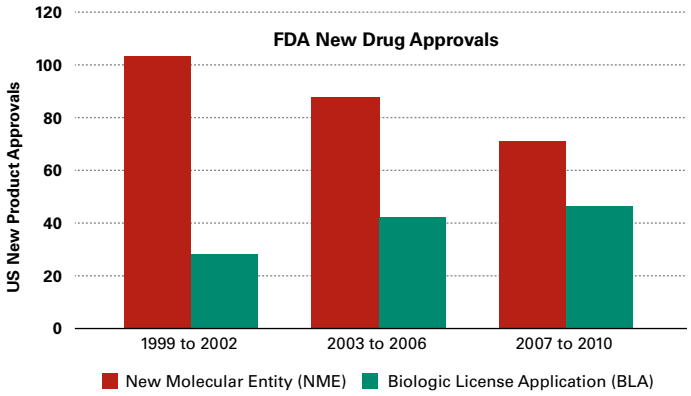
Like many other industries, this digital transformation is causing significant disruption to established value chains and business models, with new players emerging from outside the traditional healthcare sector. In this article we examine how leading players have responded to recent trends in the pharma industry, and suggest what pharma companies need to do next in order to win in the new digitalized environment.

Transformation of the business model towards Specialty Pharma

The pharma business model and key success factors have significantly changed over the last decade. For example, the share of Biologics from the total number of "new molecular entities" has risen from 25% 20 years ago, to nearly 75% in 2010, as shown in Table 1.

1 The IMS institute, the global use of medicine, outlook 2017
2 Company reports of Global Top 10 Pharma companies

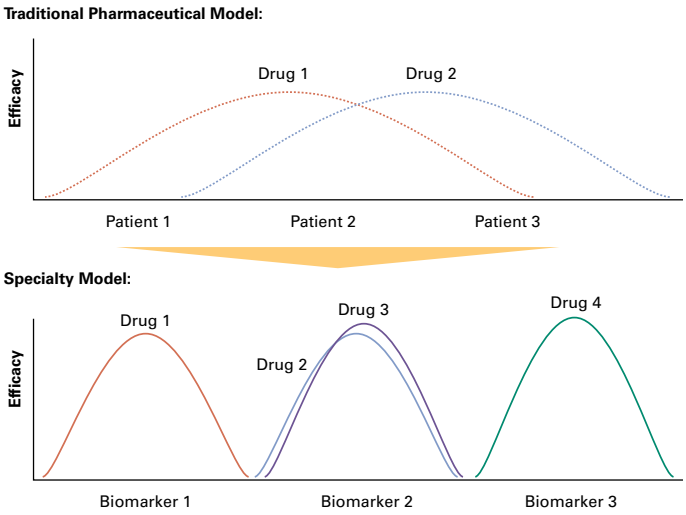
Table 1: The declining number of traditional therapeutics vs. growing number of Biologics



Source: Centers for Medicare & Medicaid Services; EvaluatePharma

At the same time, better diagnostics have made therapies more focused. This has marked the transition from the Blockbuster model (which was worth double digit billion USD in peak sales) to the Specialty Pharma model. Whilst new drugs are still able to reach the billion US Dollar landmark in annual sales, this is now based on the price premiums that companies can achieve based on medical evidence and higher efficacy, driven by a better selection of patient populations. Table 2 illustrates the difference between the two models: whereas in the blockbuster era one molecule was directed to a larger group of patients, the Specialty Pharma model is much more specific.

Table 2: Evolution of therapies: traditional vs. Specialty Pharma model



Source: Arthur D. Little

This trend towards a more personalized type of medicine has been driven significantly by companies like Roche, which were able to select and acquire the winning technology platforms. This means that Roche today is a market leader in combining diagnostics with therapies. The company has shown the ability to acquire the necessary capabilities in diagnostics and proteomics early in the process, and thus has obtained a leadership position which is ahead of most of its competitors.

Roche – market leader in the combination of diagnostics and therapies[3]

Roche was founded on October 1st, 1896. With a strong focus on thyroid drugs and vitamins, the company grew and developed a series of breakthrough innovations such as the discovery of the tranquilizing effect of benzodiazepine, a number of highly active formulations against acne and chemotherapies against cancer. Roche also acquired the patents for the polymerase chain reaction, a key technology in the early days of genetics.

The history of Roche is also a series of smart mergers. Through the acquisition of Boehringer Mannheim in 1997, the company gained access to diagnostics and the first biotech projects, and through the Genentech deal, which was fully concluded in 2009, clear leadership in biologics and personalized medicine was secured for decades to come.
The company is aware that there are breakthrough innovations elsewhere, and tries to address this with an open culture. Roche CEO Severin Schwan said in Prism 2/2013: "I always tell my people that probably 99% of all discoveries happen outside of Roche, so we need to stay open and bring in external expertise to the company."

3 Roche.com, milestones, March 2014

Shire – mastering business development and regional expansion in Specialty Pharma[4]

Shire's future growth strategy reinforces its focus on the Specialty area, where innovation still enables companies to differentiate and to drive value. The focus will be on developing and providing innovative specialty pharmaceuticals for niche and orphan indications to meet significant unmet patient needs.

Shire's current product portfolio now contains specialty pharmaceuticals in the area of attention deficit hyperactivity disorder (ADHD), gastrointestinal treatments, and renal disease. Leading orphan drugs and highly specialized treatments in the area of lysosomal storage disorders for Fabry disease and Hunter syndrome, as well as hereditary angioedema, complete the portfolio. They all have three aspects in common: they target extremely rare diseases with an incidence of one patient in a population of 10 -150,000 people, address conditions with a high medical need, and are able to charge between 150 - 400,000 USD per patient for annual treatment costs.

Throughout its 30 year history, Shire identified, acquired and successfully integrated a number of targets and product portfolios. Its capability to systematically screen the option space of medium to late stage development compounds and portfolios is a competence that is ahead of the industry.

The rapid growth of Specialty Pharma is creating an inflection point across the entire healthcare landscape. Substantial differences between Specialty and traditional pharmaceuticals – not only structurally and chemically, but often in terms of distribution, marketing, and regulation – are challenging the health care ecosystem. The discovery, development, manufacturing, delivery, and sales of specialty pharmaceuticals require new and advanced tools, techniques, and expertise. The growth of Specialty Pharma is therefore not only driving significant change across the entire value chain, but also has important implications in terms of value creation market opportunities for traditional players and new entrants alike.

Whereas long-term established players like Roche drove the change mainly by the combination of diagnostics and therapies, rising new companies, such as Shire, started to focus on rare diseases with a high medical need. In fact, the success of Shire was built on a series of M&A transactions and the establishment of a virtual value chain which enabled the company to operate with a minimum of fixed assets, targeting limited patient numbers with specialized therapies.

Other examples of traditional pharma companies moving into Specialty Pharma include Sanofi[5, 6], who successfully acquired Genzyme, a biotech leader in the treatment of orphan diseases. By acquiring Genzyme, Sanofi both reinforced its biologics portfolio and initiated a new culture of specialty biopharma. The deal also strengthened Sanofi's competitive position in the US.

In summary, the value chain of pharma companies has been transformed by a number of drivers from science and technology, fuelled by research-driven, small and midsized companies, and university spin-offs. Companies have largely adapted towards this and most of the big players have managed to buy and build their way into the new model.

The transformation towards Digital Pharma

Today, IT advancements are starting to further transform the pharmaceutical value chain. The digitalization of large parts of the world's population is giving people access to health-relevant information and services, which have only just begun to be developed. For example, "Telehealth" and "Mobile Health" (m-Health) applications have the potential to greatly improve prevention and early therapy success. Running apps, heart rate measurements and glucose monitoring applications are moving beyond the exploratory stage and will soon be integrated into existing care pathways - or even define their own new

4 Shire.com (investor news, 2013 Q3 and Q4 earnings presentations, results 2013, press release 13 February 2014)
5 Sanofi's annual report 2010 (February 09, 2011), Announcement of the acquisition of Genzyme (February 16, 2011), annual report 2013 and investor presentation (February 06, 2014), interviews
6 Wall Street Journal, Feb. 17, 2011, "Sanofi Wins Long-Sought Biotech Deal", Bloomberg

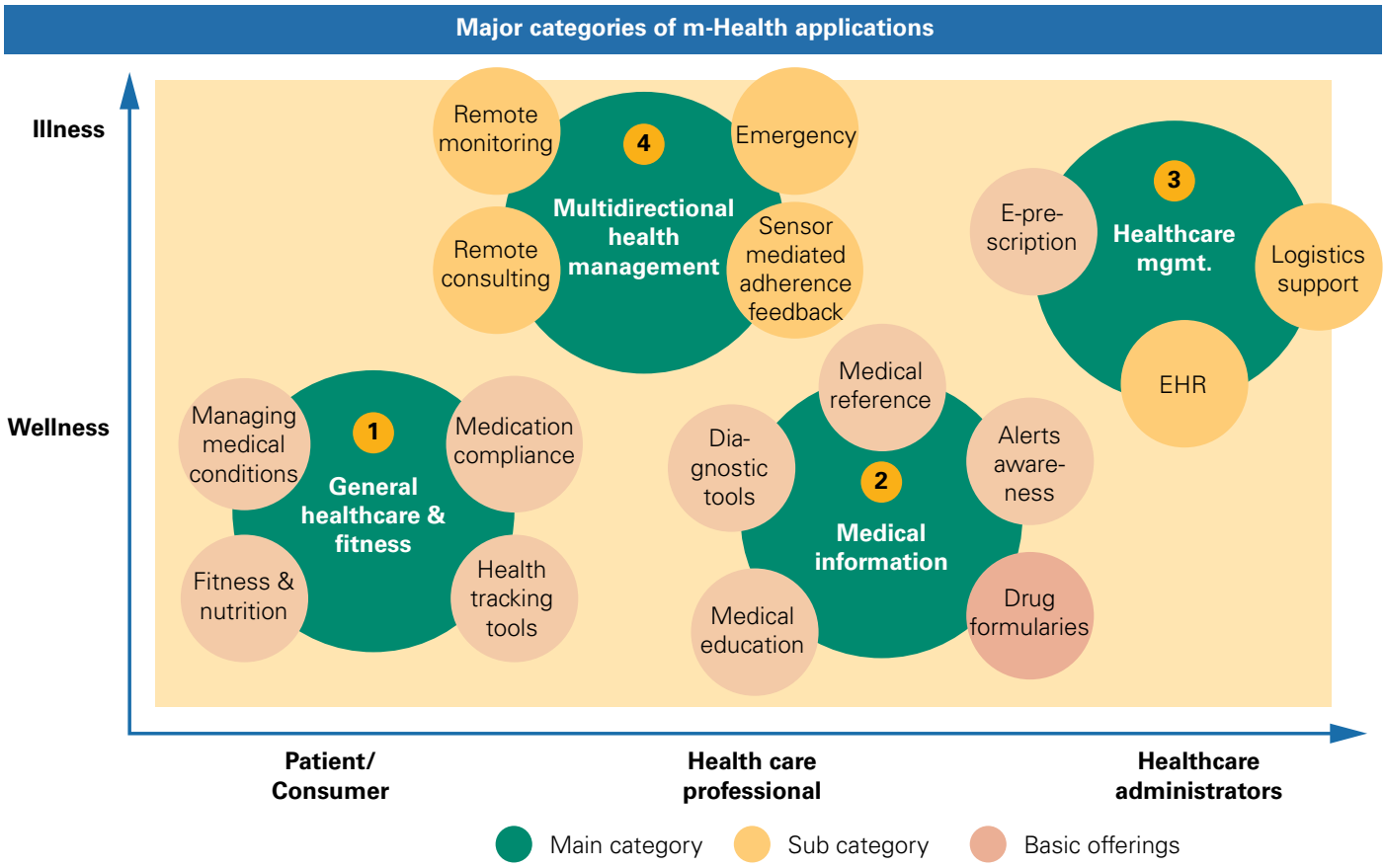
pathways with the patient at the center. Table 3 shows the different categories of m-Health applications that can be used by consumers, as well as health professionals and administrators, depending on the actual health status of the individual person.

Obesity, one of the most significant burdens on healthcare in developed countries, can now be approached through these new measures. Patients will therefore evolve towards being "consumers" of healthcare services.

If applied in a smart way, these health lifestyle solutions will have an enormous potential to tackle chronic mass diseases such as diabetes, cardiovascular disease, back pain, and depression. The convergence of medical advancements and IT is a clear trend in the development of clinical practice and has been described by authors such as Eric Topol in his book "The creative destruction of medicine"[7]. Based on a recent Arthur D. Little survey amongst senior pharma executives[8], the industry clearly sees the significance of the impact digital technologies will have on its business model, but is today still lacking strategies to tackle it. Companies stumble over the fact that becoming leaders in this area requires significant upfront investment and a business case which does not deliver the kind of ROI the pharma industry and its shareholders are used to. It requires a high initial investment, and provides a disruptive business model with risky benefits.

One of the new players approaching healthcare from the IT, media, electronics and mobility angle is Google. With its recently launched CALICO (California Life Company) initiative, Google is putting pressure on traditional pharma companies to adapt their business model to the digital world of the future.

Table 3: Major categories of m-Health applications



Source: Arthur D. Little

7 Eric Topol: The creative destruction of medicine, January 2012, Basic Books (Perseus Book Group)
8 Study: impact of digital health on Pharmaceutical industry, Arthur D. Little, January 2014

Google's Moonshot program in Healthcare[9, 10, 11]

Google's approach could not be any more different: whereas pharma companies take 10-15 years to quietly develop new molecular entities (NMEs) in areas such as cancer, Google announced in September 2013 with its Moonshot thinking that it wanted to "solve the problem of death".

Google today has a total turnover of 60bn USD, 48,000 employees worldwide and an operating profit level of 14bn USD in 2013. Pharma giant and market leader Pfizer is generating about the same level of turnover and profits with just under double as many employees (92,000 in 2012). Google's profits are driven by its core business Google Search and online advertising. In September 2013 Google launched a healthcare company to attack some of the most difficult scientific problems in diseases related to ageing, marking the biggest step yet beyond its core internet business.

Larry Page, chief executive, unveiled the venture, called Calico, with a characteristically ambitious and vague claim that "with some longer term, Moonshot thinking around healthcare and biotechnology, I believe we can improve millions of lives".

The new venture is to be headed by Art Levinson, the former chairman of biotech company Genentech, which was bought by Roche in 2009. Mr. Levinson brings along a team or researchers from Roche and his personal network.

The move to Digital Pharma implies new business models and players, leading to a different market structure which consists of:

- Established traditional large pharma players
- Specialty Pharma players
- New game changing market entrants.

Companies like Roche are leading through the combination of diagnostics and therapies, Specialty Pharma players such as Shire market their drug product innovations to a targeted group of patients, and the new market entrants such as Google aim to mobilize consumers to directly access healthcare solutions.

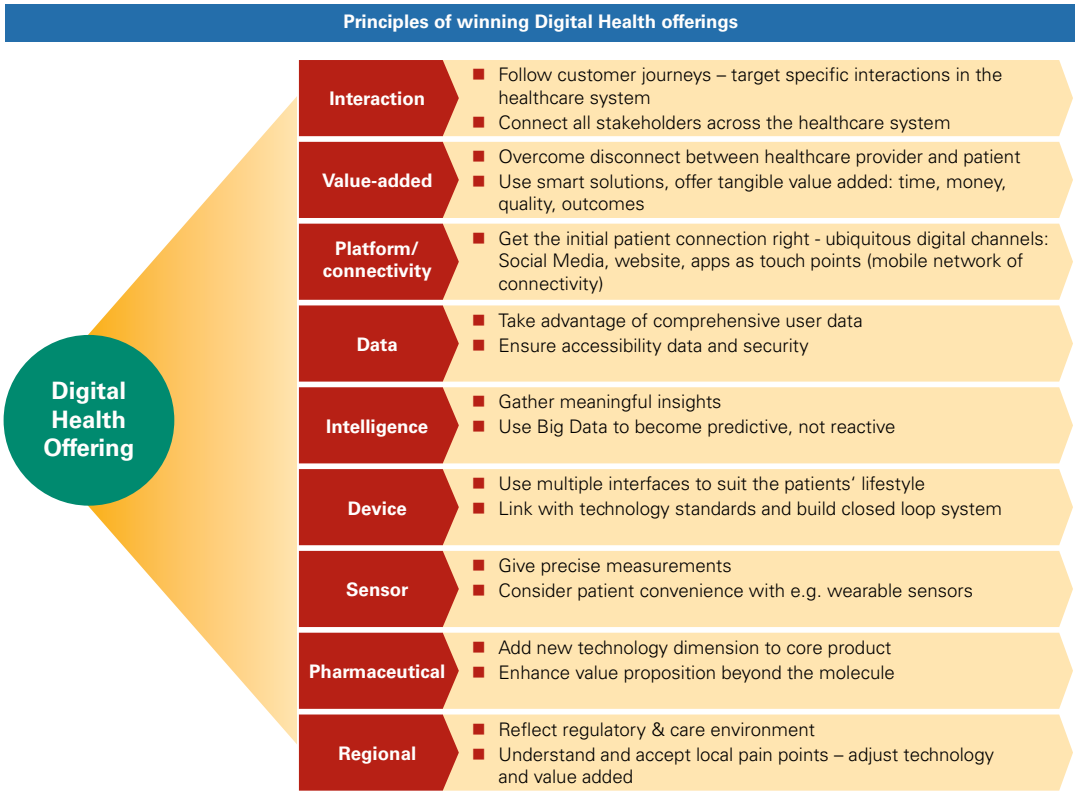
All players are driven by innovation. The traditional pharma value chain is going to change for these reasons:

- R&D needs to adapt to combine drugs and devices, diagnostics and IT.
- Manufacturing can benefit from the Internet of Things and inventions such as 3D printing.
- Market access will be dependent on evaluation of real life data.
- Marketing will focus more on consumers, less on prescribers, and will address a solution to a problem rather than focus on a physical product only.
- Sales will be increasingly directly to patients, enabled by online channels.

This digital transformation affects each part of the value chain and thus needs to be managed comprehensively. It has the potential to be truly disruptive[12], because it targets a much wider range of customers, with a simple but modern approach of bringing healthcare gradually to consumers instead of having them travel to wherever healthcare is provided.

9 Time, 30. September 2013: Calico: Google's New Project to Solve Death
10 Capital, March 2013
11 Die Zeit, January 2014
12 http://www.claytonchristensen.com/key-concepts/

Table 4: Principles of winning Digital Health solutions



Source: Arthur D. Little

How companies can respond to the Digital Pharma challenge

Pharma companies generally suffer from possessing the biggest barrier towards innovation and change – a sizeable and profitable existing business. Decision makers are afraid of margin dilution, whatever new business they introduce. However, in order to maintain their market position over the long term, pharma companies need to embrace digital transformation. They have a range of options with which to respond. They can drive change from within, spin-off their new digital business arms, or access essential new capabilities through JVs, partnerships or mergers and acquisitions.

In order to succeed in this environment, we have identified five key ingredients:

1. Deep knowledge of disease patterns and therapeutic pathways
2. Regulatory competence to ensure applications are safe and well accepted by authorities
3. Cutting edge biochemical technologies in the medical therapy space
4. Offerings that directly attract consumers and patients
5. Competence in digital and media technology to ensure smooth application in practice.

Whereas the first two of these are core competencies of traditional pharma companies, innovative small and midsized biotech companies own the innovation space for the third.

Attractive, workable solutions for consumers are critical. Offerings must gain acceptance, or even better, create a strong desire to use them in consumers and health professionals. We set out some principles of winning Digital Health offerings in Table 4:

It is obvious that these capabilities are very much owned by today's digital media companies. Established players will therefore need to acquire this new set of tools to successfully play in the new world of pharma. They have to become familiar with direct patient/consumer interactions and gain access to digital technologies. In doing so, they can choose from a number of different options in order to prepare their business model for the digital age:

- **1 Defend:** Defend their place in the ecosystem by pushing for drug innovation, quality surveillance and the involvement of the medical community which they are familiar with.
- **2 Partner:** Partner with emerging players from the IT/Telecom/ Internet business space to access their technical capabilities related to IT, Telecommunications and their customer base.
- **3 Transform:** Transform their business to become digital experts and connect the dots between IT and medicine to become the first choice for caregivers, not only as a drug supplier, but also as a provider of therapeutic solutions.

The Specialty Pharma players need to extend their commercial platforms, and acquire the tools of the new players, while new entrants will have to acquire the medical and regulatory know-how to deal with established care structures. They need to further expand their value chain to find profitable commercial models in different geographies and develop secure and efficient distribution chains. Those who are focused on orphan indications have the opportunity to consolidate their knowledge about how patients benefit from treatment with their drugs. They will then be able to utilize this knowledge to create digital offerings which support patients in order to further improve their quality of life. These may include nutritional information and online shopping opportunities, guidance about how to deal with disease specific complications, maps with centers of excellence near their location, and opportunities to engage in clinical trials.

One option for established players to overcome the barriers of past success is to spin-off new ventures to give them the space and freedom to develop to a point where they can begin to disrupt the pharma model. Although losing some meaningful synergies, for many of the larger pharma companies this might be the only solution to ensure a sustainable development of innovative digital approaches.

The new emerging players from the IT/Telecom/ Internet business side have by nature different shortcomings to established players. Firstly, they need to acquire medical knowledge. Their rule-breaking attitudes will only prevail once their initiatives are backed by regulators such as the FDA, and at least parts of the medical community and payer organizations. Each of these stakeholders can only be convinced through the creation of medical evidence, a discipline which as of today is still the key domain of established players.

Insights for the executive

Recent developments in the healthcare industry provide some useful insights that are also relevant for other sectors. For example:

1. Business models even in profitable industry segments with high barriers to entry are subject to change and disruption.
2. Change is often driven by new technologies which are not necessarily invented in the same industry.
3. Business model transformation is often accompanied by the rise of new players who are better adapted to the new environment than established players and have less to lose.
4. Established players need to decide their response strategy: either adopt a leadership position, or buy into it at a later stage. Doing nothing is not an option as disruption gathers pace.

Many established players aim for business sustainability, based on the interests of their shareholders and stakeholders such as customers, employees, governments and societies. A key pillar to ensure sustainability is the imagination to draft a vision of the mid- and long-term future of the business. Pursuit of this vision must be fuelled by creativity and entrepreneurial power to transform the company's capabilities to succeed.

Illustration by Sylvia Neuner


15:52
Health
Runtastic
Fitbit
Road Bike
RunKeeper
Running
Heart Rate
Moves
MyFitnessPal

Embracing the consumer health opportunity

How new market entrants are changing the sector

The number of companies entering the healthcare market has vastly increased, making it an interdisciplinary arena for many sectors with many companies from other industries seeing new opportunities in the sector and trying to enter it. At the same time consumer behavior is changing as people become more sophisticated in their use of technology and expect greater access to self-help healthcare solutions. In this article the authors provide the background to this underlying change in consumer behavior and examine three cases of new business models implemented to successfully capture the consumer health opportunity.

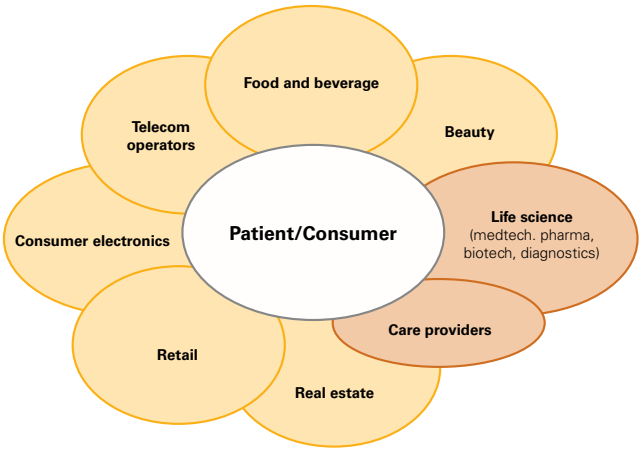
Healthcare is no longer solely a business sector for companies in traditional life science core industries such as pharmaceuticals, med tech and diagnostics. It is rapidly becoming an interdisciplinary arena that is of interest to businesses from many other industries, such as R&D-driven food and beverage companies, consumer electronics, telecom, housing/real estate, and retail.

This is because of the increasing sophistication of consumers, combined with the drive towards healthier lifestyles, which is leading to the creation of new, cross-industry business opportunities. Innovative technologies that enable increased access to information and greater possibilities for knowledge sharing have led to health consciousness moving from a niche to a mainstream market.

In addition, aging populations and strong pressure to reduce national healthcare expenditure are driving new business development and exciting consumer health R&D activities in developed countries. Responding to the demands of consumers can potentially be a partial remedy for cost-pressured public and insurance-based healthcare systems, while also providing new business opportunities.

This article provides a background to the underlying changes in consumer behavior and examines three case studies of new business models that have been implemented to successfully capture the consumer health opportunity.

Table 1: The patient in the center of focus in various industries



Source: Arthur D. Little analysis

Technological development and changing purchase and consumption patterns

Today's technological landscape is completely different from the recent past. New generations of consumers use mobile technology as a natural extension of themselves. Consumers are adopting broadband: 34% of the global population now has access to it. Europe is embracing mobile devices: 38% of European consumers own a smartphone or a tablet. Online retail is annually growing by double digit percentages. Looking further

ahead, the Internet of Things (IoT) is extending connectivity to cars, houses and medical equipment, for example.

New technology is also leading to changes in consumption patterns – in the retail world the role of the traditional store is changing as online and mobile shopping becomes more prevalent and different consumption modes overlap. Today's consumers want the ability to buy when and where they want. This means that retailers and consumer goods suppliers must adopt a multichannel or omnichannel approach centered around online stores.

These technology and consumption trends also apply to the healthcare world. As retail consumption patterns change, the same trends spill over into the consumption and provision of healthcare.

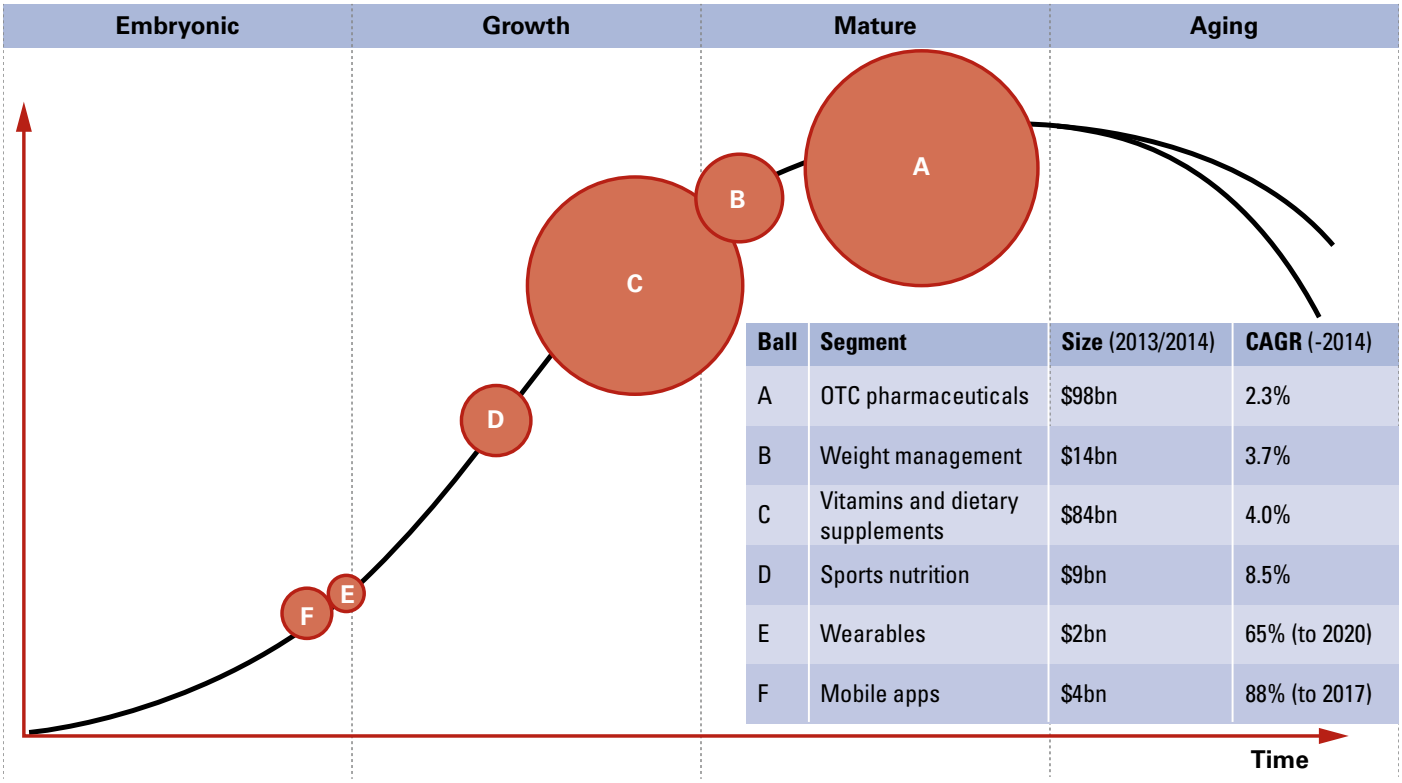
The future development of consumer healthcare

Consumer health is a broad definition, covering everything from a gym-goer aiming to stay healthy to a patient looking to manage a chronic disease. Consequently, it is composed of a number of business areas, ranging from the large and mature, such as over-the-counter (OTC) pharmaceutical sales, to expected fast-growth markets, such as wearables and mobile apps. The common denominator is that they are all centered on the patient/consumer. Within the consumer health space it is the individual who is paying the costs and making the decisions.

As a consequence of technological development, both consumers and patients are better informed, have a wider choice, and demand increased personalization. Today, patients have plenty of options on where to go for information, and once they reach the doctor's office they already have their own hypotheses on potential diseases and disease management. Patients are also increasingly open to non-state funded solutions and are looking towards solutions outside of cost-pressured healthcare systems.

On top of this, pressure on the public financing of classical healthcare provision is pushing patients towards more self-care. The increased prevalence of "diseases of affluence" and an aging population means health systems must move from acute towards

Table 2: Selected consumer health segments by size and maturity



Ball	Segment	Size (2013/2014)	CAGR (-2014)
A	OTC pharmaceuticals	$98bn	2.3%
B	Weight management	$14bn	3.7%
C	Vitamins and dietary supplements	$84bn	4.0%
D	Sports nutrition	$9bn	8.5%
E	Wearables	$2bn	65% (to 2020)
F	Mobile apps	$4bn	88% (to 2017)

Source: Euromonitor International, Reseach2guidance, Soreon Research, Arthur D. Little analysis

preventative care and chronic disease management. As this happens, healthcare and consumer health increasingly converge. Players within traditional healthcare systems will therefore need to adapt to consumer needs and requirements as new entrants step into the market from the consumer side.

Opportunities offered

The actions required to reap the benefits of this development depend on existing capabilities, but it is clear that new business opportunities are available both to established healthcare players and to new entrants. The qualities required to succeed are likely to be a combination of those possessed by the two. In order to capture consumers' interests, players already in the market need new perspectives, whereas new entrants need to ensure health knowledge and credibility.

The consumer health space is naturally more oriented towards screening and prevention, and towards capturing consumers before they become patients. The successful business models of the future will be associated with giving a large population access to awareness and "prevention" solutions. Innovation will clearly be a driving force here, both in terms of technology and in the development of "consumer-friendly" business models.

New entrants

New players can leverage existing expertise from their original markets and use them for healthcare products and applications. Telecom operators, who are facing margin pressure in their core business, are looking towards connected devices, for example, for remote patient monitoring, to be a strong revenue driver going forward.

Table 3: LAWSON's new store concept "Health station in your town"

"Health station in your town"		LAWSON Remote Medical Service
Meal Solution	**Self-medication support**	
On and offline sales of healthy foods	• Sales of OTC and dispensing service • Health check and counseling service	• **Customers can get counseling service by pharmaceutical chemist via Video phone at classic LAWSON stores** • **LAWSON collaborates with QoL Pharmacy for combined CVS/Pharmacy Store and use of their pharmaceutical chemist**

Source: Arthur D. Little analysis

Case Study 1: LifeQ

In order for consumers to take a more prominent and central role in healthcare decisions, they will need access to information – not just data but actionable information.

One company intent on providing consumers with personal life and health information as well as corresponding insights is LifeQ. It traces its origins back to 2010 when its technology – built around computational systems biology – was initially developed. The goal of computational systems biology is to apply large-scale numerical methods to the study of molecular, cellular and structural biology. According to Dr. Riaan Conradie, its Executive Founder, LifeQ was founded to address the needs of large segments of the population – groups that lie between those suffering

from chronic diseases that are being monitored by a health provider at one end to exercise enthusiasts tracking their fitness at the other. By trading a few key physiological data points, LifeQ believes it can produce many outputs through its advanced scientific models and transform them into actionable insights for consumers, based upon its computational systems biology engine.

LifeQ has positioned itself as a B2B company with what it believes are four (4) distinct components to its business model:

- a data acquisition license fee to incorporate its technology into partners' / manufacturers' devices
- a revenue sharing model with 3rd party application providers
- licensing fees to access the company's anonymized population level data sets
- a contextual advertising model whereby the company would receive advertising revenues to promote product a services to consumers tailored to one's unique physiology.

Originally founded in South Africa and headquartered today in Atlanta with 45 full-time employees, LifeQ has grand ambitions not only to establish itself as a global consumer health company, but also to change the face of healthcare and, most importantly, address some of the inequities inherent in the system by empowering consumers. In fact, CEO Laurie Olivier firmly believes that "it is unavoidable that consumers will play a larger role in healthcare and healthcare decisions."

Case Study 2: Diagnosis and nutrition solution

In Japan, the private and public sector alike are aggressively trying to make the healthcare ecosystem sustainable.

One interesting business example is the diagnosis and nutrition solution offering by a Kao & Ajinomoto joint-venture, aimed at health insurance groups and doctors. Kao Corporation (a leading cosmetics company) has been pursuing initiatives to prevent lifestyle diseases and improve their care by offering a prevention program called "QUPiO" (Ku-pee-oh) to health insurance providers. On the other hand, leading food company Ajinomoto has launched health check/diagnostic support services using an "Amino Index®" to analyze the amino acid balance in the bloodstream and then report on the degree of risk for developing certain lifestyle diseases. Ajinomoto has also marketed ingredients and supplements that aid health.

The newly-established JV is trying to build a new business model to generate health solutions that target individuals through insurance providers. This uses personal health data and know-how from the prevention program built by Kao and metabolic screening information from Ajinomoto's "Amino Index Technology," to provide more comprehensive and personalized lifestyle improvement counseling (covering which foods and exercises are to be taken, for example.) This is personalized for each individual, based on their health.

Retailers are also rapidly moving into the health related services market. One development here is the introduction of health centers where retailers incorporate professional medical services into their offerings. This repositioning of stores is an efficient way of attracting health conscious customers looking for a one-stop-shop where all their needs are met. A real-life example of this is the health station concept introduced by LAWSON, an Asian chain of convenience stores.

A similar concept is also used by Walmart in the US, which provides low-cost primary care doctor sessions in-store. Real estate owners and operators also see these "health centers" as sources of profitable growth at a time when demand for retail space is reducing.

There are also completely new businesses emerging. Companies such as LifeQ, which uses computational systems biology to provide consumers with actionable health information, are trying to fill gaps in existing solutions and thus enable a shift towards a patient-centric model.

While new players might lack the credibility offered by a strong healthcare brand, those from the B2C space are strongly consumer centric and have a deep understanding of their target groups, as well as products and technology that can potentially be leveraged for consumer health applications.

Adjacent industries

For industries that border healthcare, such as food and beauty, consumer health represents a growth market as well as a way to create a positive brand image. Willingness to spend money on diet options perceived to be healthy is increasing enormously and traditional food giants such as Nestlé are developing "health brands". After recent food scandals it has become vital for the giants to prove that their food is indeed healthy. One way of doing so is by clearly linking the brand to a healthcare value proposition.

Other companies have gone even further and have extended their value proposition to diagnosis and active lifestyles improvements, as exemplified in the diagnosis and nutrition solution case study.

Case Study 3: The Mayo Clinic

The Mayo Clinic is one of the world's largest non-profit medical organizations, which has established a powerful brand reputation and strong brand loyalty among consumers worldwide.

Its success can be explained by the fact that Mayo is at the heart of a new healthcare ecosystem, providing an extended range of medical products and services to consumers and healthcare professionals. In addition to medical treatments, these include the organization of multiple health programs, laboratory services for healthcare organizations and the provision of educational materials for patients and professionals. On its website, for instance, patients can find information on over 100 diseases, together with symptoms, possible causes, risk factors, and complications. It also tells the patient how to prepare for an appointment (to-do lists, questions to ask, what to expect from your doctor, etc.), the tests available, information regarding treatment and drugs, as well as how to cope with the disease and advice for support.

Even more importantly, Mayo has cultivated a spirit of service excellence, which is deeply embedded in the organization, emphasizing a patient-centric culture. Social media and mobile technology is an enabler of this culture, with the organization offering various apps. For example, with the 'Mayo Clinic Patient App', patients are offered access to the latest news, publications and health information from Mayo Clinic. It also includes personal medical records and appointment schedules. Recent features include the availability of the patient's radiology images and immediate access to lab results.

In 2010, Mayo Clinic created the 'Mayo Clinic Center for Social Media' to regroup and coordinate its various social media initiatives and programs. It believes individuals have the right and responsibility to control their own health, and that it has a responsibility to help patients use social media tools to get the best information, to connect with providers and each other, as well as to inspire healthy choices.

Social media is at the forefront of the Clinic's values and the leadership is actively involved. CEO John Noseworthy supports the Clinic's online presence and even highlighted the critical role of it in the future of healthcare. Social media will become a part of routine healthcare operations and consumers' day-to-day lives and thus increasingly influence the choice of healthcare provider. A key element is patient engagement through social media: patients sharing outcomes and supporting each other, doctors discussing treatments, and hospitals acquiring new patients through Facebook. The Clinic is also creative in discovering new applications for social media and is regularly introducing innovative ways of interacting and introducing patients to the professional they will be receiving their care from. As an example, YouTube is used to show videos of a surgeon performing surgery.

Existing healthcare players

The development of consumer health offers a potential for healthcare players to make money outside of their traditional business models and customer groups. Health service providers (such as Mayo Clinic) are using their health related brand strength to expand into all types of health related services and products aimed at both consumers and professionals. Just as it is possible for retail players to add healthcare capabilities to become health centers, it is possible for professional health service providers to dedicate space and time to consumer driven business and achieve theme-oriented retail concepts. In Japan, "anti-aging clinics" are an attractive segment for younger doctors looking to broaden their medical offering outside of public coverage.

The increased amount of information available to patients is not only positive. It also provides a huge challenge for healthcare as hypotheses are often developed from various sources and without clinical education. This tends to drive cost for healthcare as patients demand expensive examinations and tests even if they are not relevant. Healthcare providers who can provide their patients with information in a consumer-friendly manner could gain control by providing constructive information that aligns patient expectations with the medical reality. Hospitals can further respond by transforming themselves into client-centered organizations that are always connected with their patients, both before they enter hospital and after they leave. A best practice example is the Mayo Clinic, which proactively manages knowledge sharing and interaction with patients through online channels and social media.

Traditional healthcare players should consider broadening their offering to gain additional revenue and customer reach. There is also a potential to partner with retail or consumer goods players who have to ensure they are delivering solutions that appeal to consumers.

Insights for the executive – Capturing the opportunity

Over the course of the last decade the consumer health industry has risen as an important force that is reshaping the future of healthcare, enabling an individual-centric model whereby consumers play a more central and informed role, alongside providers, in healthcare prevention, maintenance and ultimately, treatment. One thing is clear – there is enormous market potential in this cross-dimensional opportunity space. All players need to improve weak capabilities and leverage strengths:

- Existing players such as care providers and life sciences companies need to build consumer insight and sales capability, leveraging their healthcare knowledge.
- Adjacent players such as food & beverage and beauty companies need to focus on credibility and validation of health claims to satisfy increasingly aware regulators.
- New entrants such as telecom operators, consumer electronics companies, retailers and facilities/housing

companies will need to build adequate understanding of how to succeed in the highly regulated healthcare space, whilst leveraging their consumer insight and digital technology strengths.

In the center, of course, is the consumer. Future users of the consumer health offering need to be carefully segmented and understood. Today there are many means to shadow customer groups to identify their interests, needs, preferences and buying patterns. Big data generated through mobile internet applications enables companies to gain a much better understanding of the target groups.

Consumer understanding then needs to be combined with insight into medical and health developments to find technologies and products that match consumer demand.

Players targeting the consumer health opportunity space need to anticipate what the world will look like several years in the future and what kind of solutions will be offered to consumers. Examining what type of markets, channels and technologies that can or should be targeted is key.

Based on the expected outcome companies need to decide where to be present and build the capabilities required. Cross-industry collaboration can also be expected to increase as a result of industry convergence.

Companies that have shown the ability to capitalize on the development so far have a number of traits in common:

- They master new technologies.
- They are knowledgeable of, and take into account, consumer behavior as well as healthcare development.
- They are not afraid to make changes to their existing business models or test completely new business models to capture a new target customer group.

For those that succeed, the rewards are likely to be substantial.

Digital pharma – responding to challenges and opportunities from outside

How digital is reshaping the pharma arena

Innovation has always been one of the foundations for success in the pharmaceutical industry. While the sector has been very good at developing innovation from scratch or incremental innovation of existing products, it now faces an ultimately different challenge – dealing with disruptive innovation that is driven by inventions outside the healthcare sector. New players from the digital arena are currently redefining the way the industry works. In this article the authors outline the nature and origins of the disruptive pressure on the pharma sector and how companies should transform to respond to the challenges and opportunities arising from this new era of digitalization.

The pharmaceutical industry in the 20th and early 21st century has been in constant change, driven by both incremental and breakthrough innovations. These range from the discovery of penicillin and effective, targeted cancer drugs to personalized medicine. Recently, the European Medicines Agency (EMA) approved a gene therapy for LPLD (Lipoprotein Lipase Deficiency), the first-ever gene therapy to be approved in the Western world, marking another innovation milestone.

However, what the industry has not seen before is disruptive innovation driven by inventions outside the healthcare sector. With the introduction of smartphones and big data analysis, along with progress in robotics, new players in the media, electronics and IT industries have substantially changed the way we live and do business. By merging these technologies with the latest developments in medicine, including genomics, stem cells and stratified approaches, the speed of innovation can be accelerated significantly.

In its report "Impact of Digital Health on the Pharmaceutical Industry – Will Business Models be Reshaped by Digital Health?" Arthur D. Little provided an industry snapshot of the goals of the pharmaceutical industry for 2020, and their progress so far in achieving them. The study indicated that by 2020, the business model of the pharmaceutical industry will be transformed by digital health. It revealed that managers expect digital health to significantly extend current business models, or even to create completely new ones for their industry.

Today we are already seeing pharma companies such as Merck (through its patient engagement platform, Merckengage) and AbbVie (with a video solution for the management of Parkinson's Disease with Karolinska University Hospital), making initial steps towards offering a range of basic services that support important areas such as patient compliance, adherence or interdisciplinary collaboration. But the world can expect many more innovations to be applied to healthcare by pharma companies. Big data will enable them to measure the real-life effects of their medicines, while fully integrated services will improve the quality and efficiency of care. In order to implement such integrated solutions ahead of new entrants such as Calico (established by Google

and with a R&D partnership with AbbVie), pharma companies will need to undergo major transformation programs and convert three completely different value chains: pharma, medical devices for measuring health parameters, and IT solutions to process and connect data.

This article outlines the nature and origins of the disruptive pressure on the pharmaceutical industry and how companies should transform themselves to respond to the challenges and opportunities arising from this new era of digitalization.

Inventions outside healthcare driving change in the pharma industry

Many of the innovative solutions that digital health offers are being developed by non-traditional entrants into the healthcare arena. They are now providing new offerings that are very quickly changing the dynamics of how the ecosystem works, and, in particular, how the individual patient is engaged.

From new biosensor technologies and smart devices to portals and physician guidance tools, there are numerous exciting breakthroughs that allow enhanced self-monitoring capabilities and patient adherence.

One telling measure is the amount of venture capital that is continuing to flow into the digital health market. According to digital health startup accelerator Rock Health, USD2.1 billion was invested in digital health startups during the first half of 2015 – up 25% compared to the previous 12 months. The biggest portion, USD387 million, went to wearables and biosensing companies, but analytics and big data, as well as electronic health records, are other categories that are seeing significant investment activity and a vibrant innovation environment. Take Health Catalyst, a Salt Lake City-based startup, for example. The company, which recently secured USD70 million in additional funding, helps healthcare organizations perform the advanced clinical and operational data analysis needed for population health and accountable care according to the Three-Part Aim of the US Affordable Care Act (ACA). It is now pioneering innovative health analytics capabilities in which an application layer uses the company's data warehouse to provide new insight, helping physicians and hospitals make better clinical and operational decisions.

The innovations coming from outside the traditional healthcare industry span a wide spectrum of products and services, but all take advantage of advances in digital technologies and the ability to analyze and present large amounts of data in new ways. From new biosensor technologies and smart devices to portals and physician guidance tools, there are numerous exciting breakthroughs that allow enhanced self-monitoring capabilities and patient adherence – and ultimately superior clinical decision-making and treatment success. Add on the data analytics capabilities that are now being put to use by purchasing bodies (payers) and hospital systems, and it is clear that healthcare is in the middle of a profound transformational shift.

How should a pharma company act in the midst of this rapid change if it is to remain relevant going forward? In our work, we have found that many companies are struggling to fully understand the new landscape. This is particularly due to the constraints of being vertically integrated organizations with business models that are essentially built around independence and self-reliance, meaning they have promoted internal solutions over broader ecosystem collaborations.

A common theme among the new solution providers and the digital health innovations they are creating, is that they tend to have a much stronger consumer mindset as a natural part of their organizational "DNA" and thinking relative to pharma companies. This is evident in digital health solutions such as new continuous blood glucose meters which, connected to a smartphone application, directly empower the patient to take control of his or her own diabetes by guiding insulin therapy through access to real-time glucose levels.

Digital health solutions could therefore solve the major long-term issues of pharma's most important client groups – patients, providers and payers – all at the same time.

It is becoming clear that in order to stay relevant in the future healthcare ecosystem, pharma companies must look to business models that foster much more direct patient engagement than previously. New methods offer significant potential in increasing the quality and efficiency of care. Digital health solutions could therefore solve the major long-term issues of Pharma's most important client groups – patients, providers and payers – all at the same time.

Success factors for pharma companies

In order to understand the disruptive power of digital health and its impact on pharma, one has to take a closer look at the relationships within this well-connected ecosystem. Traditionally, healthcare providers, payers and pharma companies have had a conventional supplier-consumer relationship. However, there are now increasing demands from payers and providers around the delivery of better health outcomes and greater cost-effectiveness. These provide a strong driving force for pharma companies to more actively engage in the opportunities arising from the digital revolution and patient-centred care. More than ever, regulatory bodies now insist on pharma companies demonstrating benefits and cost-effectiveness, with many countries introducing reforms that aim to restrain overall spending. Ensuring responsiveness to treatment and patient compliance, while minimizing side effects, are therefore key success factors if pharma companies are to meet society's demands.

The disruptive pressure from healthcare systems and industries outside the sector changes the key success factors of pharma companies. In particular, they need to:

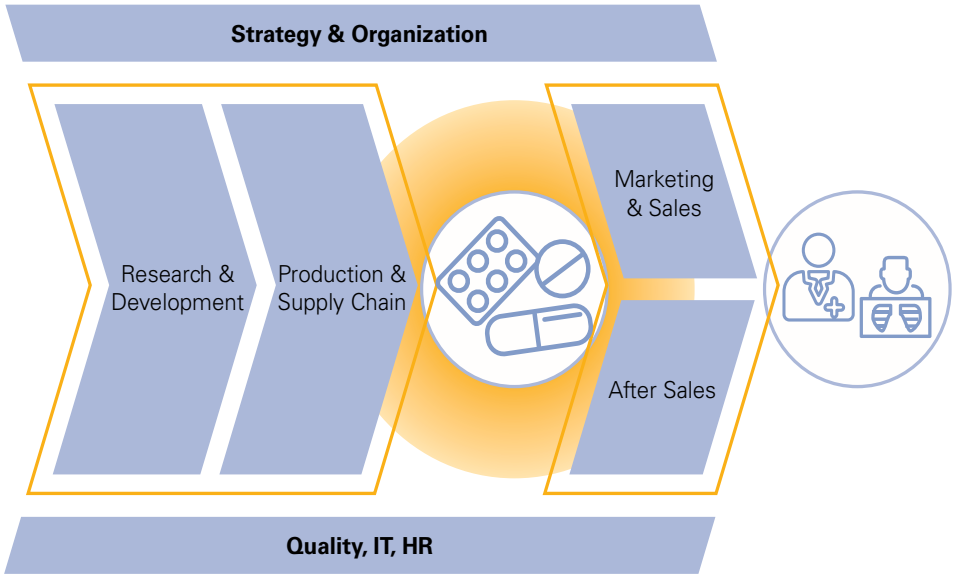
- Respond even faster than before with more comprehensive approaches to change,
- Embrace new strategies with enhanced flexibility and the willingness to work through new ways in pilots,
- Speed up development programs that foster new skill sets; new mindsets; and new behaviors,
- Open up to greater collaboration with new partners. This includes connecting and sharing information with players that were previously seen as competitors, as individual patients will increasingly require a combined approach to treatment,
- Ensure that they take advantage of cheap and efficient devices that collect health data, such as the Apple Watch, continuous glucose monitors and portable electroencephalogram (EEG) monitors, as they become available,
- Increase transparency to earn the trust of regulatory bodies and patients.

Generally these success factors apply to any pharma company. However, the visions of where specific companies want to be might be very different. Overall, it is about what core competences a player has, and what business model will provide the best leverage. Pharma organizations can be broadly divided into two groups: research-driven and disease management-driven companies. Roche is an example par excellence of a research-driven company with a core competence in developing leading edge, stratified medicines. Subsequently, it is investing in collaborations with digital empowered genetic diagnostic companies. In contrast, companies such as Novartis and Sanofi have started to explore digital disease management solutions. Hence, they collaborate with medical devices and media companies such as Google.

What to consider when preparing for transformation

In order to achieve these new success factors, pharma companies need to begin a process of transformation. The proven, classical, product-centric approach with an indirect value chain (as shown in Table 1) will not be able to embrace the required speed, new collaboration needs, flexibility and ability to learn quickly.

Table 1: Times are changing: The classic, productcentric pharma world will no longer hold up

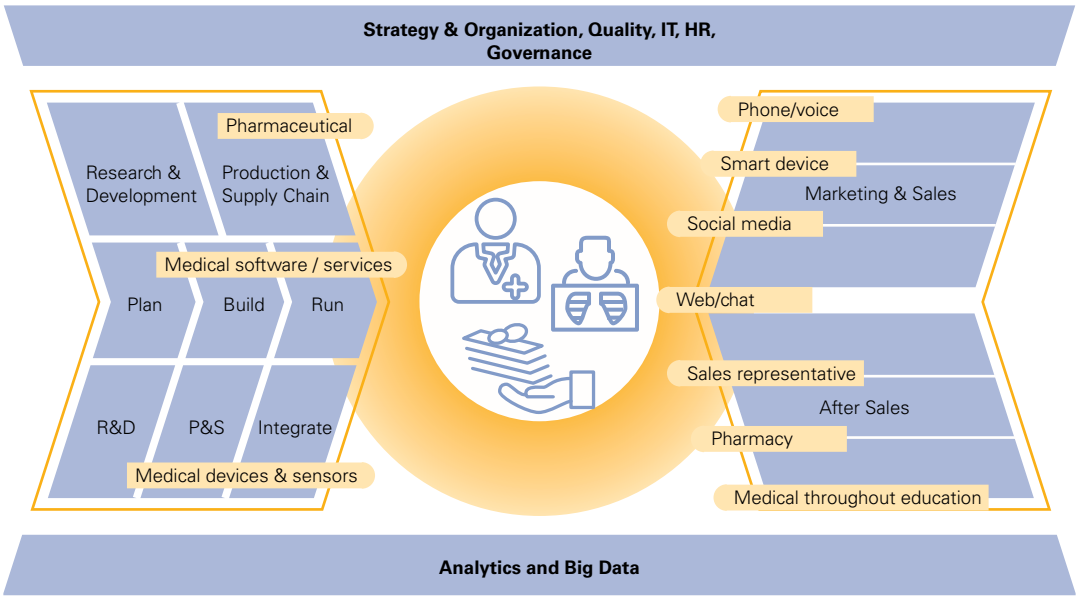


Source: Arthur D. Little

A pharma value chain in a digitalized environment needs to incorporate new characteristics. Therefore, as a first step, the company needs to develop a vision of how it will earn money in the new digitalized world. Will the revenue model stay? Will the business model instead be built around new manufactured products or services? What will the portfolio and customer experience look like? A vision how a transformed organization can be structured is shown in Table 2.

In such a vision, pharmaceutical product offerings can be strengthened through complementary digital software/ digital services offerings. These help patients with their treatment, help practitioners with their work, and give them insights on the success of their treatments, while helping payers and legal entities to receive proof of efficacy. Depending on the pharmaceutical product, medical devices and sensors will measure the consistency of product usage and its success. The combination of all three product groups result in an integrated digital health offering that is able to give a new competitive advantage.

Table 2: The future pharma value chain needs to be customer-centric, integrated and multichannel



Source: Arthur D. Little

The "customer" is at the center of this vision. This includes not just the patient/ consumer, but also the practitioner and the payer. All products and services, as well as all administrative processes, focus on long-term customer value through customer group-specific journeys.

Sales, marketing and after-sales processes are channeled through clear physical and digital touch points and contain the correct information to meet specific customer needs. Touch points are coordinated and contain consistent and compliant information, based on customer status and requirements.

To coordinate product offerings, the customer-centric view, and the multiple touch points, strong strategy and governance are required. Furthermore, big data analytics capabilities will integrate information from R&D, existing products, and customers, as well as other touch points, to generate additional value and improve products, services, processes and touch points.

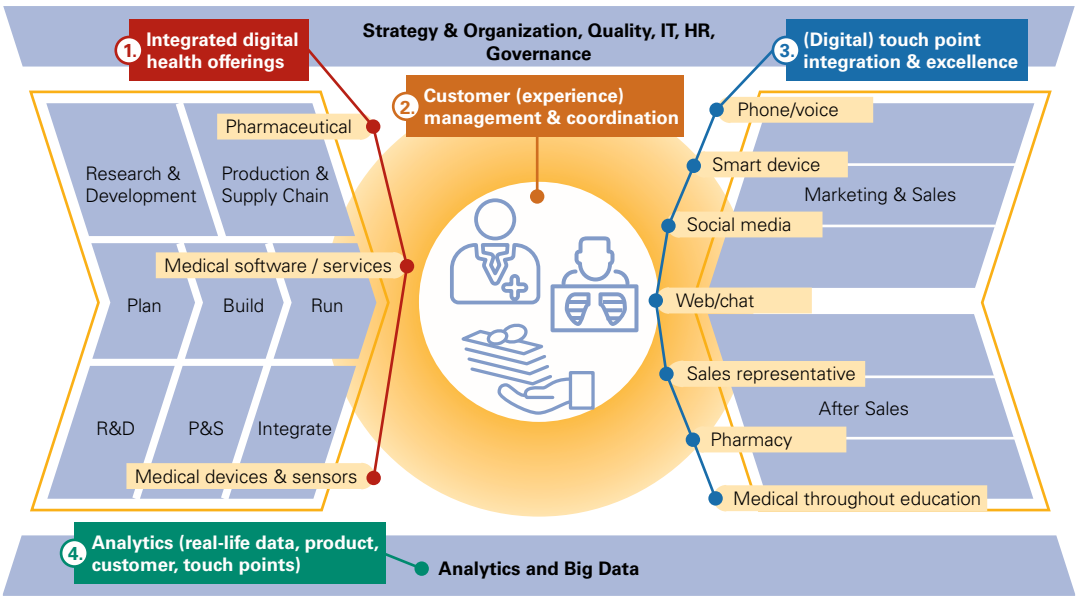
We see that large pharmaceutical companies are already defining their visions, strategies and initiatives. Corinne Le Goof, VP CNS Marketing, Sanofi Aventis, stated that a "lack of customer understanding is a threat to our revenues and to our health. We need to understand customer value and do it better than our competition". Pfizer has implemented customer journey mapping for customer-centric decision-making, Johnson & Johnson has established a cross-franchise digital center of excellence, and GSK is pushing multi-channel marketing campaigns.

To create action plans and concrete initiatives, the transformational need has to be cascaded down to processes, data and technology requirements, and management capabilities. The major challenge to success is the need to integrate organizations, concepts, processes and technology. A successful transformation program typically incorporates the major pillars of the new vision within four fields of action, as shown in Table 3:

1. Integrated digital health offerings

To define integrated digital health offerings we have to set the overall future business model and its components, incorporating existing products and business units. By analyzing the existing product portfolio and comparing it to the new business model components, gaps become apparent. We can define and decide where to build up skills and capabilities internally, and where to use new partnering models and external interfaces. The overall product strategy is communicated and a product development excellence project is set up, such as enabling an approach to personalized medicine.

Table 3: Four key factors will determine the future success in healthcare



Source: Arthur D. Little

2. Customer (experience) management and coordination

Customer management is the core of the transformation program. Here we define the strategic components as well as the governance structures for a customer-centric and digitalized pharma company. The different customers (patient, practitioner and payer) are analyzed and high-level customer journeys are defined. These journeys are the basis for more detailed use cases – experiences with the brand from the customer point of view – such as a treatment process or information gathering across different touch points.

To create action plans and concrete initiatives, the transformational need has to be cascaded down to processes, data and technology requirements, and management capabilities.

Especially for big pharma, it is not possible to drive this transformation through a deep-dive, top-down approach. Therefore we favor a "highly aligned, but loosely coupled" approach in the execution of the program, in which the detailed use cases will be run by dedicated owners who have end-to-end responsibility for both budgets and success. The company will run a lean customer integration office where the use cases are consolidated. Existing company committees for budgeting and prioritization will be extended so that top management is able to make decisions based on customer and business value.

3. (Digital) touch-point integration and excellence

As a major enabler for customer-focused use cases, touch points and their back-end capabilities need to be built and integrated. Based on the use cases and their requirements, we define and prioritize touch-point projects, such as online consumer chat or a new digital sales representative application. Overarching capabilities for an integrated journey are defined as well, covering customer data and customer relationship management, as well as knowledge management. Projects to implement these basic enablers are the highest priority as they span multiple use cases and touch points.

4. Analytics (real-life data, product, customer, touch points)

A digitalized and customer-focused value chain offers new opportunities for gaining insight, measuring success and driving improvements. As a basis, we recommend creating a lean, cross-business-unit, technology-focused, big data analytics team that has the technical and consulting capabilities (covering data scientists, the provision of a big data cluster, etc.) to help business units with the implementation of new analytics methodologies. Within the business units capabilities need to be created for each purpose, such as using the technology in R&D for personalized and precision medicine based on field data. Clear data analytics responsibilities are set for each business unit to enable fast learning, such as touch point analytics to assess how well particular touch points are accepted, and how they can be improved.

Insights for the executive

The pharma industry today is facing a complex and difficult situation. Digitizing industries are entering the healthcare market with innovations that have the potential to change the way healthcare is provided to people. Customer groups demand the same level of digital services they experience in other sectors. Beyond that, practitioners and payers expect solutions that use digital innovation to drive efficiency and increase the quality of healthcare service provision. Pharma companies face a situation in which parts of their business may be disrupted by new market entrants, whereas other areas will be suited to a traditional business model for many more years. They therefore need to avoid introducing immature services too fast in areas where there is no urgency, and need to correctly set priorities. For example, in many cancer and orphan treatments, efficacy rules over comfort and compliance is not an issue since medication is given under medical supervision in a controlled environment. In other areas, such as diabetes and many cardiovascular diseases, digital services can significantly increase the success of a therapy through increased compliance/adherence, and systems that support lifestyle changes. Pharma companies need to deal with this ambiguity in the market place. They should thoroughly assess the need for change along their value chain

and start a systematic transformation process to become digital players at the right speed and time in the right areas.

To accomplish this, we recommend pharma companies initiate a transformation program built around the four fields of action described above. All four streams of the program can be driven in parallel and need to be tailored to company needs, cultural specifics and the business/product situation. Depending on the baseline, some streams can be prioritized, but all aspects are important in order to build up the capabilities required to succeed in the new global healthcare and life sciences ecosystem.

It should be emphasized that implementing these changes will lead to new business models and value chains for the pharma industry, which combine the traditional drug business, IT and medical technology. The change is significant, and pharma companies need to acquire new competencies through acquisitions or partnerships in order to cope with each aspect of the combined value chain.

Illustration by Sylvia Neuner

How to manage your return on investment in innovation

Reaping the most from innovation investments

In any company around the globe investment in innovation and R&D is under critical scrutiny. Is it going to the right places and is the amount spent exactly appropiate? Is the company getting the best return on its innovation spend? These are questions that any CTO today must be able to answer. In this article the authors explore the challenges of managing the Return On Investment (ROI) of innovation, and provide some examples of good practices and key factors for success.

Any CTO or Innovation Leader will be very familiar with the following question from the CEO. It goes something like "You know I'm fully committed to innovation… but is all of our investment really necessary? Our competitors seem to be growing as fast as us, yet they spend less of their revenue on R&D than we do. Can you assure me that we're really getting the best return on our innovation spend?"

What might seem at first sight to be a straightforward question can be quite difficult to answer. There are numerous complications around what we really mean by 'Innovation', 'Investment' and 'Return', and indeed what effective management means in this context, such as:

- What should we include and exclude in 'innovation investment?'
- What types of value do we care about?
- Which methods should we use to assess value?
- What's the best way to communicate the results?

In this article we explore the challenges of managing the Return On Investment (ROI) of innovation, and provide some examples of good practice and key factors for success.

The importance of managing the ROI of Innovation

Managing spend on R&D has always been an important priority for business, and this trend is increasing. For example, since the financial crisis in 2008/9, the world's top 2000 R&D investing companies have been growing their R&D investments by around 6% annually, during a period of generally reduced net sales growth and squeezed margins. Not only is spend on R&D increasing, but the type of R&D being carried out is also changing. In our previous article on the "The Creativity Era – A new paradigm for business", we made the case that in the face of drivers such as hyper-competition, technology disruption and new customer power, companies are increasingly looking to achieve growth from new non-core areas, requiring more focus on innovation – especially breakthrough innovation – in order to survive and prosper. Even in "traditional" sectors with longer product development cycles, companies are now taking on riskier, more long-term and/or more breakthrough non-core innovation projects as part of their portfolios. For example, the proportion of innovation spending on breakthrough innovation across companies has been shown to have increased by around 50% from 2007 to 2012[1]. Arthur D. Little's own 2011 survey of Chief Technology Officers revealed that the proportion of revenues from non-core business was expected to double in the decade after 2010[2].

At the same time, trading conditions in many economies remain challenging, and the pressure to justify and optimize investment and discretionary costs remains intense. Consequently, companies are looking to find more meaningful and robust ways to manage the value of their innovation portfolios to better meet the various needs of their stakeholders, be they the top team, shareholders, or potential partners.

1 APQC, 2012
2 The Future of Innovation Management, Arthur D. Little 2011

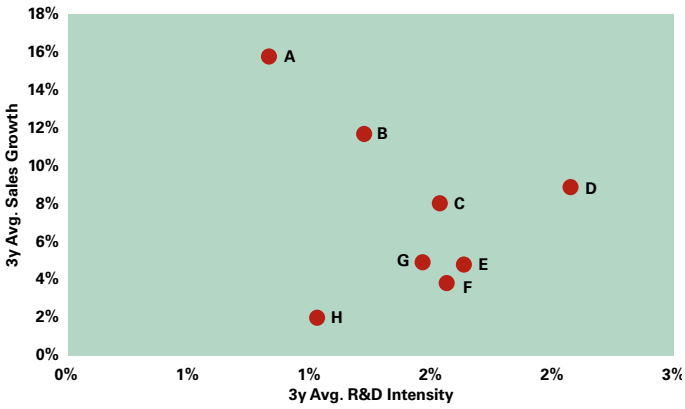
Some typical challenges

In principle, managing the ROI of innovation is simple: work out how much you spend on innovation and where you spend it, compare this with the added-value that each part of the portfolio delivers to the business, and take appropriate management actions to improve performance.

However, in practice, many companies struggle for a variety of reasons which are mainly concerned with the lack of a clear, shared view about what 'managing the ROI of innovation' really means:

- **What does "Innovation Investment" mean?** A key early challenge is to define clearly what is included in "Innovation Investment". Spend on R&D is clearly a significant part of this, but in many companies R&D spend also includes activities such as technical support, troubleshooting, product reformulations and quality testing. These activities do add value, but more in terms of risk mitigation, improved assurance and loss avoidance than in terms of growth. Should they be part of the "ROI of Innovation" equation?

Table1: R&D intensity vs sales growth for global food & drink companies



Source: ADL analysis, Data from 2009 -2012. R&D Intensity means R&D annual cost as a proportion of annual sales

An even bigger problem is that innovation is much broader than just R&D. For example, in consumer goods companies, brand innovation is often more important than technical innovation in terms of its direct impact on growth and margins, and this investment is usually made through Marketing or Brand Development functions rather than R&D. Effective innovators invest in innovation across many functions, such as manufacturing, procurement, IT, HR and finance. In some companies this type of innovation might be called Operational Excellence or Continuous Improvement.

Should this also be part of the ROI equation? If companies just stick to R&D spend only, then they are missing the full picture. For example, if the CEO is looking for a direct link between R&D spend and growth, then he or she is likely to be disappointed – many studies have shown that there is no clear correlation between R&D spend and revenue growth, as shown by the following study of a selection of leading global food and drink companies:

- **What does "Return" mean?** Estimating returns on innovation investment is often fraught with difficulty. The biggest challenge is that of dealing with risk and uncertainty, especially for investment in early-stage research, platform developments with multiple (perhaps as yet undefined) applications, and R&D which might be "enabling" – for example, R&D into methods and approaches which could be applied across different products, processes or services. Some R&D activities may yield hard-to-quantify benefits such as enhanced reputation or better environmental performance. The most commonly used valuation approach of Risk-adjusted Net Present Value, (i.e. standard economic analysis with adjustments to allow for uncertainties in future costs and revenues), starts to lose meaning in these situations, because it requires huge assumptions to be made on future revenue streams, based on little or no evidence. Sometimes it requires the use of theoretical algorithms that try to express things like reputation enhancement and customer satisfaction in monetary terms. Whilst these methods have their place, their validity is often open to question. A further pitfall in the estimation of returns is the assumption that "Do Nothing" means that revenues continue to flow as at present, whilst the reality may be that they will deteriorate if no changes are made.
- **What does "Manage" mean?** It may seem strange to suggest the term 'manage' is unclear, but actually there is often confu-sion between different management needs. For example, com-panies may need to manage the ROI of innovation in order to:
  - Make the business case for new investment in innovation.
  - Justify and communicate the current level of innovation spend to internal and external stakeholders.
  - Demonstrate company value to shareholders or to potential partners.
  - Optimize the value of the innovation project portfolio.
  - Inform technology and business strategy development.

The management tools and approaches that you would use are not necessarily the same for all these differing needs, There are usually different stakeholders whose interests need to be considered, including the innovation management function itself, business leadership, potential partners and shareholders. This means that there are often challenges in establishing the right authorities and accountabilities to take management decisions on the innovation portfolio.

If these challenges are not properly addressed, there can be some undesirable consequences for the business, for example:

- Tendency to stifle long-term, higher risk/return, breakthrough innovation projects.
- Poorly optimized innovation project portfolio.
- Poor management decisions on key innovation investments.
- Imposed cuts on R&D and Innovation resources which could damage strategically important capabilities.

The net effect of these consequences can be very large indeed. We have worked for one packaging solutions company where the cumulative benefits of its R&D portfolio amounted to no less than 10 times what its historical performance would suggest, leading to a substantial but unnoticed shortfall in its innovation pipeline. On the other hand, we have witnessed how at a large and risk-averse chemicals conglomerate, people tended to discount R&D project business cases to such an extent that only the most incremental innovations made it through all stage-gate reviews.

So how can these challenges be overcome? Based on our experience working with a wide range of companies we have identified four key factors for success.

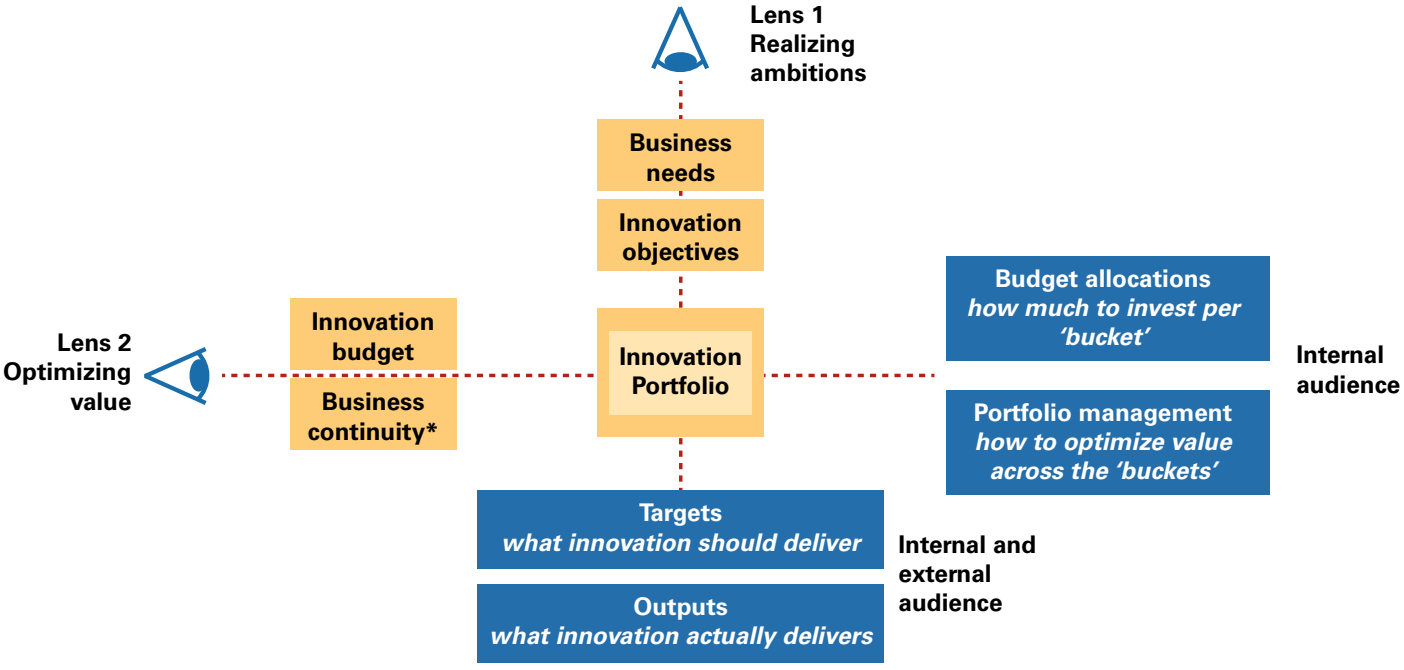
Four key factors for success:

1. **Articulate precisely your objectives in managing ROI and optimize their execution**

First of all, it is important to be clear about why you are managing ROI and who the outputs are intended for. It is helpful to consider two "lenses" through which the innovation portfolio of activities can be viewed:

1. Realizing ambitions
2. Optimizing value, as shown below.

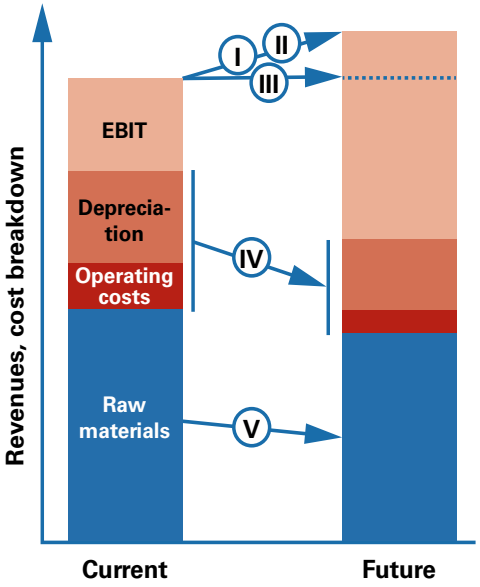
Table 2: Two lenses to view the Innovation Portfolio



Source: Arthur D. Little

* Especially essential requirements such as quality, safety or asset continuity

Table 3: Setting targets and objectives for different types of innovation



	Innovation type	Example approach
Product & service innovation	I Transform	• Grow new markets and new products/ processes/services
	II Enhance	• Grow in adjacent market areas (i.e. similar markets products/processes / services)
	III Defend	• Offer 'heart beat' of incremental product/process/service innovations
Process innovation	IV Increase asset / employee productivity	• Use technology to redesign supply chain concept • Realize process debottlenecking
	V Decrease raw material & energy intensity	• Reformulate ingredients • Change product/process /service composition

Source: Arthur D. Little

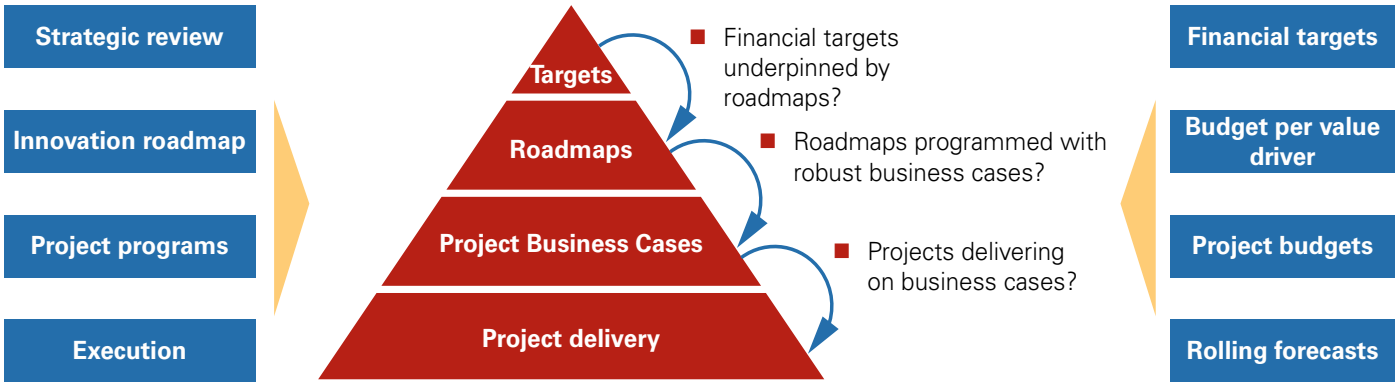
An effective management approach for the ROI of innovation will balance both of these views:

Lens 1 Realizing ambitions:

Managing value in this dimension firstly requires clarity on the targets for what innovation should deliver. Good practice in this respect is to set some quantified delivery objectives. We typically recognize five types of innovation, and it is helpful to set targets for each type, as shown above:

Distinguishing between different innovation types is important because the nature of the value (returns) is different between Process and Product/Service innovation. By setting targets it is possible to link innovation investment in a direct way to the achievement of business goals, and clarify what is – and is not – included in the definition. For example, a global MedTech company we have worked for adopts this type of approach through its use of 'financial innovation roadmapping', in which roadmaps connect business strategy to innovation projects in a very direct way, as shown below:

Table 4: Financial innovation roadmapping



Source: Arthur D. Little

[3] Arthur D. Little's book "Third Generation R&D Management" was a pioneering text on this subject

Lens 2 Optimizing value:

Most companies we know have the bulk of their governance and processes in place to deal with Lens 2, which falls largely in the realm of normal R&D management. There are several very good text books on the subject of project portfolio management[3] and a wide variety of supporting tools can be bought from vendors, ranging from off-the-shelf modules linked to ERP systems to highly tailored automated innovation suites. As always in managing complex business issues, the difference between 'acceptable' and 'good' or even 'great' lies not so much in adopting certain processes or tools, but much more in letting these work for you rather than the other way round.

A first limitation that many companies seem to have accepted (but shouldn't) is that their portfolio management mechanism does not allow them to manage 'innovation', but looks exclusively at (incremental) product development, as was also pointed out in the previous paragraph. The second common shortcoming is that portfolio tools present management with lots of data that is related, but not quite relevant, whereas it should of course enable smart decision making by answering those questions that matter most to any given audience and meeting agenda.

We have seen too many examples of companies where tools and processes have started to live lives of their own and where R&D managers and innovation boards have learned to 'go through the motions' while hardly ever getting to the most important or urgent questions at hand. The best portfolio management practices therefore are those that are designed to answer those questions at the right moment, using the right fact base to 'good enough' levels of detail and robustness:

2. Clarify accountabilities and governance approach

Setting clear objectives and measuring performance against them is one thing, taking appropriate management action is another. The best companies in managing their ROI of innovation have in place clear and appropriate accountability for taking rapid decisions, based on the monitoring and feedback information they receive. Good practice in setting up a structure for accountability and governance includes the following:

- Create a cross-functional body with sufficient authority to take rapid decisions on resourcing, prioritization, and go/no go for projects in the innovation portfolio.
- Avoid separation between R&D/Technical and Marketing/ Brand innovation project governance, since value is often created through integration and combination.
- Ensure that there are clear single-point responsibilities for implementation and maintenance of each of the chosen valuation processes, including data gathering, analysis and reporting.
- Formulate very clearly what responsibility and accountability means ("ownership of what?").

For example, a highly innovative chemical firm active in advanced materials has appointed a cross-functional team to create, update and manage a common innovation roadmap. This roadmap contains all major milestones to satisfy the unmet needs in priority market segments, and connects these milestones

Table 5: Commonly used R&D project portfolio analyses at leading companies

Key management questions	... and project parameters to optimize
Are we getting an optimal return on our project portfolio?	Rewards (e.g. EBIT or contribution margin) versus risk and investment
Are we working on the best projects?	Existing projects versus new project proposals (ideas)
Is our portfolio optimally balanced?	Investment versus time to market and "newness" of the product or technology
Are we utilizing all our material streams and assets?	Rewards (e.g. EBIT or contribution margin) versus material stream or asset
Should we accelerate certain projects?	Cost to deliver early versus additional rewards if launched earlier

Source: Arthur D. Little

to (technical) performance features, R&D and technology requirements, and the competencies needed to fulfill these. Meeting the major milestones in the roadmap is now a common task for both Marketing and R&D, and matching KPIs are used in yearly performance appraisal.

3. Take account of cannibalization and the "cost of doing nothing"

Developing a business case is like reading the altitude gauge in an airplane: cruising at 10,000ft above sea level offers little comfort when flying over a high mountain range. We have seen plenty of examples where forecasted sales of new products did not properly address the existing revenues these would be displacing ("cannibalization"). Or, conversely, business cases that conveniently assume existing products would continue to thrive into perpetuity at the same price levels and volumes, implying that there is no cost or penalty for doing no innovation at all.

Whilst it may be obvious that neither of such business cases is likely to be correct, in practice we see that these aspects are often overlooked. This may be acceptable if, for example, projects in a portfolio are very comparable in terms of market dynamics, but this is more the exception than the rule. Best practice in ROI valuation is for R&D, Marketing and other functions to work together to characterize and take account of:

3. Those sets of product-segment combinations in which current and future products compete for the share of wallet of similar customers.
4. Historical rates of margin erosion based on product life cycle analyses.
5. Likely product releases by competitors and of possibly disruptive technology developments.
6. Anticipated commoditization for existing and new product families. The higher the degree of commoditization, the larger the effect of cannibalization and the higher the likely cost of doing nothing.

Interestingly we observe that in many companies the Control/ Assurance function is stepping up to the plate to fulfill the roles of 'Legislator" (imposing requirements on how to develop business cases), 'Auditor' (poking holes in suspect proposals) and 'Arbitrator' (helping to resolve disputes). A benchmarking survey carried out in 2013 by Arthur D. Little on R&D support functions in technology-intensive industry sectors showed that most participants believed they would be increasing their spend on R&D-related Control in the coming years.

4. Use consistent logic and match valuation methodologies with levels of risk and uncertainty across the portfolio

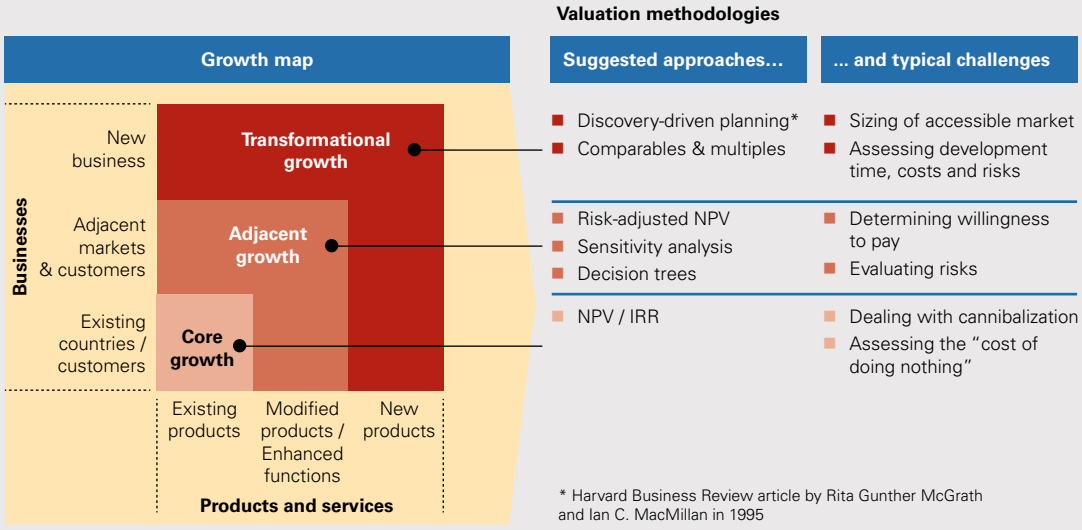
One of the most important requirements for robust valuation of a portfolio is to use consistent logic throughout. In practice this often doesn't happen. There are five principles that can be applied to help:

- Single source of truth: Use commonly shared data for important and frequently used parameters, such as market growth rates.
- Transparency: Apply clear and consistent methods, assumptions, approximations and calculation models.
- Shared ownership: Ensure that all functions, such as R&D and Marketing, understand and support the approaches being used.
- Feedback & learning: Capture, track and feedback actual post-launch data to help improve prediction.
- Fit for purpose: Distinguish between data and methodology requirements for major versus minor investments.

Selection of the right valuation approaches for parts of the portfolio with different risk and reward profiles is one of the most important aspects of good practice. One helpful way to look at this is to consider the basic Growth Map for products/services versus markets, as shown in Box 1:

Box 1 - How to obtain a realistic valuation of your innovation portfolio

Table 6: Matching valuation methodologies to varying levels of risk and uncertainty



Source: HBR, adapted and developed by Arthur D. Little

Core growth areas: NPV and IRR

Most companies need to defend and grow their core activities by launching improved products in order to cater to known needs of existing customers. Development costs, time to market, product volumes and price points can typically be forecasted fairly precisely, and normal financial evaluations based on discounted cash flows (DCF) can be applied, such as NPV (Net Present Value) and IRR (Internal Rate of Return). Even so, great care must be taken to consider cannibalization and the "cost of doing nothing", as explained in point 3 above. We note in passing that the boundary with the next category (adjacent growth) is somewhat blurred and that most companies do not include the full NPV value for projects early in their pipeline.

Adjacent growth areas: Risk-adjusted NPV, sensitivity analysis, decision trees

As we have seen above, companies increasingly need to grow beyond their existing core, developing opportunities in selling modified or enhanced products and services and/or to adjacent markets and customers. Given their intrinsic uncertainties, simply applying DCF calculations to such business cases will usually yield flawed results. Many companies therefore apply a probability-related discount factor, for which a robust and calibrated assessment of the probability of success during development and after product launch is required. Some companies use standard check-

lists for this, others have more sophisticated databases of similar projects in the past to which new opportunities can be compared. In any event, it is essential that business cases are not represented as a single number, but are accompanied by sensitivity analyses on key assumptions, and also show the results of possible alternatives in development or launch (for instance, using probability-weighted decision trees). Decision tree approaches are also useful for investments in platform developments with multiple applications, although care has to be taken that the methodology does not become too labor intensive.

Transformational growth areas: Discovery-driven planning, comparables and multiples

Transformational growth opportunities, on the other hand, typically defy any of these approaches. In fact, applying any kind of financial formula to whatever quantitative information is available typically makes the problem even bigger by taking away transparency and suggesting spurious accuracy. Innovation teams are much better off discussing business assumptions (such as minimal required market sizes) directly, an approach that has been referred to as Discovery-driven planning[4]. Rather than try to predict a discrete valuation, this approach assumes a minimum acceptable valuation for viability, and sets about clarifying and validating the assumptions that would need to be met for this to be realized. If it is proved that a key assumption is impossible to meet, then the project is killed. Interactive approaches can be used to elucidate the relevant assumptions and how various value parameters relate to them.
From a portfolio valuation perspective, this will only yield a range of values until the definition level is developed sufficiently to enable greater accuracy. Under such circumstances it often proves valuable to evaluate the opportunity by comparing it to what companies and investors have paid for comparable technologies and resembling market applications. This can be useful even if the resemblance is limited. For example, we have seen situations where project teams insisted that an opportunity was worth at least many tens of millions of dollars, but we could show that no Venture Capital fund had ever paid more than $10 million for similar types of technology.

Companies should resist the urge to simply add up the expected returns from these parts of the Growth Map to arrive at an overall estimate of the value of their portfolio. Though there are some useful approaches to doing so (such as by looking at historical cost-benefit results, or through regression analyses), these are always based on large comparability assumptions (between past and future results and between different types of R&D projects) which make them useful only in specific circumstances.

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[4] "Innovation Killers: How financial tools destroy your capacity to do new things" HBR 2008

Insights for the executive

With spend on innovation and R&D increasing every year, and with a greater proportion of that investment going to more uncertain breakthrough and long-term innovation, the pressures on companies to optimize their management of their 'Return On Investment' of innovation are intense. However, estimating and reporting the value being delivered by innovation investments remains challenging. Doing it badly can lead to problems such as long-term/radical projects being stifled, poorly-performing projects failing to be killed early enough, and strategically important capabilities being damaged through inappropriate cuts. Companies can overcome these challenges by taking account of four key factors for success:

1. Articulate precisely your objectives in managing ROI

Consider carefully your management objectives by considering two lenses to view the portfolio: Lens 1 (Realizing ambitions), which requires clarity on targets, strategic objectives and roadmaps; and Lens 2 (Optimizing value) which requires a balanced set of portfolio measures.

2. Clarify accountabilities and governance approach

Put in place clear accountabilities and governance systems for managing ROI, such as empowered cross-functional bodies, single-point responsibilities for valuation and suitable Control functions in order to ensure consistency of approach.

3. Take account of cannibalization and the "cost of doing nothing"

Ensure that the value impact of new innovations on existing core business is properly considered, both in terms of possible competition with core products, and potential deterioration of core business if the innovation is not implemented.

4. Use consistent logic and match valuation methodologies with levels of risk and uncertainty across the portfolio

Use 'single truth' key data sources, consistent methods, shared ownership across functions, post-launch feedback, and tailor the approach to the scale of the investment. Use assumption-focused approaches such as Discovery-driven planning to cover high uncertainty parts of the portfolio, and use external comparisons as reality checks.

Of course, managing the ROI of Innovation is in itself not enough to guarantee good business performance. Innovation success depends on having in place a comprehensive, integrated innovation management approach that covers several key 'building blocks'[5]. However, we have found that companies who manage the ROI of Innovation well consistently outperform others in the quality of their decision making, in the predictability of innovation results, and in getting the most out of their innovation spend.

[5]Prism S1 2013 'Getting a better return on your innovation investment'

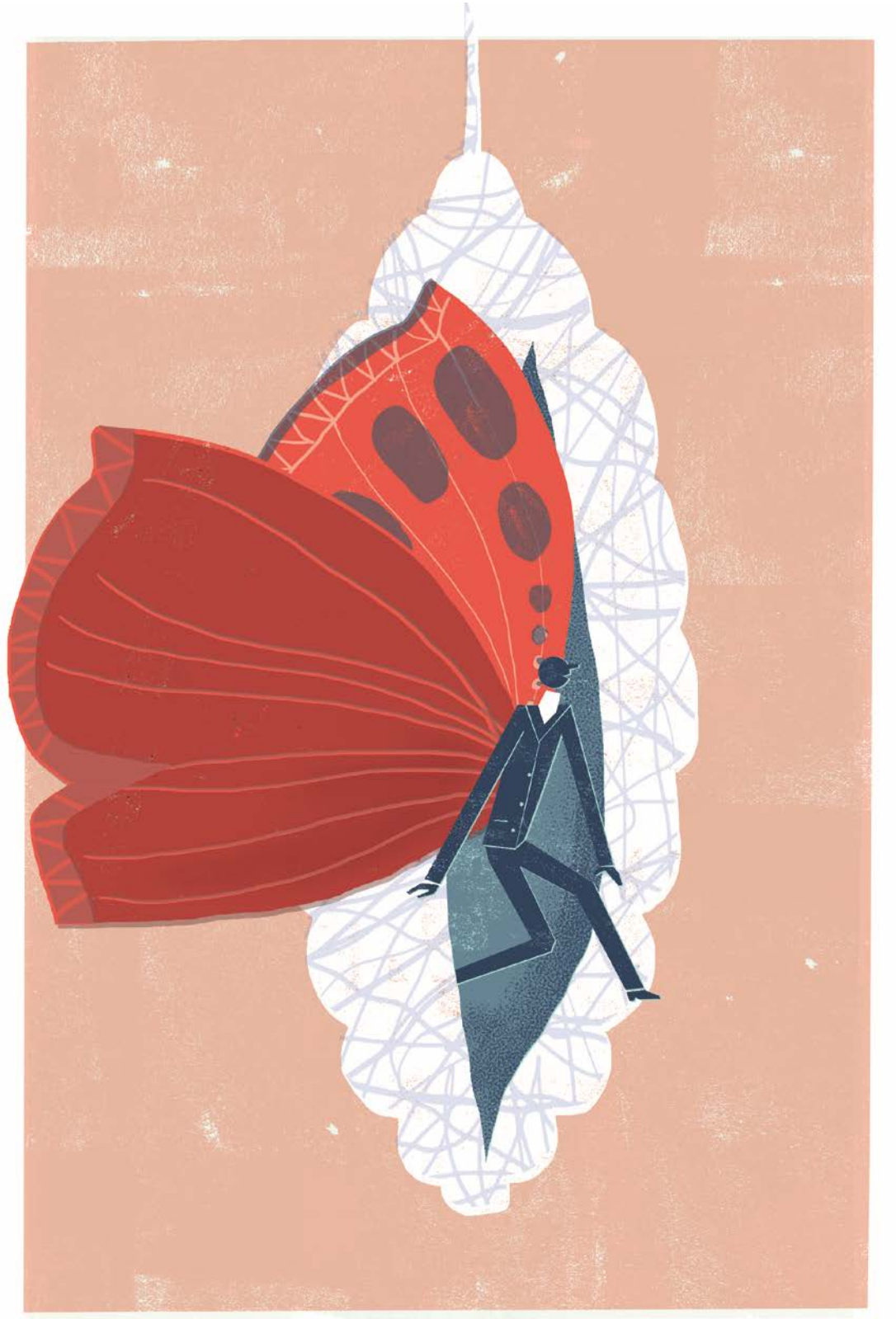


Illustration by Sylvia Neuner

The change side of transformation – a wolf in sheep's clothing?

How to go the last mile to make change approaches really effective

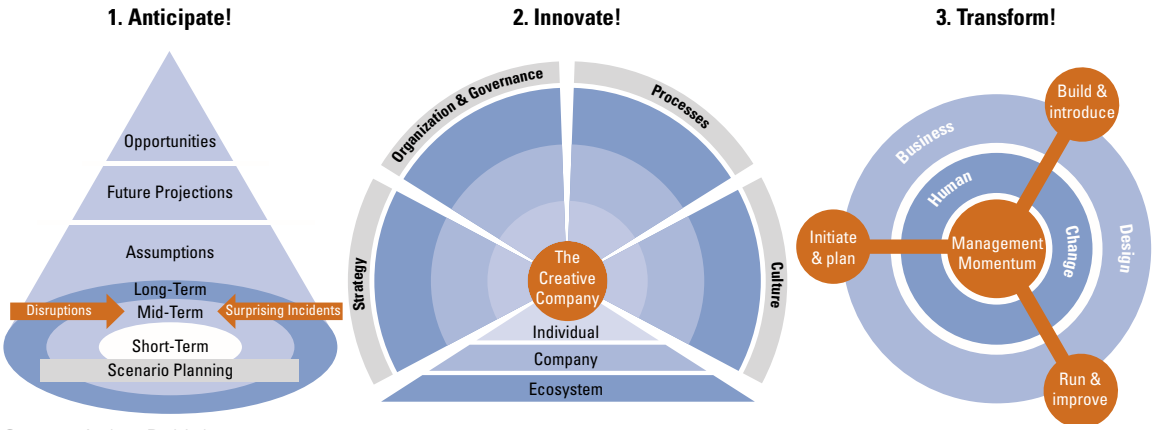
In the new era of "Hypercompetition", companies increasingly need to be agile enough to reinvent and transform themselves. In this article the authors take a closer look at transformation, focusing on the human or change management aspects which are widely recognized as being the key obstacles to success. Whilst there are some well-established approaches for managing these aspects, the success rate is still low. In this article the authors explore ways to improve the success rate through tailoring the approach to suit the type of organization and its prevailing culture.

Nearly 10 years ago Richard D'Aveni published an article that challenged the core beliefs of strategic thinking. The conclusion of this paper, titled "Waking up to the new Era of Hypercompetition", is simple but far reaching – our traditional thinking, that corporations have to develop strategies that will give them a "sustainable competitive advantage", is outdated. D'Aveni argues instead that the current phase of "Hypercompetition" calls for something else. We have to look for a competence that may be best labeled as agility – understanding the environment very quickly and coming up with appropriate responses that enable companies to adapt. At Arthur D. Little we have described this new business paradigm as the "Creativity Era". Over time we have developed approaches to deal with this challenge.

Today, companies, especially those in the digital arena like Apple or Google, have become masters in reinventing and transforming themselves – and whole industries. They have at least three features in common: They anticipate trends. They come up with innovative products, services and / or business models, and they transform a traditional and established business into a new structure.

In this article we will take a closer look at one angle of the anticipate-innovate-transform sequence – the capacity to transform. Our focus here lies on the human side – the change aspect – of transformation. So we will deal with individuals, teams, and organizational dynamics – rather than technical aspects such as transformation (migration) of IT systems – or changing business processes.

Table 1: Core competencies in the "Creativity Era"



Source: Arthur D. Little

Based on lessons from recent case examples, we will provide our insights into questions including: What does it take to transform a company? What are the typical failures and shortcomings in conventional transformation processes? How can we best overcome them?

Accepted models to deal with change are fine, but do not always lead to the desired results

Before we address questions, problems and shortcomings – here is some good news. Today, there is a widely accepted model to deal with the human aspects of change. In 1996 John Kotter published "Leading Change" – which is still essential reading for anyone involved in change management. Kotter's eight steps to successfully steer a corporation through times of change make good sense. Transformation programs require a compelling story ("Sense of Urgency"), a strong cross-hierarchical team ("Guiding Coalition"), a clear vision for where to go, good communication, empowered employees rather than just top-down procedures, quick-wins and consolidated gains which help to keep momentum, and finally a refined organizational culture that recognizes the right new behaviors. Arthur D. Little's own approach is based on this model (see below).

This type of approach has certainly helped many organizations to manage change, and continues to be broadly applied. However, the other side of the story is that, in far too many cases, despite the efforts of dedicated change managers, transformation projects simply do not work. CEOs often complain that the identified improvements and cost savings did not materialize, that the project got stuck or that the success did not last.

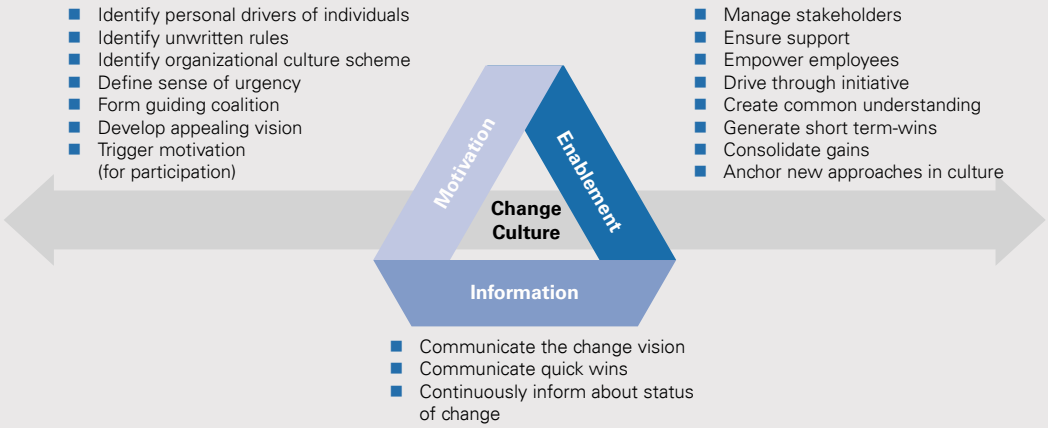
A recent study looking at the success rate of large-scale transformation programs backs up these impressions and provides some evidence about the root causes. The authors interviewed 822 participants from 63 countries. Over 79% of study participants used a structured methodology to manage the people side of change. However, in spite of this, the key obstacles to project success were related directly to people.

These findings correspond closely with the views of CEOs who ask us to support their attempts to turn around transformation projects that have run into problems. Nearly all of our clients had included change management expertise in their business transformation projects. But in the initial project phase they are confronted with problems that include:

Arthur D. Little's well-tried approach to transformation and change

Based on Kotter's logic, Arthur D. Little's own basic change management model recognizes three key success factors: Motivation, Enablement and Information. Project teams need to score well in these three dimensions to achieve what we would call a positive change culture.

Table 2: Arthur D. Little change management approach



Source: Arthur D. Little, based on John P. Kotter and own case experience

Table 3 Greatest change management obstacles

1	Ineffective change management sponsorship from senior leaders (e.g. poor alignment among key stakeholders)
2	Resistance to change from employees (e.g. strong resistance of those with the greatest knowledge and expertise on current systems and processes)
3	Insufficient change management resourcing
4	Division between project management and change management
5	Middle management resistance (e.g. fear of loss of power)

Source: PROSCI Benchmarking Report 2014 – Best Practices in Change Management (n = 822 companies)

- Mistrust: "We do not believe that this process is really open. It is most likely that the solution has already been decided"
- Cynicism: "Why should we invest energy and commitment in this process? Our comments are just window dressing"
- Opportunism: "I will keep quiet about what I really think. If I just wait, in the end I will be better off as I can just join the winning team"

The key point is that in today's business environment the ability to change has become a key factor for success. There is an abundance of change management methods available to foster transformation processes, and companies make considerable efforts to apply them. Yet, it seems that many of these conventional change efforts do not work or are even counterproductive.

Effective change and transformation projects require careful tailoring of the approach to make it fit

Our experience has shown that the key to successful change management is to recognize that not every situation is the same. Classical change paradigms are still very useful, but they must be tailored and interpreted according to the particular situation in order to be effective. It is useful to characterize this "particular situation" in terms of two dimensions: "Change Intensity" and "Type of Organizational Culture".

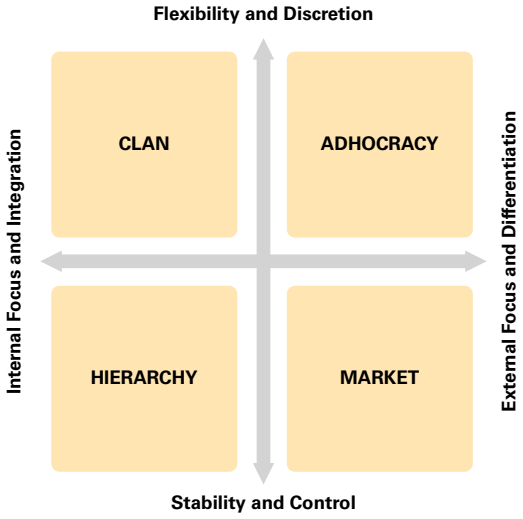
"Change Intensity" describes the scale of change / transformation – covering four levels, from modest to substantial:

- Tuning – for example, the introduction of a new customer relationship management approach
- Adaptation – such as adding a new sales channel to an existing dealership structure
- Reorientation – for example, setting up a new organizational structure
- Re-creation – which describes the complete reinvention of a business

There are no sharp boundaries between these levels of change intensity, but there are big differences. For example, it is obvious that the task of "creating a sense of urgency" will differ dramatically between a "Tuning" exercise and a "Re-creation". To determine the "Change Intensity" of a program a set of criteria can be applied, for example through a workshop format, before any change or transformation activity starts.

With "Type of Organizational Culture" we consider the "Personality" of an organization. There are four broad types, as shown below, based on the axes of Flexibility/Discretion vs Stability/Control, and Internal focus/Integration vs External focus/ Differentiation.

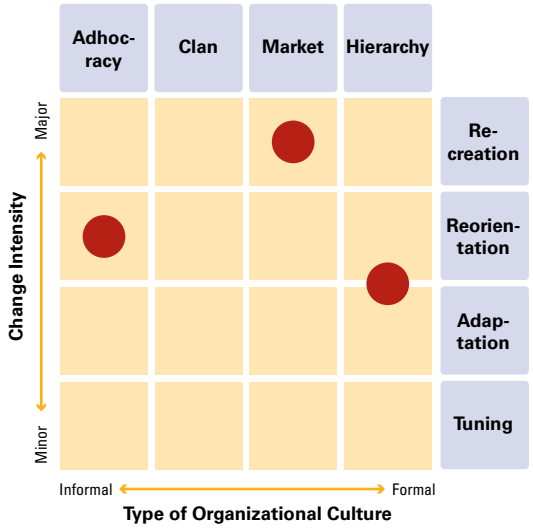
Table 4: Cultural types



Source: Arthur D. Little based on Nadler and Cameron/Quinn

For example, a company that cherishes personal relationships more than rules is referred to as a Clan culture, whereas a company that emphasizes ranks, titles and rules is a Hierarchy culture. There are also companies that are strongly driven by market needs (Market), and those that value flexibility and responsiveness to new ideas and innovations above all else (Adhocracy). Again, there are no sharp boundaries, but each of them requires a different "medicine" when it comes to change and transformation.

Table 5: Framework to tailor change / transformation programs



Source: Arthur D. Little based on Nadler and Cameron/Quinn

Combining the two dimensions provides a valuable framework to help tailor the change program approach, as shown below.

We see examples of companies with cultures in all four categories, from Adhocracy to Hierarchy, and in some larger corporations there may be more than one culture type in different locations or business units. Many change programs aim to preserve the prevailing culture during transformation, while other programs require a shift from one culture type to another as part of the process. Transformations with the greatest "Change Intensity" are clearly the most challenging to achieve.

The way this approach works in practice can be best illustrated by introducing the following three real-life case examples, two of which focus on the biggest challenge of "Re-creation", and one on "Reorientation."

Case study 1: "Re-creation" in a Clan environment

A global leader in logistics with offices around the world had suffered from long-term margin erosion. Over the years it had applied a number of typical fixes, including process improvement and IT modernization. When all of these failed to lead to the desired effect, it appointed Arthur D. Little to run a project to drive change through stronger governance. Driven by the corporate headquarters, the central steering system for this highly decentralized corporation was to be strengthened to allow for a more consistent approach to alignment and efficiency. The deliverables were clearly specified as "new structure and organizational charts", "steering system", "new job descriptions", and "shared service centers". After a phase of conceptual development, the new governance system was to be implemented. On the way, "communication and change" were to be addressed.

Assessing the transformation task

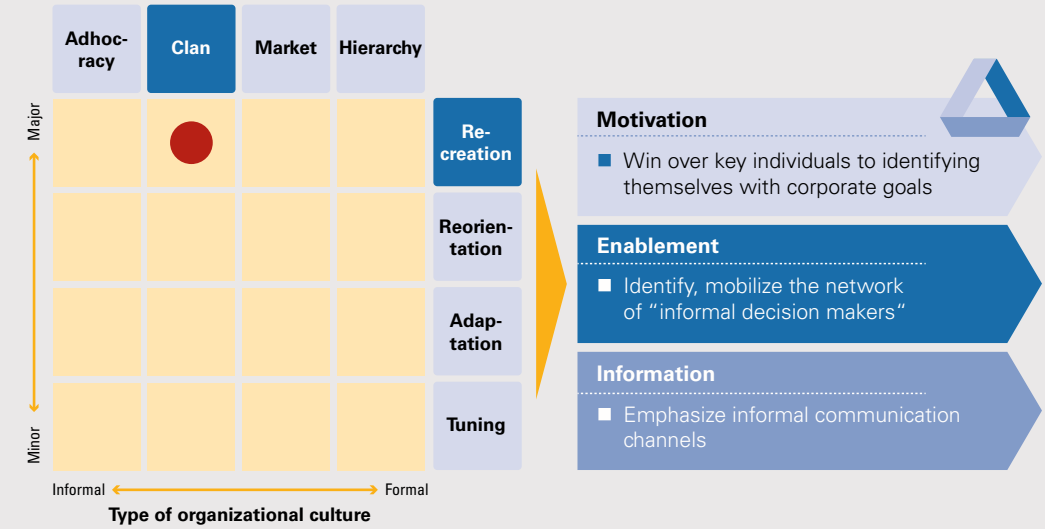
Looking at the tradition, project history and competitive environment of this company, we concluded that this project was much more than just a change of structure and governance. It was a major reorientation (i.e. a Re-creation), which was being initiated from the top. Like many other companies, this client was very well structured and organized in a formal sense. However, in analyzing the current culture, it became clear that the real power was not at the top, but actually resided in a number of pockets and niches. And it was bound not to the formal hierarchy, but to individuals who entertained personal relationships and "old boys" networks. Both of these elements meant that a tailored interpretation of the classical change program model was needed.

Shaping a tailored change program

Based on an initial assessment, the normal meaning of "Sense of Urgency" was turned around, so that rather than articulating and communicating top management's "urgency", instead we explicitly focused on the views of the many decentralized units. Next, the "Guiding Coalition" (i.e. the change team) did not follow the traditional headquarters' logic, but rather reflected the perceived – not the formal – position and profile of employees and managers. This turned out to be a very colorful and cross-hierarchical group.

A Clan culture does not always communicate through project newsletters, web sites and formal company information. It is also not always receptive to more modern and "hip" ways of communication but instead prefers the personal approach. All formal communications were therefore kept to a bare minimum, with no glossy newsletters, no big "town hall" announcements or declarations, and no formal message cascades. Instead, a number of personal exchanges, talks and regular phone conferences were introduced to reinforce key messages, building on the availability of empowered employees across regions and markets. Competition and regular monitoring were used as incentives, with different units competing against a common target. They were measured, monitored and advised but never controlled. "Quick Wins and Gains" were a cornerstone of the corporate culture. Every project step and every communication was intended to make a clear reference to results.

Table 6: Key learnings for major transformation in Clan Cultures



Source: Arthur D. Little, based on Cameron/Quinn

Results and learnings from this case study

At the end of this project, all the specified deliverables were in place with a new organizational set-up that harmonized a previously diverse structure. This was supported by new job descriptions and all the other project deliverables. The key difference, however, was that the change was discussed, adopted and personally promoted throughout the company. Whilst the general change paradigm was followed, lasting results were achieved through interpreting, adapting and bringing it to life within the organization in a way that suited both corporate culture and the nature of the change.

Case study 2: "Re-creation" in an Adhocracy environment

A travel management company had seen remarkable success, growing its business within 10 years to become a national market leader. Consequently, it had embarked on a course of international expansion, creating subsidiaries across the world. However, it could not seem to globally replicate the success achieved in its home market. The company therefore initiated a change program to address the issue.

Assessing the transformation task

Initially the company had pictured itself as having an entrepreneurial, but controlled, "Market" culture. Hence, the original aim was to replicate this culture internationally, promoting entrepreneurialism and taking steps to limit the growth of the unwanted bureaucracy that usually accompanies global operations. However, the initial assessment, which included management workshops, collation of work-practice examples and a structured questionnaire, revealed a different picture. Instead of being a Market culture, a core pattern of Adhocracy was apparent – rather than relying on stable structures and controls, the organization flexed rapidly according to signals from the market, new ideas, and

signals from financial investors, for example. Whilst Adhocracy was well suited to a high-growth start-up environment, it was less suited to international growth – with so much flexibility, how could new people hired in foreign markets understand what they needed to do? A senior management workshop was held to envision the desired culture and values of a successful global company, and to illustrate the huge gap between this and the current situation.

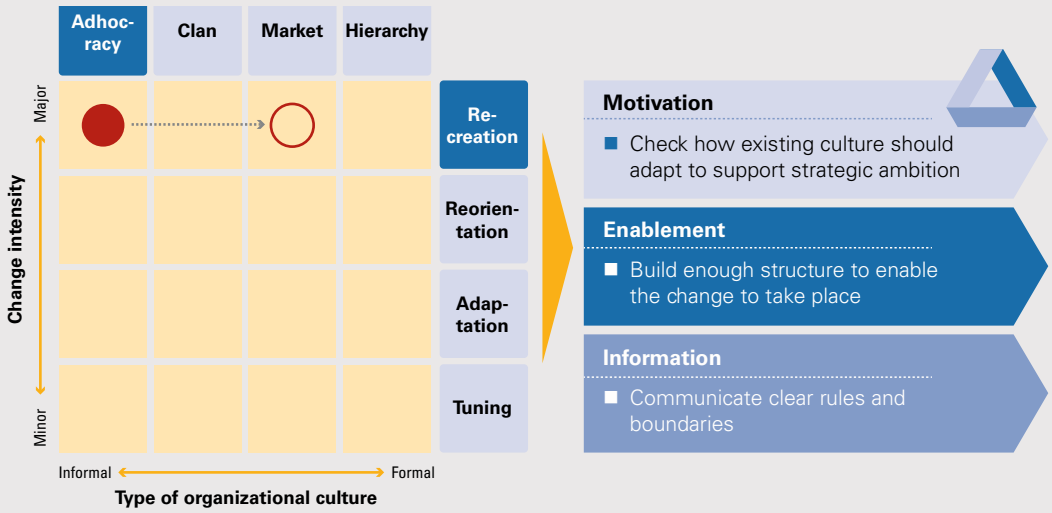
Shaping a tailored change program

The assessment showed that the culture of the company was such that the classical approach of "Creating a Sense of Urgency", "Building a Guiding Coalition" etc. would not work straight away. Too much emphasis on cooperation and collaboration on top of a weak core process foundation had, in the past, created a sense of cynicism and frustration instead of excitement, and resulted in slow motion instead of rapid growth. Therefore, the change program was reconfigured to focus first on clarity of head office core processes and culture. This was actually almost the opposite of the original intention of focusing on "limiting bureaucracy". However, once this had been done, the rest of the change program could be carried out much more effectively.

Results and learnings from this case study

In this example the gap between the current situation and the desired ambition was too wide to be able to make the desired change in one step – the prevailing Adhocracy start-up culture was unsuitable for a coordinated international organization. The key lesson is that transformation programs need to carefully consider the current situation and the ambitions that are being formulated. Whilst in some cases a bridge can be built by classical change management methods, if the gap is too wide work may need to be done initially to build a firmer foundation – even if it feels "counter-cultural" at first. This will avoid meeting hurdles later on that cannot be easily overcome.

Table 7: Key learnings – Re-creation from an Adhocracy to a Market culture



Source: Arthur D. Little, based on Cameron/Quinn

Case study 3: "Re-creation" in a Hierarchical environment

The department responsible for building and maintaining track infrastructure for the public transport provider of a major city was a highly specialist organization. It was staffed by highly experienced and competent employees. The newly appointed head of the department realized early on that numerous changes were going to be required if the organization was going to cope with two challenges – a major increase in new-build and infrastructure programs over the next 10 years, and the impending loss of highly experienced people only a few years from retirement. It was critical therefore to shape a new high-performing, collaborative, team-based organization before these experts left.

Assessing the transformation task

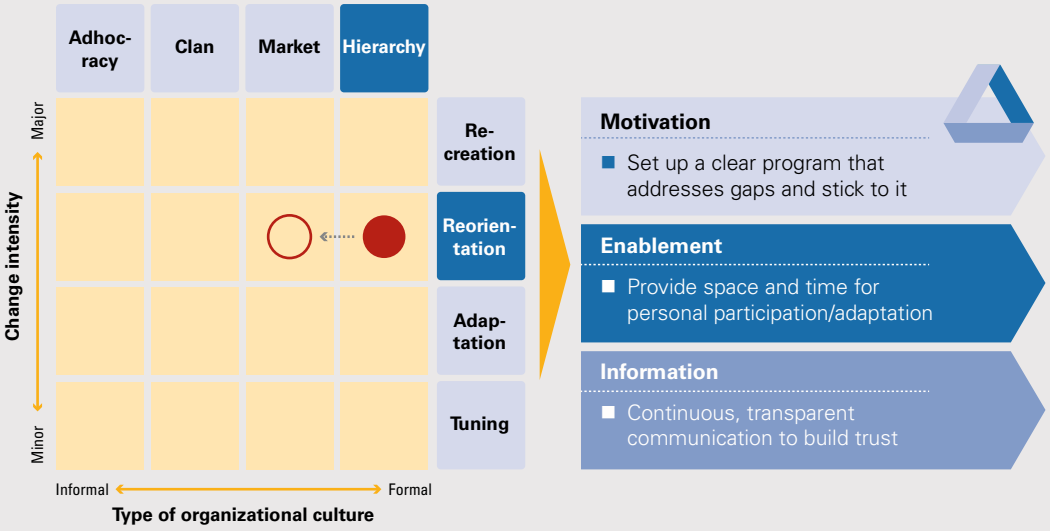
The head of department realized that while the company had strong systems and controls for its core track infrastructure maintenance activities, it was very weak in terms of arrangements to manage the human requirements needed to create a a collaborative, team-oriented organization. It was clear that a "quick-fix redrawing of reporting lines" would not be sufficient.

The initial assessment, which was conducted by means of a thorough interview program encompassing all employees within the department and its key stakeholders, confirmed that there was a strong Hierarchical culture. With the aim of controlling risks and avoiding accidents, the former department head had kept strict control over operations, holding onto all power and letting no one else take true responsibility without first checking with him. This command-and-control leadership style, in combination with weak guidance from company leadership on the department's strategic goals, had resulted in a severe lack of trust in the leadership team among people in the department. There was a widespread opinion that no one outside the department saw, understood, or recognized the hard and important work the people there did. It was now necessary to maintain the engagement of key staff, to build trust in the organization, and to create an environment where young and talented employees could start to take responsibility and grow their experience.

Shaping a tailored change program

The change involved a significant Reorientation from a purely Hierarchical culture towards a more Market version. Stronger involvement of key people in important decisions, as well as broader participation of all employees in the transformation project, were key to building trust, not only for the program itself but also for the new leadership of the department and company. A common vision for the department's desired future state, empowering the need for change, was created. Based on this, a comprehensive one-year transformation program was developed.
The transformation program set up a mission-oriented organization with clearly defined roles, responsibilities and authorities that addressed the identified gaps between the department's current situation and the desired position. One key aspect was to provide people with short-term measures to make their day-to-day work easier. Despite some initial resistance from a handful of people in the organization who feared losing power, employees demonstrated strong commitment throughout the whole project, with full ownership of the results that were generated.

Table 8: Key learnings – Reorientation from a Hierarchy to a Market culture



Source: Arthur D. Little, based on Cameron/Quinn

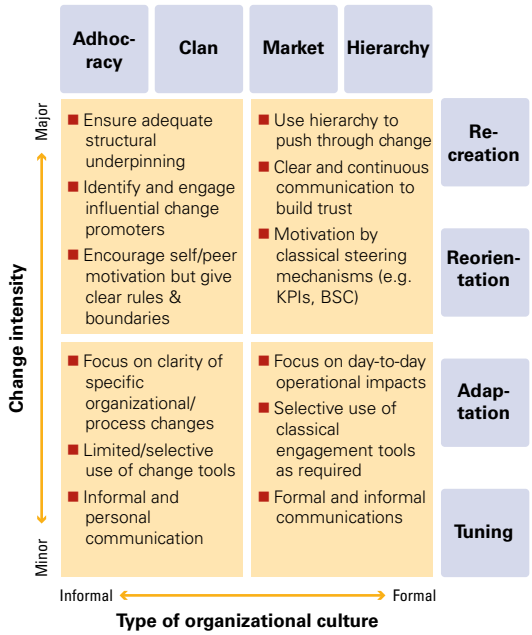
Conclusions

The examples above illustrate that change programs are very individual exercises, and careful tailoring is necessary to avoid falling into the common pitfalls of adopting a "standard" change management approach. However, by considering the two dimensions of "Change Intensity" and type of "Organizational Culture", it provides some ideas on how to orient the change program:

- More informal cultures (Clan and Adhocracy) do not respond well to the tactics of classical change approaches, such as workshops, newsletters, blackboards and web sites. For major changes (Re-creation or Reorientation), there is a high risk that change programs that rely on traditional tools can even be counterproductive.
- More formal organizational cultures (Hierarchy and Market) are more conducive to classic textbook change program approaches. This is particularly true for modest changes (Tuning and Adaptation), but will also work for major programs, provided that structures and hierarchies are also suitably modified.

This is illustrated in the generic summary below:

Table 9: Generic Change Strategies



Source: Arthur D. Little, based on Nadler and Cameron/Quinn

Insights for the executive

In this era of Hypercompetition, the capacity for companies to transform themselves is a key success factor. Today, we have well-established methodologies and approaches that can help to get the transformation job done effectively.

However, the continued low satisfaction rate, especially in terms of the "people" side of change, means that we need to avoid applying these classical methodologies in the same way for every project. Instead, we need to carefully consider the cultural "personality" of the organization and the intensity of the change that is being sought, and define an individual approach that fits. Using the "Change Intensity"/ "Type of Organizational Culture" framework can help in this process. We summarize the Dos and Don'ts as follows:

Table 10: How to make Organizational Transformation effective?

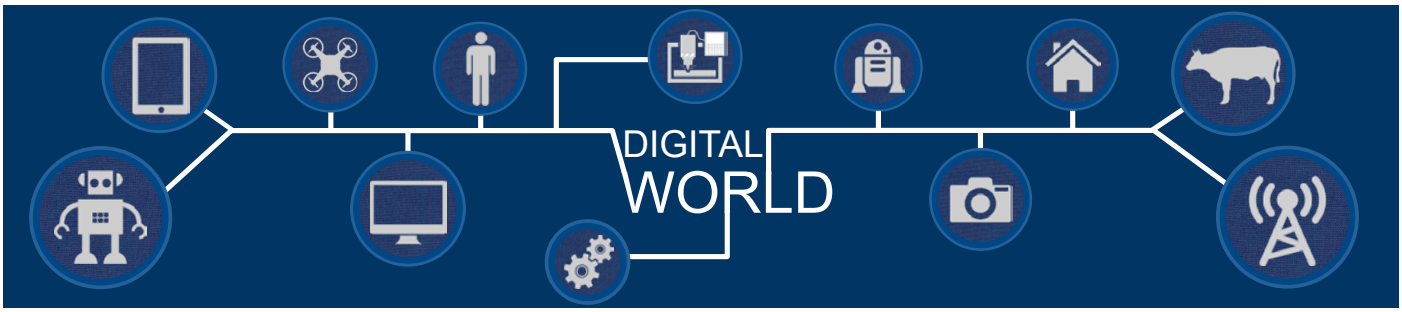
Do's	Don'ts
Do focus on precise management of the "hard facts" of the change: Organizational charts, role descriptions, processes, but....	...don't underestimate the importance of the "soft factors" and hidden cultural barriers: the "unwritten rules" in your organization
Do apply state-of-the-art change management methods, but...	...don't skimp on the initial assessment to tailor the change approach to your context
Do use formal approaches where these are effective, but...	...don't underestimate the need for informal and unconventional approaches in many situations

Source: Arthur D. Little, based on Nadler and Cameron/Quinn

Standards and methodologies are important – but very often it is actually the unconventional, informal, and sometimes counter-intuitive techniques that make all the difference between success and failure. With this mindset, executives shall be well equipped to make the wolf step outside the sheep's clothing and engage in a fair match.

Future of operations in the digital world

Industry 4.0: CEOs' master plan for driving the race in performance excellence



Industry 4.0 and the related new technologies, such as the "Internet of Things", "cyber-physical systems" and "additive manufacturing", will drive radical performance improvements in terms of cost and customer excitement. CxOs in all industries are currently defining their ways to explore and exploit the benefits. The bad news is that the variety of technologies and limited number of industrialized examples make it hard to understand the complexity of the topic. The good message is that this is far more than buzzwords. The new technologies have actual game-changing potential. Savings of between 15 and 50 percent per cost line can be achieved on the operations side. Leaders need to act now. The challenge is to define a powerful operations concept that is forward looking and ensures measurable short-term benefits.

Technology opportunities drive radical performance improvement in future operations

Industry 4.0 and its related technologies offer great opportunities to accelerate and streamline all kinds of operations processes like R&D, procurement, production, logistics and customer relationship management. But the list of technologies and buzzwords is long: Industry 4.0, smart factory, cyber-physical systems, digital revolution, Internet of Things, data-driven business models, augmented reality, additive manufacturing, virtual manufacturing, Workplace 4.0, predictive analytics, cognitive analytics, analytics among others.

Understanding what is only hype, what brings value and how to transform

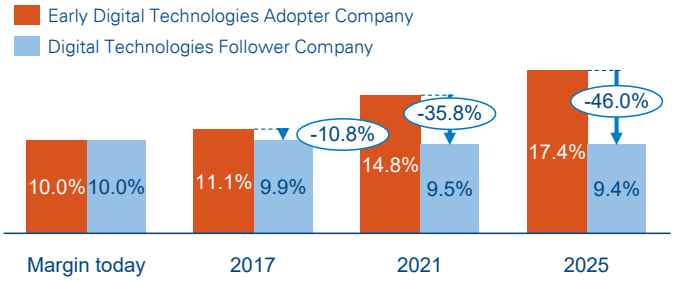
Few companies have organized themselves well and have systems and structures in place to manage the future of operations. CxOs are reporting that they are lost as far as understanding what is only fashion versus what brings real value and hopefully a competitive advantage to their companies. They also ask themselves how to organize a continuous transformation towards a future-of-operations target picture, how to be reactive to technology disruptions in an agile way and, last but not least, how to gain access to required technologies.

Risks are non-competitive operational performance, stranded investments and lost profits

In these disruptive times most companies are at risk. In our current "Digital Transformation" study we have found that more than 80% of the companies have no clear target picture and transformation plan regarding Industry 4.0 and the related digital and non-digital technologies. They are designing and developing their operational performance by accident. The funding for the differentiating investments in operations redesign and technology does not come through – moreover, it is diluted.

The opportunity is to become industry leaders in EBIT margin development and operational agility.

In several operations projects we have modeled the cost advantage an early adopter could achieve over a follower. The results depend on who you are exciting or threatening. On average, an early adopter improves by 10% within two years and almost doubles EBIT margin in 10 years.



Five-step management agenda to make it happen

Defining, building and operating an enhanced operations model using new digital technologies is a significant challenge for the CxO suite: underlying technology bandwidth is beyond the available competences of almost any traditional industry player. Implementation times for global Industry 4.0 projects are beyond the horizon of technology developments, and their evaluation can be assessed. Capex and investment required for globally consistent business model changes in operations exceed typical investment budgets by far. So how can these challenges be overcome? Five steps are necessary to fully leverage technology and value-chain opportunities to become an industry leader in operational performance:

1. Understand the relevant technologies and their maturity levels
2. Identify and describe concrete applications of these technologies per operations function
3. Determine each of these applications' value and define a target picture
4. Define a transformation path and launch a portfolio of concrete implementation projects
5. Establish technology access and an innovation network

Each of these steps has its own success factors and benefits.

Functions	R&D and innovation	Supply Chain configuration	Processing and Assembly	Logistics	Quality and maintenance	Sales and planning
Key Technology (examples)	■ Big Data ■ AR ■ Simulation ■ Cyber Physical Systems(CPS)	■ CPS ■ Simulation ■ Reconfig-urable machines	■ Smart Robots ■ AR ■ Big Data ■ Advanced machining	■ Internet of things ■ RFID ■ Augmented Reality (AR)	■ IoT and CPS ■ Big Data ■ Smart robots ■ AR	■ Big Data ■ Simulation ■ Internet of Things
Example applications	■ 24/7 R&D ■ Virtual innovation networks ■ Innovation sourcing ■ ...	■ Virtual network optimization ■ Virtual supplier integration ■ …	■ Agile Global performance management ■ Augmented assembly ■ Collaborative robotics ■ …	■ Cloud based end-to-end and real time material tracking ■ Smart intra-plant material transport ■ …	■ Inline process and quality control ■ Predictive quality analytics ■ Augmented quality control ■ …	■ Predictive demand and supply chain planning ■ Digital show rooms ■ …
OPEX potential	10-25%	15-25%	15-20%	35-50%	15-45%	10-40%

Step 1: Anticipation and understanding of relevant technologies

Understanding technology is key to anticipating the future operating business model. Relevant technologies can be clustered into five categories:

- Data-based technologies contain applications around virtual manufacturing, simulation, augmented reality and predictive analytics.
- Connectivity-driven applications allow connection of the virtual world with the physical, such as cyber-physical systems, the Internet of Things and collaborative robots.
- Advanced equipment and machining need to be incorporated – often specific to the requirements of products and services. In addition, smart energy systems and additive manufacturing contribute to this sector of technologies.
- Value-chain networks and ecosystems change rapidly, and therefore need to be explicitly analyzed with regard to a converging ecosystem (integration with customers, suppliers and other players), centralization or de-centralization of value-add, and crowd intelligence technologies.
- Finally, solutions for enhancement of operator productivity, such as virtual workplace technologies and e-learning, need to find their way into the relevant set of technologies.

Top management needs to install intelligence for identifying and exploring relevant technologies, as well as develop information about practical application and maturity stage per technology. This capability can be installed in-house or sourced from a third party. Arthur D. Little maintains a comprehensive technology database highlighting the most relevant information to understand these technologies efficiently.

Step 2: Identification of possible technology applications to enhance the operating model

Identifying relevant applications in the company's operations is a straightforward approach: every relevant technology is analyzed for potential applications. For each function in the operations, whether it is R&D, processing, maintenance or other, a long list of applications is derived. Regardless of business-model enhancement or opportunity to drive productivity, technology, application and potential deployment date (depending on technology maturity) are listed. This step is essential, since it bridges technology intelligence and the subsequent step of operations strategy. To cover the technology bandwidth and expertise in relevant fields of operations, a team of outsourced technology experts and in-house operations specialists is required.

Step 3: Business case and target picture development

Every single technology application is evaluated regarding its contribution to monetary and qualitative benefit potentials: EBIT improvement, working capital and asset reduction, increase of operations agility, competitive position and proposition. This evaluation is done per application and operations area. If data is missing (e.g. quality or maintenance cost), a company-specific baseline model needs to be developed. Finally, the puzzle of high-benefit applications is put together and a target picture with a 5–10-year horizon is developed. Since technologies mature unpredictably, this target picture needs to be reassessed and if needed be adjusted annually.

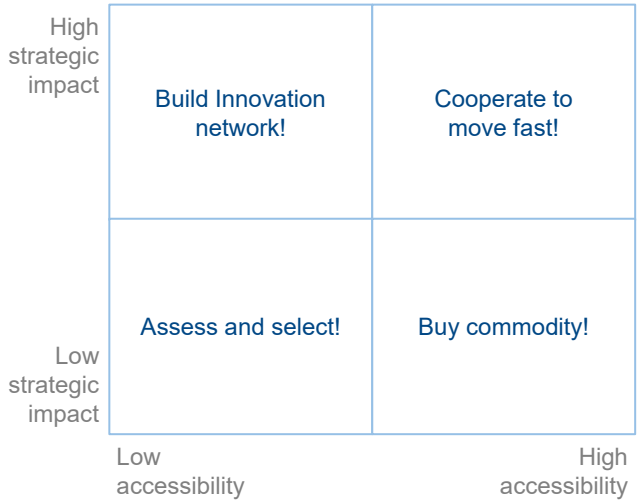
Step 4: Transformation approach determines how the wheel keeps turning

To implement successfully, momentum and continuity are key. Pilots with significant and short-term measurable financial impact based on available technology are defined and conducted first, with the respective projects rolled out globally. Speed is key – amortization should be less than two years. Savings are reinvested to launch the next series of pilots and projects. Therefore, the level of initial investment determines the transformation schedule. Depending on the progress of projects rolled out and the organizational capability, further pilots and projects are kicked off subsequently. By doing so, transformation towards "Industry 4.0" is overseen as a portfolio of dedicated projects with respective multi-project management – and therefore manageable with well-known tools.

Step 5: Building capabilities and establishing technology access

Careful decisions need to be made about whether competence for single technologies should be built in-house. Should a company invest in a predictive data analytics center? Is it required

to keep product data modeling along value chains as a core competence? The make-or-buy decision for each technology determines the future operating model. For technological competence to be built up, careful selection of the acquisition strategy is on top management's agenda: cooperation, acquisition (of players) and partnering strategies are the key dimensions. Central capability needs to be built up regarding the set-up and management of multilateral innovation networks – initiatives without dedicated partner management approaches typically require more time or fail.



Conclusion

The (digital) technologies now becoming fully available for industrial companies are going to re-intensify the efficiency race that is already taking place in all manufacturing industries. Because of the game-changing potential these technologies can bring, each company will have to manage them sooner or later.

By being proactive today, companies ensure that they will stay ahead, at least in this race, which will enable them to match their competitors on cost. At the same time, they have the best chance to identify new business models and unique selling propositions enabled by technologies in their industries. Through this, companies can build truly sustainable advantage outside the efficiency race.

The best way to be proactive on this is to start the transformation in a targeted way. The target is to focus on key long-term technologies and, at the same time, on specific pilot implementation projects. This enables companies to build practical experience and expertise with these technologies and reinvest the savings from these projects into technologies for the next wave of projects.

Case Example

A leading Tier-1 automotive supplier with several hundred manufacturing sites decided to take a proactive approach to incorporating modern technologies into its manufacturing and supply-chain operations. A key challenge for the supplier was to organize such an endeavor effectively across divisions. The divisions of the supplier serve products that are technologically different to those of their OEM customers. Due to this, the operations are historically organized at division level, with limited standardization and centralized control.

Together with Arthur D. Little, the supplier organized a cross-divisional project to identify and assess the key technologies for optimizing its own operations in the coming decade, and to implement an organization to launch and manage the transformation associated with implementing these technologies.

The joint project assessed 20 different technology areas and ranked their potential for the different parts of the operations based on current technological maturity, savings potential and required implementation effort. Based on this assessment, the key technologies for the supplier were selected, and a new organization was established at group level to drive these technologies into the operations.

This organization is responsible for realizing the estimated 1.2 bn. EUR of savings enabled by these technologies until 2025 by developing expertise, building networks with technology providers and other early adopters, and maintaining an ambitious portfolio of pilot and implementation projects. The first round of 20 implementation projects, launched during the project with Arthur D. Little, is already scheduled to bring savings of 70–100 m EUR within three years.

Contacts

Austria
Wilhelm Lerner
lerner.wilhelm@adlittle.com

Belgium
Marc Herlant
herlant.marc@adlittle.com

China
Russell Pell
pell.russell@adlittle.com

Czech Republic
Marcel Hominda
hominda.marcel@adlittle.com

France
François Deneux
deneux.francois@adlittle.com

Germany
Wilhelm Lerner
lerner.wilhelm@adlittle.com

India
Vikas Kharbanda
kharbanda.vikas@adlittle.com

Italy
Fabrizio Arena
arena.fabrizio@adlittle.com

Japan
Satoshi Ohara
ohara.satoshi@adlittle.com

Korea
Kevin Lee
lee.kevin@adlittle.com

Latin America
Guillem Casahuga
casahuga.guillem@adlittle.com

Levant Region
Vikas Kharbanda
kharbana.vikas@adlittle.com

Middle East
Vikas Kharbanda
kharbana.vikas@adlittle.com

The Netherlands
Michael Kolk
kolk.michael@adlittle.com

Nordic
Ulrica Sehlstedt
sehlstedt.ulrica@adlittle.com

Singapore
Vikas Kharbanda
kharbanda.vikas@adlittle.com

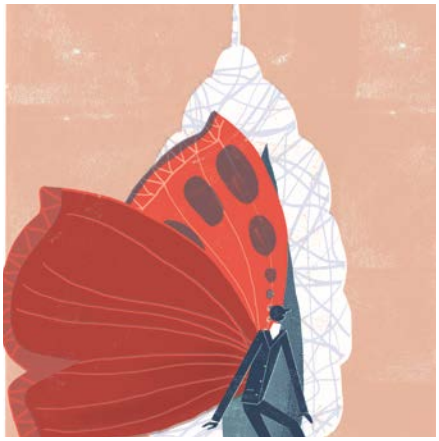
Switzerland
Wilhelm Lerner
lerner.wilhelm@adlittle.com

Spain
David Borras
borras.david@adlittle.com

Turkey
Coskun Baban
baban.coskun@adlittle.com

UK
Richard Eagar
eagar.richard@adlittle.com

USA
Craig Wylie
wylie.craig@adlittle.com



Our Healthcare Practice

Our Healthcare practice provides a range of services that can help you tackle your most complex issues. We offer side by side support with Innovation, Quality & Regulatory, Supply Chain Transformation, and Private Equity & Due Diligence services. We pride ourselves on the deep expertise of our consultants, many of whom have previously worked in industry. Our style is to be 'thought partners' with our clients, challenging conventions and offering creative yet pragmatic solutions. We feel that this approach sets us apart from many others and best drives value for our clients.

Arthur D. Little

Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations. With over 30 global office locations we provide worldwide reach with local presence.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. Arthur D. Little is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

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