STRATEGIC IMPACT OF IT TRENDS

IN THE PHARMACEUTICAL INDUSTRY

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LIST OF ABBREVIATIONS

BD&A	Strategic Big-Data and Analytics
BYOD	Bring Your Own Device
CISR	Centre for Information Systems Research
CoE	Centre of Excellence
DoI	Diffusion on Innovation
EIU	Economist Intelligence Unit
ERP	Enterprise Resource Planning
FDA	Food and Drug Administration
HBR	Harvard Business Review
HR	Human Resources
IoT	Internet of Things
IT	Information Technology
M&A	Mergers and Acquisitions
MGI	McKinsey Group Institute
MIT	Massachusetts Institute of Technology
MNC	Multi-National Company
NSA	National Security Agency
PEIT	Processing Enabling Information Technology
R&D	Research & Development
RoI	Return on Investment
S&M	Sales & Marketing
SSC	Shared Services Centre
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TCO	Total Cost of Ownership
TOE	Technology, Organisation and Environment Framework

FOREWORD

To keep up or stay ahead of the competition, firms are increasingly looking towards technology for answers. Technological developments in fields such as data and analytics, and more recently in products where hardware, microprocessors and sensors are fused together are reshaping not only the way firms do business but also how they are configured internally. However firms cannot afford the opportunity to follow these developments blindly- resources are limited and so is the managerial attention.

Identifying areas where to allocate the precious resources requires managers to understand the trends and what they mean for their industry. The importance of this in industries such as pharmaceuticals where resource commitments can reshape the operating model and disrupt the value chains is enormous.

Through this book André Correia offers the reader an opportunity to understand how pharmaceutical industry is responding to the current technology trends. André presents several key questions managers need to answer before separating what may be a technological fad rather than one, which has long term implications. The book also offers insights into the challenges of adapting new technologies in pharmaceutical industry.

Lastly André goes beyond pharmaceutical industry to provide convincing insights and recommendations for managers from other industries.

Ajay Bhalla

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ACKNOWLEDGEMENTS

I would like to take this opportunity to thank my wife for all her support and my son for his positive attitude and smiles, which gave me motivation when I needed it the most in order to carry on. I would also like to thank my parents, sister and in-laws for their encouragement.

I would also like to thank Professor Ajay Bhalla for his availability and guidance throughout the research done for this book and his thought-provoking questions, which made me go many extra miles and learn along the way.

Finally, I would also like to thank everyone who contributed to this report by answering the survey and providing me with industry and technology insights.

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EXECUTIVE SUMMARY

A quick glance at the pharmaceutical industry shows that it can be a very profitable one, but also one with a significant cost component in its income statement. An increase in life expectancy and the number of high-income households growing year-on-year on emerging markets contribute positively to the wealth of the industry.

Moreover, the market is well protected by entry barriers. A typical product lifecycle is lengthy from idea-to-market, it normally requires an extraordinary investment and, when successful, products tend to be secured through patents, regulations and intellectual property rights, making it difficult for others to copy them. For each blockbuster drug that generates a significant revenue stream, there are many others that fail.

Coupled with concerns of information leakage, such as of research data, and any association to mistrust, that is to say ethics issues, contribute to make this industry very careful with their databases and, therefore, perceive IT trends as a potential security risk. As a result, organisations tend to be very resistant to IT adoption.

On the other hand, healthcare and life science organisations are heavily dependent on innovation to develop new products and, ultimately, to provide better living conditions to the population of the world. This is tightly linked to IT and without it enterprises lose their competitive advantage and the ability to survive in the market.

Therefore, if the industry is so sceptical about IT but it depends on technology to survive in the market, is the pharmaceutical industry ready to accept and adopt the latest IT trends? And, if so, what is the strategic impact of such trends on their operating model?

The purpose of this report is to assess the pharmaceutical industry's readiness to adopt cloud computing, mobility and BD&A (i.e. Strategic Big Data and Analytics), and their impact on the enterprises' Operating Model.

In order to answer such questions, this report firstly reviews academic literature available about the industry, its operating models, and different IT adoption determinants and frameworks. Due to the complexity of adopting technology, one key conclusion from the literature review is that each organisation is distinctive and so there is not a unique model or framework that guarantees a successful IT adoption process and, consequently, multiple determinants ought to be considered along the journey. Furthermore, this report proposes a framework to be used by decision makers as a starting point for discussions that must happen in modern organisations.

One of the determinants considered here is the Operating Model. Research by the Massachusetts Institute of Technology (MIT) in 2004 identified that 63% of large organisations tend to choose Unification as their preferred model, mainly to enjoy the benefits of the highly integrated and highly standardised business processes.

Nearly a decade later, pharmaceutical companies are creating Centres of Excellence (CoE) and Shared Service Centres (SSC) to treat, organise and distribute their data, demonstrating that MIT's research holds true for this industry. To confirm this assertion, a survey, created as part of this report, corroborates that this is indeed the perceived operating model that best fits the industry's needs.

This survey also concludes that IT trends are seen as a risk rather than a benefit, mainly due to lack of knowledge.

Other relevant conclusions are summarised below:

- None of the respondents perceived their organisations to be ahead of the industry on using cloud computing, and a majority believe they are at par with the competition on all three trends;
- Respondents are happy to have Sales & Marketing data stored on the cloud and mobile access to it, but not data from other functions, especially if it is sensitive;
- Security, privacy and regulations are common barriers for IT adoption. Technology management and lack of specialist talent are also seen as limitations to implement mobility and BD&A solutions;
- Strategic decisions are already being made based upon BD&A, complemented with professional experience;
- Overall, the IT function is not seen as data owners, but the organisation is.

With the conclusions from the academic literature review and by analysing the survey data, this research proceeds to assess each trend individually.

Cloud computing, mobility and BD&A bring agility, speed and knowledge sharing into organisations, yet they are seen as threats rather than opportunities.

Although cost savings often trigger the need for IT adoption, many organisations find post-implementation benefits not foreseen in the initial business case. For example, running businesses *as a service* enables companies to integrate their business processes more efficiently, while keeping a high level of standardisation. Furthermore, companies are just beginning to realise the full potential of combining these trends to identify and resolve problems that have not happened yet.

The main adoption challenges derive from data (location, ownership or security), and talent (mind-sets and skills). The latter is especially relevant for building analytical models and algorithms that enable Big Data to be processed and presented as strategic information. Currently the global workforce is short in knowledgeable resources capable of defining these models.

Mobility also brings in additional complexity to businesses in terms of technology management. Until recently, companies made an effort to standardise the technology used by their employees, however IT consumerisation has resulted in employees beginning to demand the same tools that they use at home. These tools are often better and more advanced than those found in their workplaces.

The industry is experiencing all these trends but there are still potential growth opportunities, especially when combining cloud computing, mobility and BD&A to create value.

The key conclusions from this research are listed below:

- IT trends play a key role in supporting the chosen operating model;
- Not enough budget is currently allocated to educational programs to help lower adoption resistance;
- IT standards are not defined or advertised in this industry, so companies do not have guidelines, nor are they challenged to quickly embrace new technology;
- Return on Investment (RoI) is a selling point of IT trends due to the size and cost of such implementations (when compared to former IT programmes).

The lessons learned in the pharmaceutical industry can be applied to other regulated sectors, for example, the financial services industry. Other sectors, such as technology and telecommunications, are more dynamic in their nature and, therefore, more open to accept IT.

With this in mind, this report sets the following recommendations to successfully implement these trends:

- Re-allocate budget from other areas and proactively invest in IT adoption;
- Re-access the operating model and choose the one that best meets the needs of the organisation. Once agreed, any investment made should support such a decision;
- Share information with third-parties to allow better and quicker product development;
- Be a business partner in the organisation so IT can resolve real business issues;
- Become a pioneer in order to take advantage of innovation, but look at other sectors and competitors that have embraced the technology already to be aware of the risks involved.

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CHAPTER I: SCOPE

Industry

The pharmaceutical industry is unique and fascinating especially when discussing the future of information management.

On the one hand, this is a conservative industry, where regulations and the nature of its business leave little room for companies to be agile, thus becoming resistant to change. On the other hand, it relies ultimately on innovation and high-tech adoption to leverage its knowledge and develop new products to stay competitive in the market and, simultaneously, to provide better healthcare to the world.

The question remains is the pharmaceutical industry ready to accept and adopt the latest IT trends?

Although many reports have been written about IT trends and many more are issued on a regular basis, very few are dedicated to this industry, and very rarely attempt to collect lessons learned and apply them from, and to, other sectors. This report is an attempt to close this gap.

Project Design

Firstly, this report will analyse whether companies in this industry are ready to embrace cloud computing, mobility, and strategic big data & analytics (BD&A) to their benefit (e.g. using mobile devices to develop Operating Models in new or emerging markets); or whether they are incapable of fully utilising them because alone these trends can compromise those Operating Models, and even cause physical damage to the population if products and services fail.

Secondly, this research will look at these trends to validate whether the benefits of using them outweigh the many challenges companies face (e.g. ethics).

As a result of the author's interest in this paradigm, and his previous working experience in a pharmaceutical organisation, the proposal is to study and analyse the readiness of this particular industry for adopting the latest IT trends. It is out of its scope, however, to detail exploitation and selection of technology (e.g. technology implementation or selection within organisations).

The figure below illustrates the value chain and which sections this paper will cover.

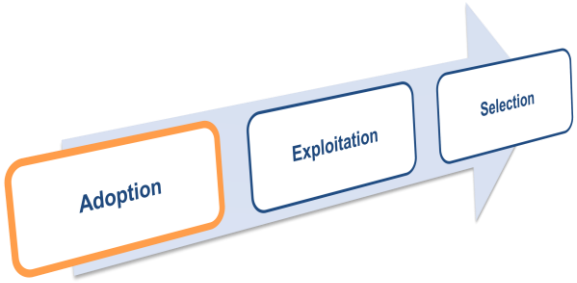

Figure 1 – Value chain *[Author's own, 2013]*

From an academic standpoint, the emphasis of this report will be mainly on the subjects of Information Management, Innovation and Managing Strategic Change.

From a practical point-of-view, this research aims primarily to answer the questions posed previously, but also to raise awareness of topics that decision makers (especially CIOs/CTOs) in this industry should be aware of when adopting such trends. Moreover, although the focus is on a particular industry, the greater goal is to draw conclusions that can be used as an accelerator for this and other industries when discussing their readiness for IT trends adoption.

The main research method to collect primary data for this report was a survey followed by informal interviews with decision makers from the industry and technology suppliers (e.g. vendors, consultants, etc.).

This topic is very dynamic, and hence the need to refer to different bodies of knowledge from the industry, technology experts and market researchers, for the latest news. For this purpose, the main sources of information were primarily the MIT Centre for Information Systems Research (CISR), Forrester and Gartner's latest reports and analysis, and Cass Business School library. Other generic publications were accessed in order to bring in up-to-date articles. The CIO Online, the Digital Wall Street Journal and the Financial Times are examples of such data sources.

Project Roadmap

The project that follows began by reading academic and industry-specific literature, mainly focusing on industry, Operating Models, and IT trends. Subsequently, a survey was prepared and distributed to a pre-selected audience, followed-up by an unofficial interview to a sample of its respondents.

During the writing phase, various articles were collected in the author's reading list to ensure the latest information could be used to improve the content of this report.

Finally the data was analysed and the report written.

Primary Research

Most companies operating in the pharmaceutical Industry are global players and doing primary research with statistical significance can be a challenge and it requires too many resources. Thus, primary research in this report was intentionally focused on a small sample of IT leaders from the industry, to collect their personal views and thought-processes, rather than on a larger sample to draw statistic-based conclusions.

To achieve this goal, a survey was created and distributed to a selected sample of nearly 40 professionals with job descriptions ranging from IT team leads responsible for smaller IT projects (e.g. adoption of Software-as-a-Service solutions) to business units CIOs (responsible for larger programmes). Nearly half of the respondents answered the survey.

Follow-up formal interviews were requested but the majority of the respondents declined to participate in them. The common theme for not being available was the concern of divulging information that could diminish the competitive advantage that their firms have built upon technology. This is an information sensitive industry and it was clear that leaders do not feel comfortable discussing these topics in the open-air. A few, however, agreed to informally and anonymously discuss it.

The results from the survey and informal interviews provided the author with insightful information. The data was analysed in detail and presented in respective chapters in this report.

Secondary Research

The main source for secondary research was several articles by experts in this field, both institutional (e.g. MIT CISR) and individuals (e.g. Andrew McAfee). Different sources were analysed and the information validated which enabled the drawing of accurate conclusions. Furthermore, the data collected was contrasted to that found in the primary research.

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CHAPTER II: LITERATURE REVIEW

Introduction

> *"The trap that executives often fall into, however, is assuming that opportunities for advantage will be available indefinitely. In actuality, the window for gaining advantage from an infrastructural technology is open only briefly." (Carr, 2003)*

This section aims to realise whether there is, in the academic literature, a unique model to explain and support technology adoption in the pharmaceutical Industry, or whether more than one should be considered to fully understand the IT readiness of this sector.

A number of models and theories have been written over time to assess companies' IT readiness, but only a few assess both organisational and individual dimensions.

When discussing IT in general, and trend adoption in particular, firms and individuals cannot be seen in isolation. Decisions taken by firms will impact the individual's working style and conditions, and individual's behaviour will impact the success of technology adoption. Thus, both need to be aligned, focused on the same end-goal and not in opposite directions as quite often happens. The aim should be to have organisations reaping the benefits of their investments; and individuals working more productively and under better conditions.

To understand the industry's determinants, two levels of analysis must first be conducted:

- Firm level;
- Individual Level.

Firm Level

Two models were identified during the literature review as being the most suitable to discuss determinants of IT adoption:

- Diffusion on Innovation (DoI) and;
- Technology, Organisation, and Environment (TOE) Framework.

These two frameworks have been the foundation for other models (Chong et al., 2009) to add additional variables that explain companies' willingness to introduce IT trends into their businesses.

The DoI theory (Rogers, 1995) supports that "individual characteristics, internal characteristics of organisational structure, and external characteristics of the organisation, are important antecedents to organisational innovativeness" (Oliveira and Martins, 2011, pp.110-121).

Both individual and organisational variables are key determinants for innovation. The model considers individual characteristics, with a particular focus on the leader's attitude towards change. Noteworthy is the fact that this model does not take into account external sources of pressure such as competition or market factors, which in today's environment, force companies to innovate and to take IT adoption seriously. Without innovation supported by IT, regardless of the industry, companies are not able to compete.

The Technology Organisation and Environment Framework (Tornatzky and Fleischer, 1990) "identifies three aspects of an enterprise's context that influence the process by which it adopts and implements a technological innovation: technological context, organisational context, and environmental context" (Oliveira and Martins, 2011, pp.110-121).

This model highlights the fact that all determinants are interlinked, which removes the importance of one over another, and instead it argues that all need to co-exist to enable innovation acceptance. Secondly, the model addresses that not only new technologies should be taken into consideration, but also existing ones. This is classified under the technological context. Thirdly, the market and competition pressure is summarised under the environment context umbrella. This is one key difference between this framework and the previous one. Lastly, the TOE framework highlights not only individual characteristics but also organisational (internal and external) ones to drive firms towards innovation.

The framework ignores governance and leadership roles and, unlike the DoI theory, it does not consider the leader's focus, centralisation or formalisation aspects.

Individual Level

Knowledge, skills and environment where individuals operate determine the firm's ability (and ultimately that of industries) to adopt technologies. Moreover, their predisposition to embrace IT, and the use they give to technology, play a key role in its acceptance level.

Scott and Christensen (1995) and Scott (2001) focus on inter-organisational systems (IOSs) to identify institutional forces, such as social, cultural and market specific, to coerce companies to embrace IOSs. This explains the tendency to copy industry leaders, and become alike. The environment context, described in the institutional theory is addition to the one referred in the TOE Framework.

Iacovou, Benbasat and Dexter (1995) discovered "*IOSs characteristics that influence firms to adopt IT innovations*" (Oliveira and Martins, 2011, pp.110-

121). Their model distinguishes between independent and dependent variables in different contexts: perceived benefits, organisational readiness and external pressure. Trading partner pressure is a new determinant in this model and an important one to explain external constrains that firms are confronted with.

Proposed IT Adoption model

With the elements already considered in mind, it is essential to identify key factors (or drivers) that serve as a base for the analysis of IT adoption conducted in this report.

Below is the author's proposed framework to discuss IT readiness in the pharmaceutical industry.

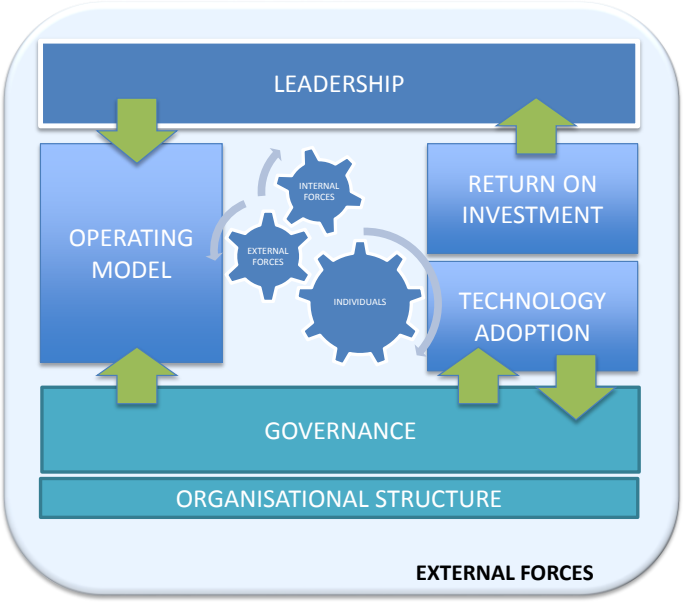

Figure 2 – Author's proposed framework [*Author's own, 2013*]

IT Adoption Determinants

In this section, the author reviews the literature that has been conducted around two of the most critical determinants for the adoption of new IT trends. The first one is the **operating model**, studied in order to understand how companies should restructure and manage their IT in order to have it as a strategic asset rather than a liability; the second refers to key resources and capabilities that companies have at their disposal to achieve sustainable competitive advantage to work around the ambiguous environment in which they run their businesses. The latter will be analysed through the lens of the **Resource-Based View** (RBV) framework.

Operating Model

The pharmaceutical industry is global and its companies, regardless of size, operate worldwide. However, they are at different stages of maturity, which influences the likelihood of implementing strategic and scalable IT initiatives.

Mature organisations have stable and solid processes in place that facilitates IT adoption, but which can also act as roadblocks when they are too engrained and, therefore, difficult to change.

With regards to investments, organisations often attempt to link IT to corporate strategy, which hinders their ability to spend these funds effectively. Corporate strategy looks after multiple programmes, creating a situation where IT is used reactively rather than proactively. Thus, understanding the operating model as a determinant for IT adoption pushes organisations to become proactive in doing business and forces them to add value.

The operating model is "*the necessary level of business process integration and standardisation for delivering goods and services to customers*" (Weill and Ross, 2008). Four different models can be adopted: **Coordination**, **Unification**, **Diversification**, and **Replication**.

According to research undertaken by MIT in 2004, 63% of large companies would opt for the unification model mainly to benefit from the high level of integration and standardisation this model has to offer. However, these costs can prove excessive, especially when building up its foundation (Ross, 2005).

By choosing the right quadrant and focus on its implementation, companies are identifying the most critical processes, deciding to either centralise or decentralise them, and planning the next move to integrate them as much as required to fulfil the organisation's needs.

Jeanne Ross (2005) says "*the operating model determines priorities for development of digital capabilities and thus IT investment*" (Ross, 2005). According to Ross, standardisation leads to flexibility as companies become more agile and able to respond faster to market needs and demands.

The difficulty in selecting one operating model is that firms cannot easily identify business processes that fit into one specific quadrant. Nonetheless, only one must be chosen per organisational level.

The first step to define which model works best should be to write down the organisation's vision, and then to define how to best achieve it (Ross and Weill, 2009). The IT function should be seen as a strategic asset at this stage. By deciding which key processes are to be integrated and standardised, and at which level it should happen, firms are simultaneously identifying what they want to use IT for.

Weill and Ross (2009) argue that the firm's digital "*platform grows out of a clear vision – provided by senior management – of how the firm will operate*" and, If IT is being used to solve immediate problems, then the "*approach to IT is broken*" (Ross and Weill, 2009).

The level of integration and standardisation fully depends on the vision that each company has for their business units. The model that works for one might not work for the other.

If **diversification** is selected, a shared services centre platform is created to treat each business unit independently. In the opposite quadrant, **unification** ensures technology and business processes are fully integrated and standardised across divisions, leaving little room for them to act individually. The third quadrant is **coordination**, which creates a platform where data is accessed throughout the organisation in order to ensure common decisions; and lastly, **replication** creates a platform that allows functions to operate locally but under the same brand.

Research shows evidence that companies which clearly defined their operating model have their strategic "*capabilities needed*" more aligned to their "*capabilities implemented*", than companies without an operating model or with one that has been randomly chosen (Ross and Weill, 2009). This is due to agility and flexibility achieved by having a clear vision and the means to get to it.

The dimension of an organisation can be a good indicator of both the influencing power within its own industry, and the flexibility to adapt and, therefore, to adopt available cutting edge technology. Small firms should choose one operating model and build the platform that best supports their decisions. However, larger players might require more than one model per organisation level – i.e. organisation, geography, business units, etc. (Ross and Weill, 2009).

Furthermore, selecting an operating model requires organisations to commit strongly to change working habits, routines and mind-sets and, therefore, a solid governance process is critical for the success of these programmes, especially in IT where resistance is a constant throughout the journey.

Through the operating model definition and the enterprise architecture strategy review, firms must monitor the misalignment between business and IT teams. On one hand, it should be done to define the desired level of integration and standardisation and, consequently, to enable IT to proactively identify future strategic initiatives; and, on the other, to delimit the pathway to successfully achieve the firm's vision.

Moreover, globalisation which leads Multi-National Companies (MNC) to expand to other geographies (e.g. emerging markets), represents a challenge for IT in the sense that often local IT teams do not report back issues to central teams. Thus, proper governance methods must be followed in order to ensure program teams work successfully towards the same goal.

MIT's working paper argues that there is no *one-fits-all* model, but that hybrid governance structures must be used. The Federal Structure (Sambamurthy and Zmud, 1999), Hybrid Governance (Brown, 1997), Centralised-Decentralised Governance (Von Simson, 1990), and Matrixed Governance (Weill and Ross, 2005) are theories developed around these structures.

Organisational structures evolve over time and through different development stages characterised by complexity, formalisation and decentralisation (Olson & Terpstra, 1992). There are a number of different forms by which organisations arrange themselves, and which influence the way they operate and perform. Organisational structure impacts the adoption of technology, but similarly it also changes accordingly to the innovation adopted. Secondary research shows that a smaller organisations' structure is guided by resources availability (Churchill and Lewis, 1983), whereas in larger firms structures are mainly driven by technology.

The structural design is not anymore about *centralisation* or *decentralisation* but more about detailed forms of IT organisational design (Sia et al., 2010).

The right operating model of the new world should enable companies to scale-up quickly, with agility and innovation, along with focussing on cost reduction. It must also serve the client base, not locally but globally, expecting that each client is now looking for an individual treatment rather than one-size-fits-all.

Organisations must understand their priorities clearly to the extent of the control they want to keep over their processes; the space they want to play in (i.e. local vs. global) and the synergies they will be able to convert into competitive advantage. Firms can operate in a decentralised manner, but they can also opt to run a SSC or a CoE.

In summary, companies today must be agile, lean and keep up with a continuous learning pattern. All models present their pros and cons and although choosing one is a high level exercise, it keeps companies focused on four key elements: "*technology, core business processes, firm-wide data, and shared support processes*" (Ross and Weill, 2009). Furthermore, although the industry will not push companies to follow a specific operating model, it can influence such decision.

There are, however, expectations and challenges that companies face when selecting and/or implementing their operating model. These are listed below:

- Desire of change (simultaneously) either all business processes or none because it has always been like this;
- Desire to change overnight;
- Lack of governance;
- Incorrect usage of resources;
- Operating model decision not taken seriously enough.

Resource-Based View (RBV)

Different resources (e.g. human, time, money and technology) are potential determinants for technology adoption.

The importance of integrating key resources within an organisation was first mooted by Roger Penrose (Penrose, 1959) and further developed, 20 years later, by other authors who referred to, and theorised about, the core elements of this idea (Lippman and Rumelt, 1982; Wernerfelt, 1984; Barney, 1986; Dierickx and Cool, 1989).

In 1991, Jay B. Barney named the **Resource-Based View** (RBV) framework and defined its core elements and their interdependencies. Through RBV, organisations identify their key resources which can act as "*isolating mechanisms and limit competition by creating rare, inimitable, non-substitutable and valuable elements*" (Barney, 1991, pp. 99-120), also known by the acronym VRIN.

- Valuable: resources that create value by leveraging opportunities or reduce threats;
- Rare: scarce resources which contribute towards the price of the final product or service;
- Inimitable: resources which have a competitive advantage;
- Non-substitutable: resources that cannot be replaced by alternative ones, even if they are rare or inimitable.

Following the identification of critical resources, organisations must find strategies to preserve and protect them, in order to leverage their potential and benefit from the competitive advantage they generate. In doing so, companies are ultimately creating value for their stakeholders. Value creation consists of the use value and exchange value of a product or service. The former refers to something that is a need but is subjective and individually specific; and the latter refers to the monetary amount realised by the source when delivered to the target (Bowman and Ambrosini, 2000).

Organisations must capture as much value as possible. Porter's Value Chain (Porter, 1985) proposes that firms can configure their primary and support activities to maximise and sustain competitive advantage.

RBV theory, however, contends that companies gain competitive advantage by making use of tangible and intangible resources that they have at their disposal, "*including a firm's management skills, its organisational processes and routines, and the information and knowledge it controls that can be used by firms to help choose and implement strategies*" (Barney, 2011).

Since its inception, the RBV framework has been refined but also criticised by various authors (Harrison *et. al*., 1991; Fiol, 1991; Conner, 1991).

During this process, *knowledge* was recognised as a key resource for an organisation and, therefore, added to the model. This is referred to as the **Knowledge-Based View** (Kogut and Zander, 1992).

Amit and Schoemaker (1993) argued that resources may be a broad term and, in their research, distinguished between *resources* and *capabilities*. The authors defined resources as "*stocks of available factors that are owned or*

controlled by the organisation, and capabilities as an organisation's capacity to deploy resources" (Amit and Schoemaker, 1993, pp. 33-46).

Teece (2014) stated that capabilities are just like best practices (Kleiner, 2013; Teece, 2014). Makadok (2001) defines capabilities as "*a special type of resource, specifically an organisationally embedded non-transferable firm-specific resource whose purpose is to improve the productivity of the other resources possessed by the firm*" (Makadok, 2001, p. 387).

Sirmon, Hitt, and Ireland (2007) summarises the definition of resources and capabilities by stating that it is the bundling of the resources that builds capabilities.

There is enough evidence that supports RBV success (Crook et al., 2008). However, as a framework, RBV lags behind today's dynamic world and, although it serves to understand companies' key resources and to derive sustainable competitive advantage, it should also enable organisations to keep focus so as to survive in a highly complex, competitive and ambiguous environment, where everything moves faster than ever.

Nicholas Carr (2012) says, "*what gives it the capacity to be the basis for a sustained competitive advantage – is not ubiquity but scarcity*" (Carr, 2012). Most IT resources are now available to all companies, so what they do with them is what matters.

Teece, Pisano, and Shuen (1997) introduced the idea of *dynamic capabilities*, and defined the dynamic capabilities approach as "*a coherent framework to integrate existing conceptual and empirical knowledge, and facilitate prescription*" (Teece et al., 1997, p. 515). Teece and Pisano (1994) said, "*first, it refers to the shifting character of the environment; second, it emphasises the key role of strategic management in appropriately adapting, integrating, and re-configuring internal and external organisational skills, resources, and functional competences toward changing environment*" (Teece and Pisano, 1994, p. 537).

These were also defined as firms' *signature processes* (Gratton and Ghoshal, 2005). The concept was further developed and adapted to the modern world by Ludwig and Pemberton (2011).

Adjusting to this new mind-set is not a simple task and it requires a commitment from the organisation to adapt to new models that better reflect the current reality of business.

Further IT Adoption Determinants

Methodologies

The company's methods and techniques constitute powerful drivers to technology adoption (or prevention), and also to the way they choose their operating models.

Methodologies are a key component of this toolbox, and hence the reference to two models that are often used in technology related projects: V-Model and Agile Methodologies.

V-Model

The V-Model is a methodology that drives IT implementations from the point where business teams list their requirements to the point where they are implemented and accepted in the new systems.

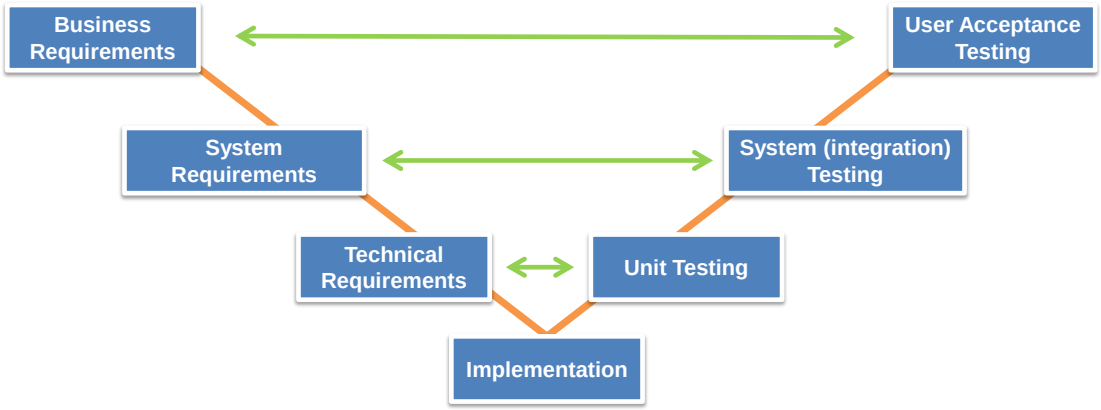

Figure 3 – V-Model

The V-Model identifies a series of occurrences where business and IT needs to go hand-in-hand throughout the process, from business requirements to user acceptance.

This model identifies sequential and chronological phases to implement IT in the organisation. Its main characteristic is to have the previous phase finished before starting the next.

Waterfall methodologies in general, and the V-Model in particular, focus on delivery but can be lengthy. Agile methods were brought into the IT space to respond to the challenges and dynamism of this function.

Agile Methodologies

Agile methodologies are characterised for their iterative cycles as well as for listing and prioritising tasks of short duration before any work commences.

These methodologies make task-lists clearer to everyone and assign specific owners to each task. A group of tasks is often called *Package* or *User Stories*, and to get them to the top of the list they need to add value to the business.

Once packages are defined, the development begins within a short timeframe (normally 2-4 weeks). Finally the package is delivered, feedback is received and, if required, minor adjustments are done. This step is completed with the process owner acceptance, which is the trigger for a new task to be initiated. Throughout the development process, there are regular status meetings to ensure that tasks and scope requirements are met within budget.

Organisational Culture & Change Management

Culture influences individuals' predisposition to embrace and accept new technologies. Not only is adoption proneness important for IT adoption, but also for system usage (DeLone and McLean, 1992 and 2003).

Different models and frameworks were developed to analyse change management within a corporate environment.

Kotter's change model (1995) is an 8-step approach to change, covering all the different stages in extremely complex change processes. The figure below illustrates this framework.

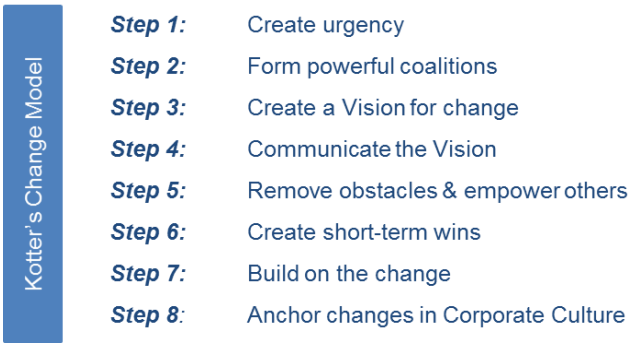

Figure 4 – Kotter's framework

This framework is detailed enough to provide a step-by-step approach but not to dictate how to run each step. This is relevant to IT as each organisation is different and each change process is unique.

A different perspective is given by Lewin's Change Model (1947), which compares the change process to that of changing a *cube of ice* into *a cone of ice*.

Figure 5 – Lewin's framework

Although there is an overlap between Kotter and Lewin's frameworks, the latter emphasises the *why* of changing by challenging the *status quo* (e.g., beliefs, values, etc.), whereas the former creates a sense of urgency, but not necessarily by defying the organisation's core values.

Equally relevant is to understand the country's cultural impact. Hofstede's (1973 and 2000) researched cultural differences between nations and summarised them in six groups: *Power Distance; Individualism-Collectivism; Uncertainty Avoidance; Masculinity-Femininity; Long-Term Orientation and Indulgence-Restraint*.

This model highlights that, regardless of the organisational culture established in the company, the cultural dimension, which is created by the country (or nation) where individuals grow up, is of significant value and impacts decisions and choices taken by them.

All these models describe variables that drive personal beliefs and habits, which employees live and work by. Changing them can be a hard task and requires companies to invest in, thus making change management critical when adopting IT.

Summary

A variety of studies have been read and various conclusions can be drawn upon the documents considered.

The most important takeaway from this analysis is that there is not a unique academic model or research that explains the choice of an operating model, or the company's readiness for cloud computing, BD&A, and mobility. Different frameworks must be considered in order to best define the dimensions (or determinants) of IT adoption, which leads to investment, implementation and use of technology, ultimately bringing benefits into the business. This research attempted to define one framework to be used as a starting point for discussion among IT decision makers.

This is an industry characterised by two different groups of organisations: a few large players holding a significant part of the market share, and a greater number of small ones that fight for survival. Size does matter when discussing agility. Although the first group has access to a wide range of resources, it is slower in adopting innovation due to a rigid decision-making structure. Moreover, the power to influence of a well-established group in the pharmaceutical industry is greater than a start-up. However, most likely, smaller players are able to adapt to new technologies quicker and, therefore, to gain a competitive advantage.

Agile firms continuously improve and scale up their IT initiatives. The overall industry agility is a sum of all parts and, therefore, a reflex of all players' capability to adopt innovation.

Furthermore, one key conclusion from the literature review is that companies are required to have both a clear understanding of their operating model, and a simple but efficient IT governance to follow and monitor these initiatives. The company's goal should be to have a well-defined vision and IT tools that create the platform to achieve it.

Moreover, the pharmaceutical industry is one that is heavily regulated and for which strict rules apply. Thus, external environment is of extreme importance as a determinant for the adoption of technology. In this sense, it refers not only to laws that affect the business and Operating Models, but also those that put them ahead of competition such as patents or intellectual property rights. Similarly, firm's internal context and the individuals' perception of the situation cannot be ignored when discussing technology adoption and its implementation.

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CHAPTER III: THE PHARMACEUTICAL INDUSTRY

Key Facts

Globally, the industry is estimated to be worth more than US$960bn according to IMS Health Market Prognosis 2013, which estimates a growth rate of 5.3% for the next five years.

A summary of the industry highlights is listed below: (*source: Economist Intelligence Unit, 2013*)

- Life expectancy continues to increase from 72.8 years in 2013 to 73.7 by 2017;
- Emerging markets represent an area of growth and their population is increasingly demanding and paying for better healthcare, especially in India, China, Indonesia, Mexico and Russia;
- High-income growth households (above US$25,000) will rise worldwide by 10% by 2017, with half of it being in Asia;
- High pressure for cost reduction in an industry characterised for spending billions of dollars in R&D every year, where lobbying is critical, and innovative drugs command the market price;
- Decrease of healthcare spending (percentage of GDP) from 10.6% in 2013 to 10.2% by 2017, and decrease of Pharmaceuticals sales from US$1,171.8bn in 2013 to US$1,536.8bn by 2017.

The industry is heavily regulated and too highly exposed to patents protection. Although such regulations are relatively standard in mature markets, they are more volatile in emerging ones where most of the growth opportunities can be found. It is unquestionable that economic recession is exerting an enormous pressure on this industry, but also on Government's new policies and regulations towards it.

External regulations represent a huge limitation to organisations when they are deciding to invest in IT assets. Location is an example of a limiting factor introduced by external regulation. There are legal restrictions to keep specific data in the country where companies are legally registered and, therefore, it limits the choices of a firm to go mobile or to have data in the cloud.

Industry

As part of this research, the following Strengths, Weaknesses, Opportunities, and Threats (SWOT) was identified for this industry:

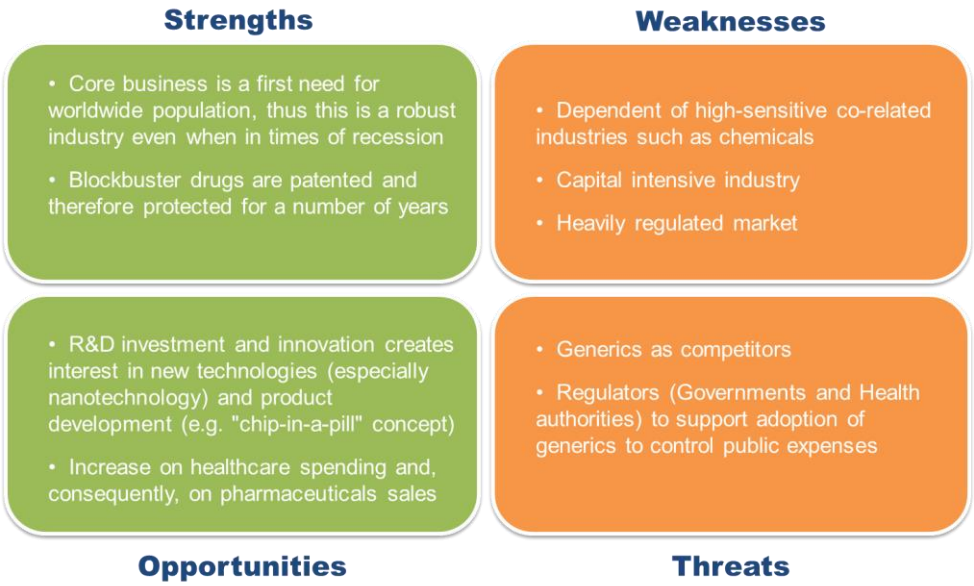

Figure 6 – SWOT analysis

Markets

The market, and especially the pressure from competitors and trading partners, is considered as a determinant for IT adoption.

Demand

Research shows Asia to be outpacing Europe and the United States when it comes to healthcare expenditure. The EIU foresees an annual growth of 7.6% for this region, where India and China have the biggest rise in spending. The first, due to the expansion of primary care and the second because of its efforts in rolling out a healthcare system that covers both rural and urban populations.

If it is true that China and India are to be the countries with the highest expenditures in healthcare, these are also the countries where pharmaceutical sales will increase the most by 2016. Brazil and Russia come next.

Curiously, stable markets such as Switzerland, where many pharmaceutical companies have their headquarters, will see a decrease in forecasted sales. The US, the UK and Norway are the exception in a scenario where EIU expects a recovery by 2015.

Supply

Cost reduction is the main concern of organisations that operate in this industry. In order to ensure the right levels of expenditure, companies are taking specific measures such as spin-offs (e.g. AbbVie), or labour force reduction (e.g. AstraZeneca's plans to reduce 700 jobs by 2016).

Moreover, patents and the increasing number of competitors are barriers limiting sales growth. According to the World Healthcare Outlook (EIU, 2013) new drugs approvals hit the highest level for 16 years in 2012, after a number of years where patents were expiring and companies had a small number of opportunities under development.

Two trends are becoming clear in this industry: one is a rise in generics and speciality drugs sales, and the other is the demand, in developed markets, which is split between demand for either very cheap drugs or very expensive ones. Such trends are noteworthy, as they will impact on industry players' pricing decisions.

With the rise in life expectancy and a constant change in life habits (more sedentary lives, changes in diet, etc.) it is clear that the largest part of healthcare funding will be spent in prevention rather than in treatment. This represents a greater opportunity for market players and, consequently, for technology adoption.

Players & Competition

In this industry there are heavy regulation and high costs throughout the product lifecycle, especially in R&D. A typical product lifecycle and industry's value chain are depicted below.

Figure 7 – Industry's typical product lifecycle

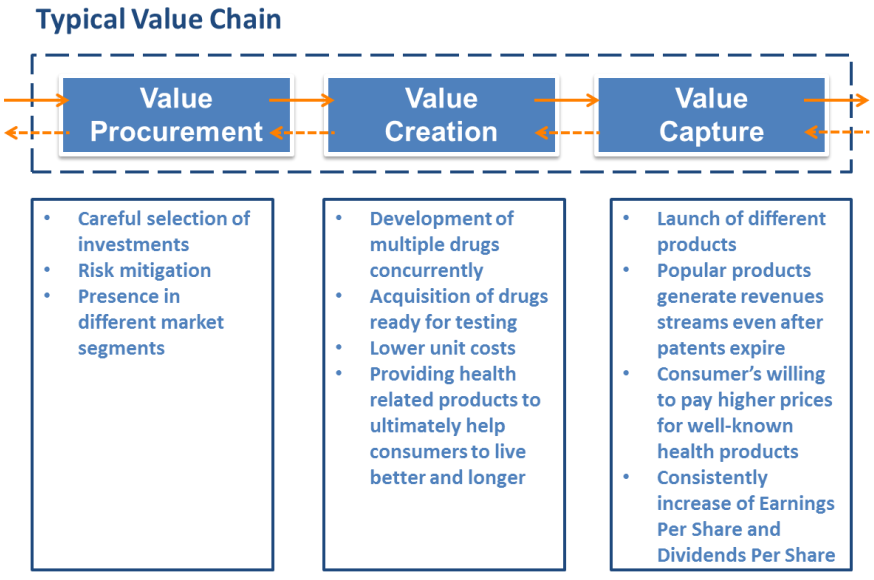

Figure 8 – Industry's typical value chain

The initial investment in the industry is huge; returns take a long time to materialise, and a variety of factors dictate the product's success or failure.

> *"The cost of inventing and developing a new drug, a cost driven by the uncomfortable fact that 95% of the experimental medicines that are studied in humans fail to be both effective and safe" (Herper, 2013).*

Thus, barriers to enter the industry are very high. Consequently, this industry counts a relatively small number of large organisations that lead the market, and a large number of smaller ones that, traditionally, focus on niche products or specific parts of the product lifecycle.

TOP 10 by Sales

Rank	Company	Sales ($m)	Employees	Market Cap ($m)	Rank by Market Cap
1	Johnson & Johnson	67,282.0	127,600	252,358.5	1
2	Pfizer Inc	58,986.0	91,500	190,664.6	4
3	Novartis AG	56,672.2	127,724	197,622.2	3
4	Bayer AG	51,242.7	110,500	94,964.6	9
5	Roche Holding AG	48,496.1	82,089	219,084.5	2
6	Merck & Co., Inc	47,347.0	83,000	140,378.3	5
7	Sanofi	45,039.7	111,974	136,579.0	6
8	GlaxoSmithKline Plc	42,635.9	99,488	126,440.1	7
9	Abbott Laboratories	39,873.9	91,000	54,441.0	-
10	Medipal Holdings Group	36,026.9	11,115	300,746.0	-

Source: *FactSet Research Systs Inc, 2013*

Figure 9 – Top-10 by sales (as of 2013)

In the past, patents would give competitive advantage to players in this industry, however, the trend now is to have governments and healthcare authorities to support generics, whenever and as frequently as possible, letting large organisations face a type of competition they were not used to.

Patents are still an advantage, but blockbuster drugs' uniqueness in the market last for shorter periods and alternatives are released much quicker. In 2011, generic drugs accounted for 50% of the sales volume but represented only 18% of sales value (EIU, 2013).

Although it is not new to have governments supporting generics, the number of funds and other public initiatives to drive consumers towards the use of these alternative drug products, has increased. This was especially visible after the European crisis in 2008, where there was an attempt to relieve patients from the additional costs of branded products.

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CHAPTER IV: SURVEY ANALYSIS

Methodology

The aim of this research is to understand the impact of IT trends in the pharmaceutical industry, and to draw a model that can be replicated in other industries, providing senior managers and decision makers with guidance on whether their companies (and industries) are ready to accept and adopt cloud computing, mobility and BD&A.

When choosing this topic of research, it was acknowledged the trends in scope are very complex, not only in their nature but also in the way they are defined among organisations. For instance, the definition of mobility might range from simply giving a smartphone to employees to large multi-million pound worldwide initiatives. Often even the definition differs between departments within a company.

Also, numerous insightful surveys are publicly available and cover, in detail, statistics associated with all these three trends. These reports explain different variables such as industry average spending in technology by organisation, by country, by expense type, etc. Moreover, companies produce their own reports about this subject as a signal to the market that they are ready for, and investing in, strategic IT adoption.

Several of these reports were read and considered for this research. Obtaining statistical data was not, therefore, the objective of the survey described below.

In order to answer the research question and, acknowledging the aforementioned facts, it was established as an objective to understand decision makers' views about IT trends, as opposed to gathering statistics.

Although some informal interviews were run, the survey was the primarily source of research, as it had the potential to reach more respondents than interviewees.

With this in mind, the survey was split into two distinct parts: one focusing on *Financial Data*, and the other looking at more *Subjective Data.*

Financial Data

Intentionally, only two questions were asked about budget. Rather than to scientifically access how much was spent by each organisation in IT trends, the author looked for a lead on how investment in IT is perceived by those who receive the funds.

Subjective data

These questions were more subjective. They helped to justify IT trends perception within each organisation and, hopefully, to conclude what would be required for trends to be fully adopted.

Survey Background

The survey was distributed to a pre-selected group of more than 40 respondents both within the IT and finance functions, between October and December of 2013. First, it was distributed to a smaller audience for initial design feedback, and then spread out to a larger population. Throughout the process, regular reminders were sent to all respondents so the survey deadline could be met.

The purpose of including Finance respondents in this poll was to also get a non-technical perspective, so the final results could be more balanced and less skewed towards an *IT dream*.

The list below highlights the respondent's job titles, which were split into six different categories:

- CIO
- IT Region Head
- IT Team Lead & Project Manager
- Head of Finance IT
- Head of Business Processes Finance
- IT and Finance Manager, and other decision-makers

The survey was distributed in different countries (UK, US, Switzerland, Germany, and Spain) and to individuals working for large organisations, such as Hoffman-La Roche, Genentech, Novartis, GSK, Eli Lilly, Boehringer Ingelheim, and Bayer. (*Disclaimer: the answers received as part of the survey reflect the opinions of the individuals and not those of their employers*).

Figure 10 – Geographical distribution of the survey

Half of the respondents went through the survey but not everyone provided answers to all the questions. The main reasons were around concerns of

giving away sensitive information, or difficulty in providing answers for questions covering *mega-trends*, especially mobility, because business units treat them differently. For example, some respondents were not sure where to include and how to label programmes such as the implementation of a Customer Relationship Management (CRM) tool running on portable devices.

Survey Conclusions

The objective of this section is to describe the key outcomes of the survey, mainly about IT trends perception inside organisations, and their links to the operating model. (*NB: All Figures shown within this section are a result of the survey created for this report*.)

Finance

Intentionally, only two questions were asked about financials, firstly because the aim of the survey was to gather *points-of-view* rather than statistical information, and secondly because it is a sensitive subject for respondents.

The perception is that organisation's total budget allocated to IT initiatives is going to increase in the next three years when compared to the past three. Respondents gave an indication that this number might go up from c.a. 17% by 2013 to slightly more than 20% by 2016.

Q3. What was/will be the percentage of the organisation's total budget allocated to IT in your organisation? (If not known, give your best estimate)

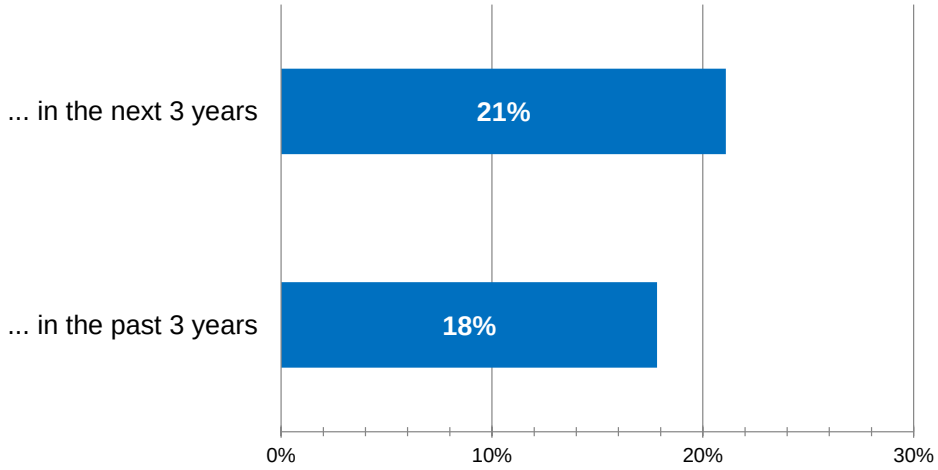
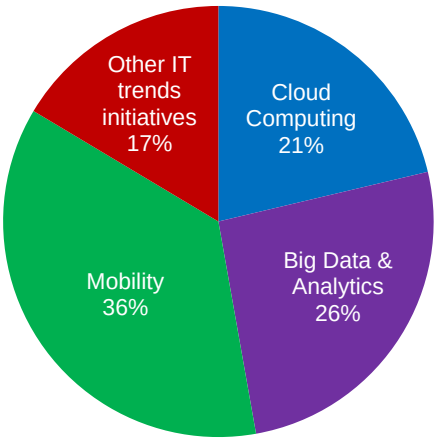


Figure 11 – Budget allocation to IT

Of all the trends, mobility seems to be the one receiving the largest part of the budget, followed by BD&A, and cloud computing.

Interestingly, IT standardisation and ERP & Enterprise Assets consolidation were referred as an area of investment under *other IT trends initiatives* (see Figure 12). In this category *exploratory work* was also mentioned which leads one to believe that organisations are aware that more investment is required and are looking at where it can be used.

Q4. What will be the percentage of IT budget allocated to each of the following in the next 3 years: (if not know, give your best estimate)



Q6. How do you see your organisation's investment plan for the next 3 years?

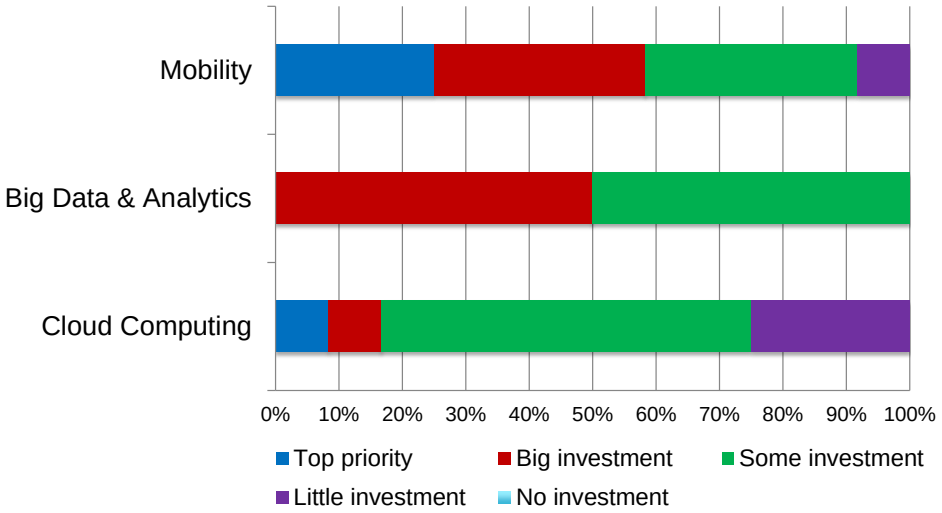
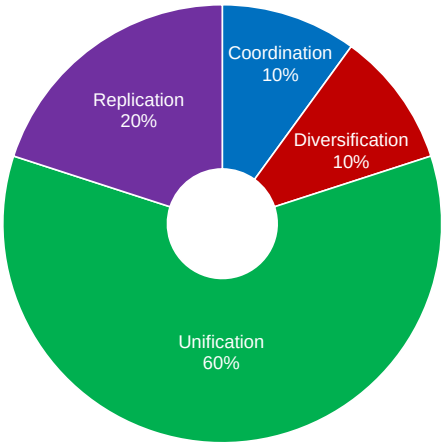


Figure 12 – IT investment

Operating Model

The following graphs reflect respondent's views about their organisation and business units/divisions' operating models:

Q10. How is the process standardization and integration within your organisation? (Please select one quadrant only)



Q11. How is the process standardisation and integration in the different business units/departments? (Please select one quadrant only)

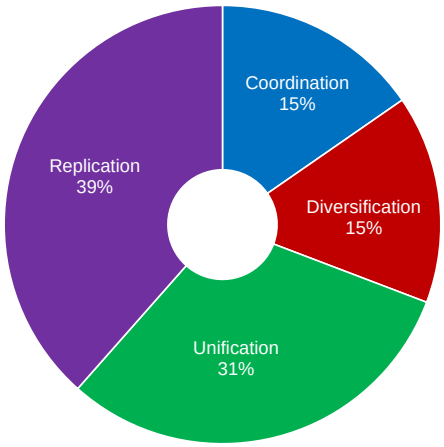


Figure 13 – Operating models

Unification was clearly identified as the main operating model at the organisation level in this industry. Respondents believe that key processes are standardised and integrated across all divisions. At a division level, two models were evidenced as being most common: Unification and Replication. All respondents agreed that their processes are very much standardised; however, the survey responses indicate that some business units are currently operating more independently than others.

IT Trends

Cloud computing

The majority of respondents stated their organisations are using private clouds only (i.e. self-owned), which might be due to the fact that this is a very sensitive-data driven industry.

The graph below highlights that 67% of the respondents believe their organisations are at par with the industry standards, and 33% think their companies are behind. None perceived their organisations to be ahead of the industry standards. When organisations are compared to their competitors: 67% see their organisations to be at par with competition, 17% behind, and 17% ahead of.

Q8. Based on your previous answers, in your opinion, how is your organisation positioned with regards to cloud computing?

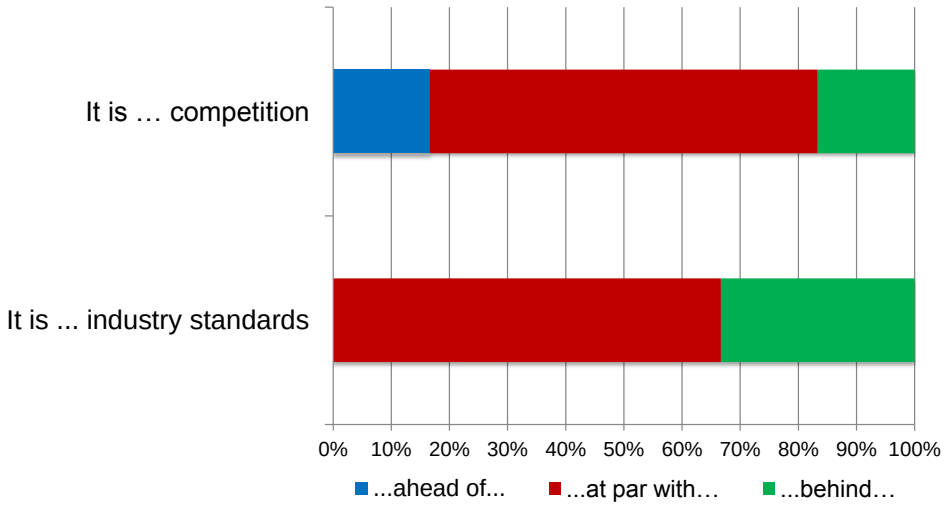


Figure 14 – Cloud computing standards

The fact that none of the respondents see their organisation to be ahead of industry standards might indicate that there is no cloud-computing standards defined for the pharmaceutical industry, or that they are not advertised widely enough. This can be due to legal restrictions, security and industry regulation that block this trend being used to its full extent.

Respondents were also asked to identify data that their organisations would be willing to store on the cloud. The large majority answered that no enterprise resource planning (ERP), finance, human resources (HR), research & development (R&D), or production information should be stored using this technology. A much smaller group, who supported having the date

from these functions in the cloud, highlighted the fact that it should be for non-critical information only (see Appendix 1).

Those who answered the survey feel more comfortable in having data outside their premises when it is sales & marketing (S&M), administrative, or IT related information, rather than, for example, financial information. Moreover, everyone agreed that sensitive information should not be stored in the cloud, regardless the area it comes from.

It was widely accepted that IT people should act as change agents when it comes to cloud computing. Some of the reasons for this are outlined below:

Q14. Can IT people act as change agents to enable the organisation in adopting cloud computing?

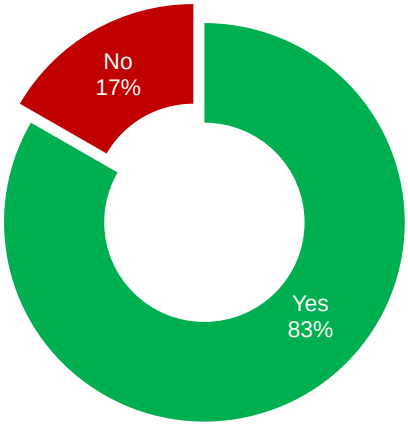


Figure 15 - Change agents

> *Because they [IT] know better the solution landscape and the implications of the changes*
>
> *IT is under cost pressure so that's a way to become more efficient*
>
> *People with more experience can convince the people who have none*

Figure 16 – Survey feedback

Lastly, security, privacy and regulations were identified as the greatest barriers for cloud computing adoption, as shown in Figure 17.

Q16. What are the main barriers to adopt cloud computing within your organisation? (Mark all that applies)

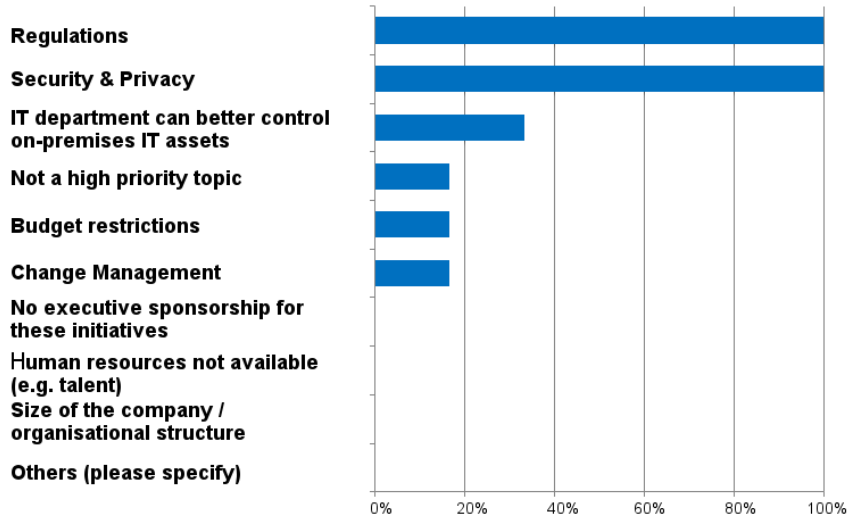
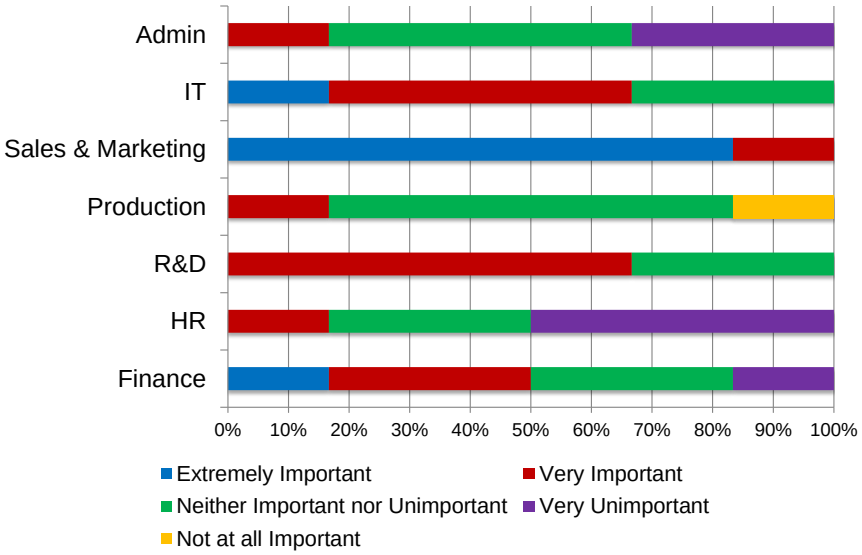


Figure 17 - Adoption barriers

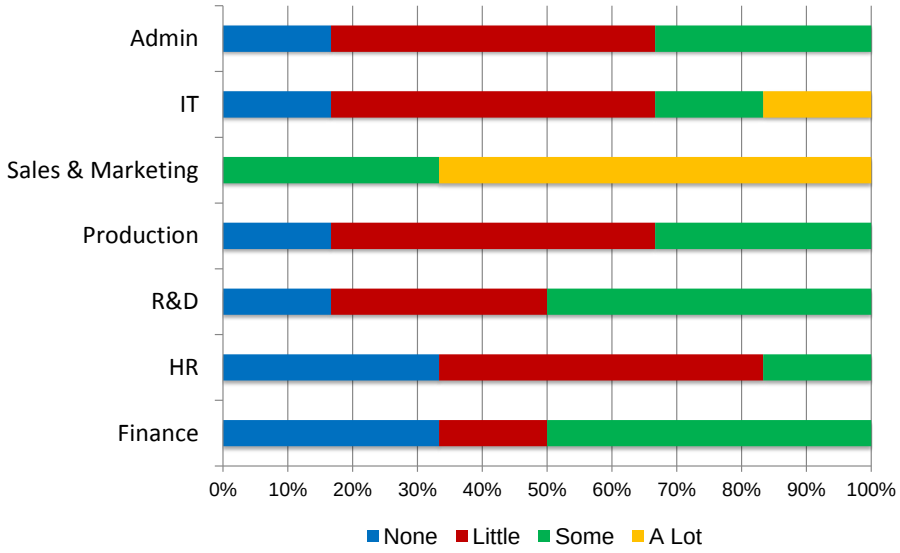
Mobility

Respondents agreed that S&M is the function where mobile working is most critical, followed by R&D and IT. On the other edge of the spectrum, HR is perceived to be the department with fewer needs of being mobile. The option *not at all important* was never chosen indicating that all departments are seen as to have some mobility requirements, even if these are minimal.

Q17. How important is for each department to be mobile (e.g. using smartphones or tablets)



Q18. How much work is done using mobile devices?



Q19. How many core applications are available in mobile devices within the organisation?

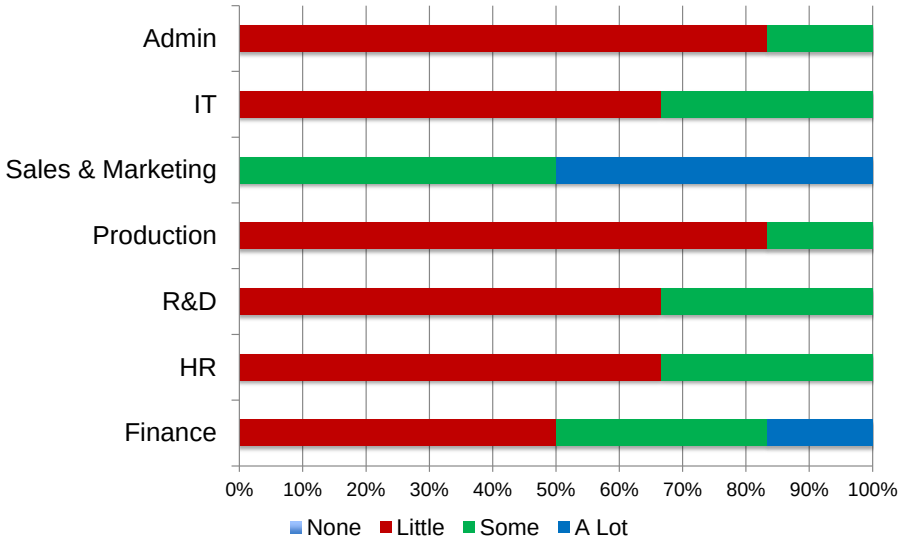


Figure 18 – Mobility per function

The majority of survey respondents believe they are at least at par with industry and competition standards (Figure 19).

Q21. Based on your previous answers, in your opinion, how is your organisation positioned with regards to mobility?

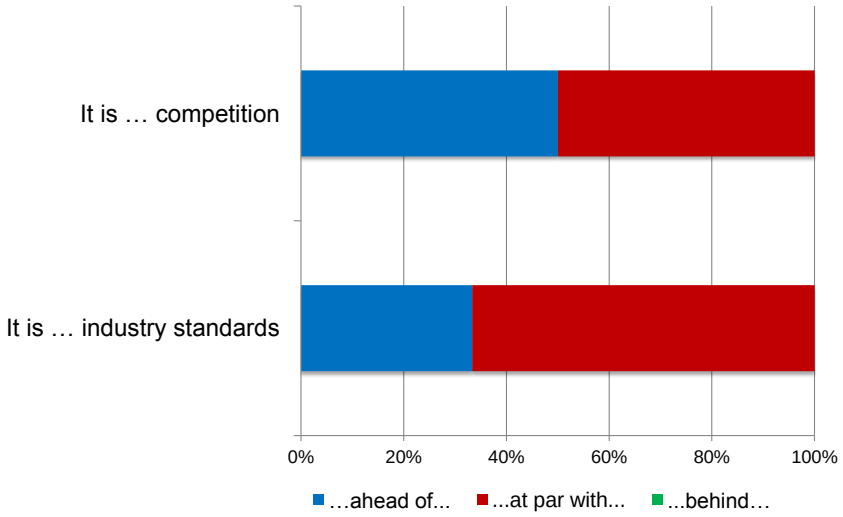


Figure 19 – Mobility standards

Similarly to cloud computing, IT people are again seen as change agents for Mobility initiatives.

Q22. Can IT people act as change agents to enable the organisation in adopting mobility?

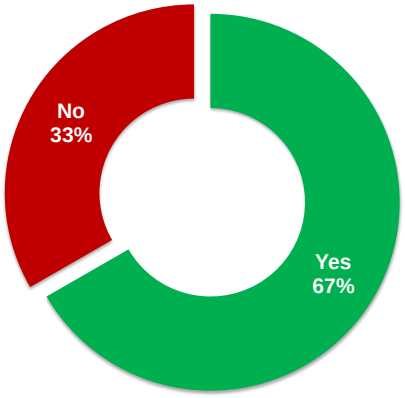


Figure 20 – Change agents

> *They [IT] are the experts*
>
> *Comparing to Cloud Computing mentioned before, I believe it is much easier for IT people to push for mobility since it appears to provide a higher ROI and it is something that non-IT people relate to better*
>
> *I think the mobility trend comes more from the business and the way we work: more in virtual teams*

Figure 21 – Survey feedback

Security, privacy and regulations were also identified as key barriers. Mobility also faces the challenge of budget restrictions and technology management to cope with different platforms.

Among the three trends in this research, mobility is perceived to be the one receiving more funds in the coming years. With the exception of sales and marketing, where this is already happening, all other functions are using very little of this technology. There is high demand for mobile infrastructures and applications though, which might have its origin on the IT consumerisation. Most of the industry's workforce is embracing mobility in their personal lives and want to bring this experience into the workplace.

Resources and capabilities available are becoming cheaper and better, leading to efficiency and productivity gains. However, it is noteworthy that this seems not to be clear in the survey respondents' minds.

Q20. Would there be productivity gains if mobility was a top priority for the organisation?

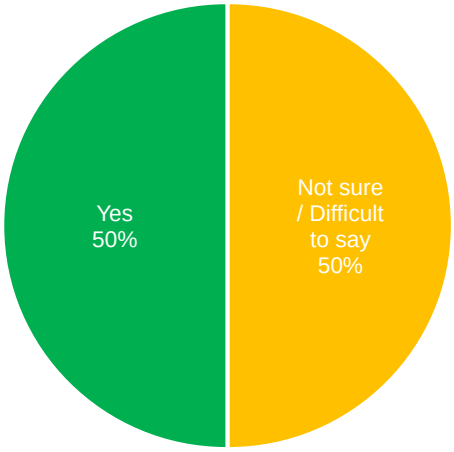


Figure 22 - Productivity gains due to Mobility

Strategic Big Data & Analytics

The survey results indicate that most people are familiar with *Analytics* as a concept, with only 17% of respondents unfamiliar with it. Furthermore, this technology is used throughout the organisation, in different divisions, as shown in the graph below:

Q26. Which departments are using Big Data & Analytics in your organisation? (Mark all that applies)

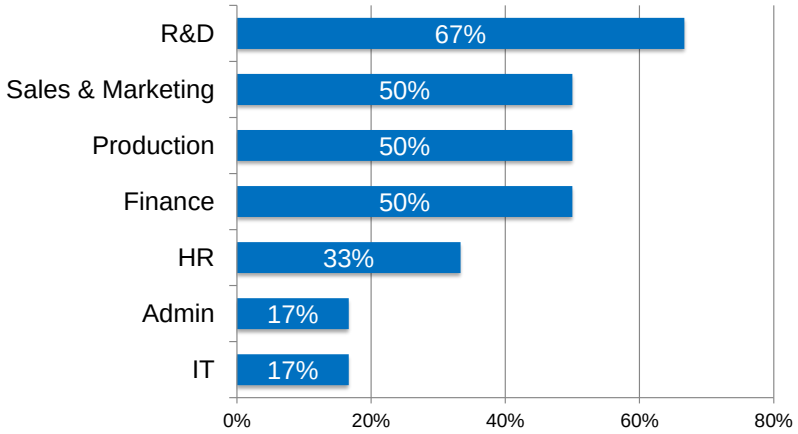


Figure 23 – Strategic BD&A per department

One key point about BD&A is to be able to understand whether it is used as a reactive way to solve business problems, or as a proactive way for companies to resolve future questions.

This survey is not conclusive, showing a 50%-50% split. However, the large majority of respondents agreed that strategic decisions are already taken based on data analysis. Only a small part of the population believes they are made using simply experience and *gut feeling*.

Q29. In your organisation, what drives key strategic decisions?

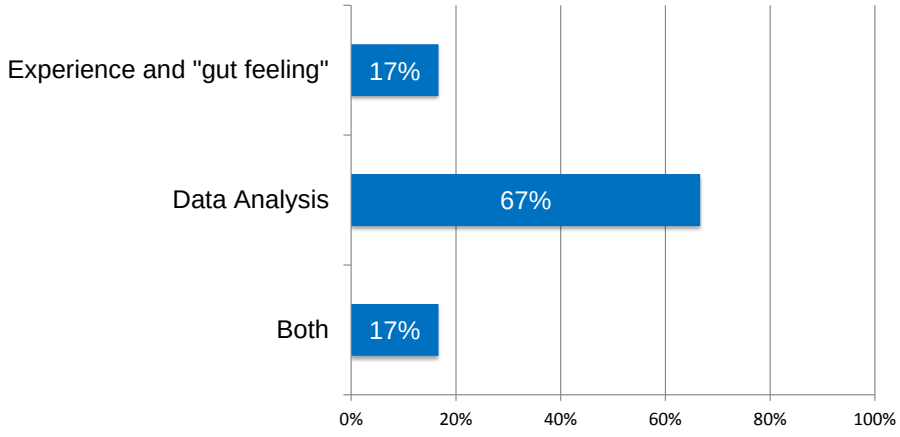


Figure 24 – Strategic decision-making drivers

The following graph indicates how *Analytics* are perceived within the industry:

Q33. In your organisation, Analytics are:

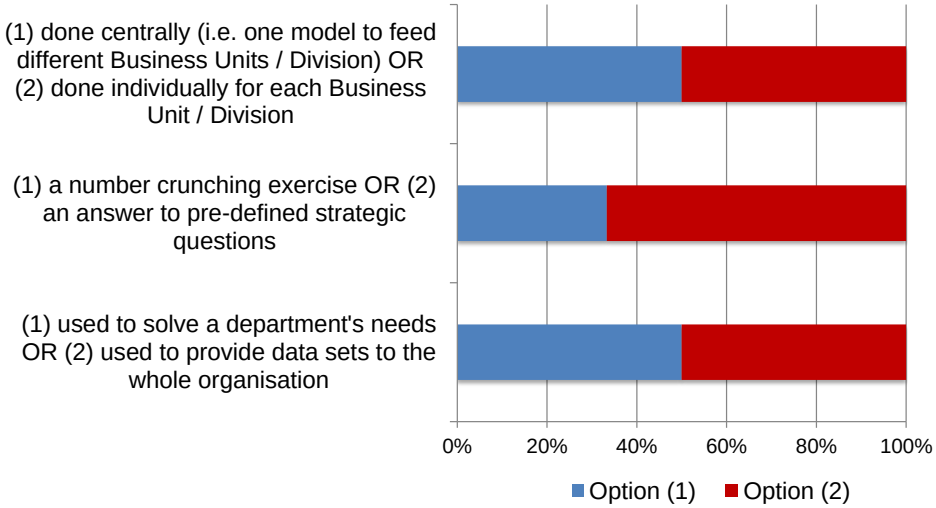


Figure 25 – Analytics perception

Although the results are not irrefutable, they might indicate that data is commonly used for decision makers' thought process and that there is some kind of systematic approach to it. There are improvements to be made in this area, which according to the respondents' standpoint could bring improvement to the strategic decision-making processes.

Q31. Could strategic decisions be improved if Big Data & Analytics were widely spread across the organisation?

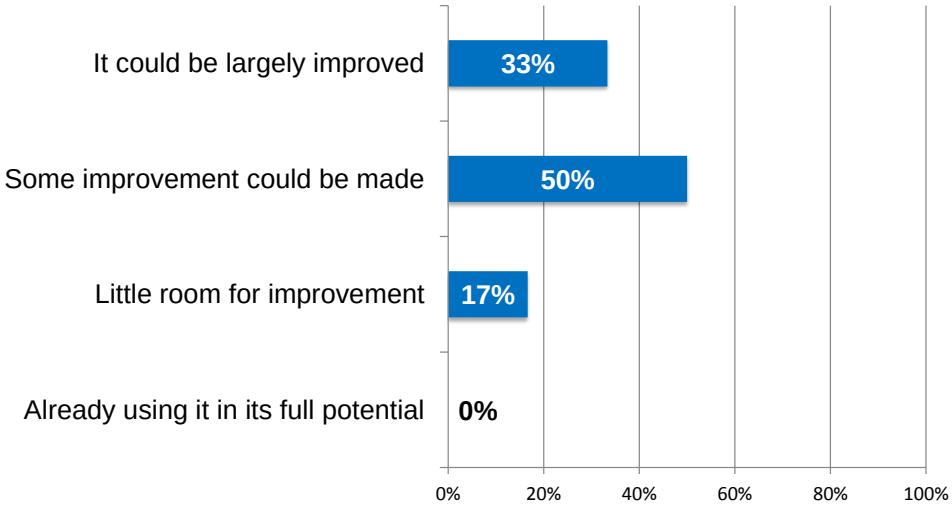


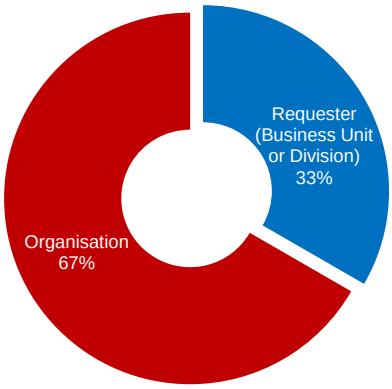
Figure 26 – Decision-making role

The survey indicates that data is perceived to belong to the organisation, though a smaller percentage believes requestors own it. Remarkably, no one identified IT as having the right of possession of the data collected.

Nonetheless, IT is perceived to be the department that sponsors most BD&A programmes.

Global C-levels were also noted to be significant sponsors of such initiatives. The exception being CFOs, which are not seen as such, even though finance is one of the functions that most benefits from BD&A.

Q30. Who owns the data gathered and analysed?



Q32. Who sponsors Big Data & Analytics programmes within your organisation?

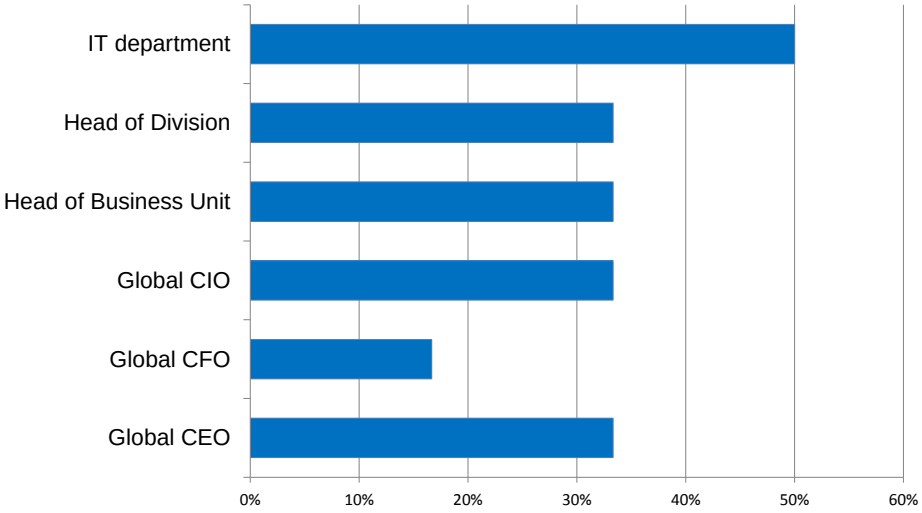


Figure 27 – Data ownership

In terms of sharing data, it was identified that a number of business units do not share information with suppliers or customers. However, 33% do it with both.

Q28. Is data being exchanged with business partners (customers or suppliers)?

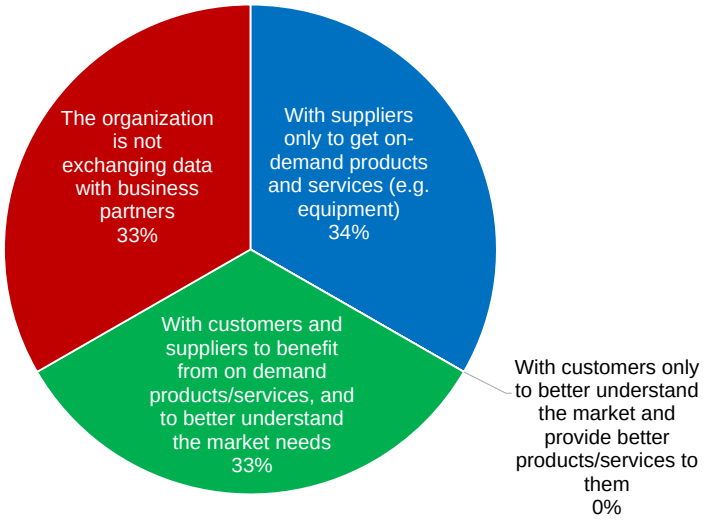


Figure 28 – Data sharing

When asked to compare the organisation with industry and competitors standards, the results were towards *at par with*, as for the previous trends. In fact, BD&A is the only trend in this survey perceived to be behind the industry standards in some organisations.

Q35. Based on your previous answers, in your opinion, how is your organisation positioned with regards to Big Data & Analytics?

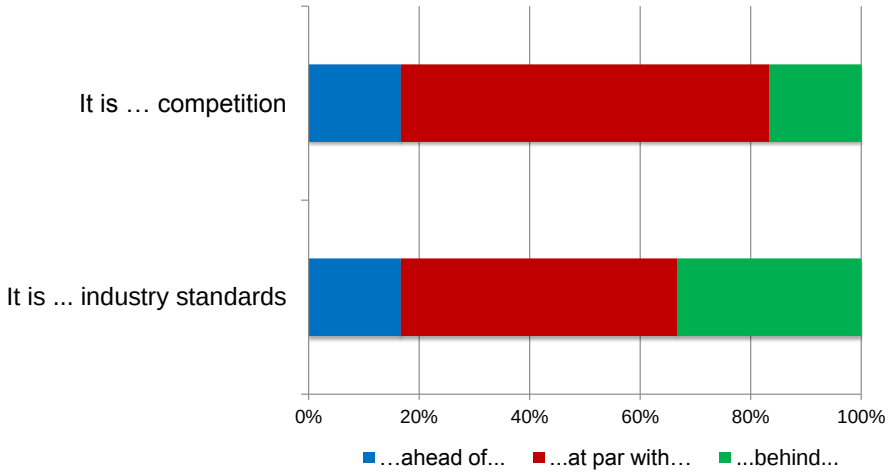


Figure 29 – BD&A standards

From the survey, it is also not evident whether IT is perceived to be an agent of change for this trend. Half of the respondents believe it is, but the other half is not convinced.

Q36. Can IT people act as change agents to enable the organisation in adopting Big Data & Analytics?

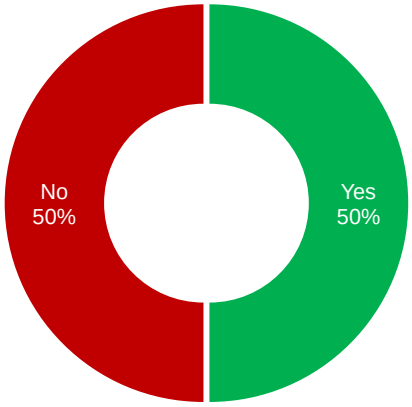


Figure 30 – Change agents

> *By introducing ideas and pilots by demonstrating value to business*
>
> *In our company the main driver is R&D*
>
> *[IT] provide the benefit and substantial information to business partner*

Figure 31 – Survey feedback

Lastly, this is the trend facing the greatest number of implementation barriers. Of relevance is the fact that budget and lack of talent are key questions to be considered when discussing this topic, as shown in Figure 32.

Q38. What are the main barriers to adopt Big Data & Analytics within the organisation? (Mark all that applies)

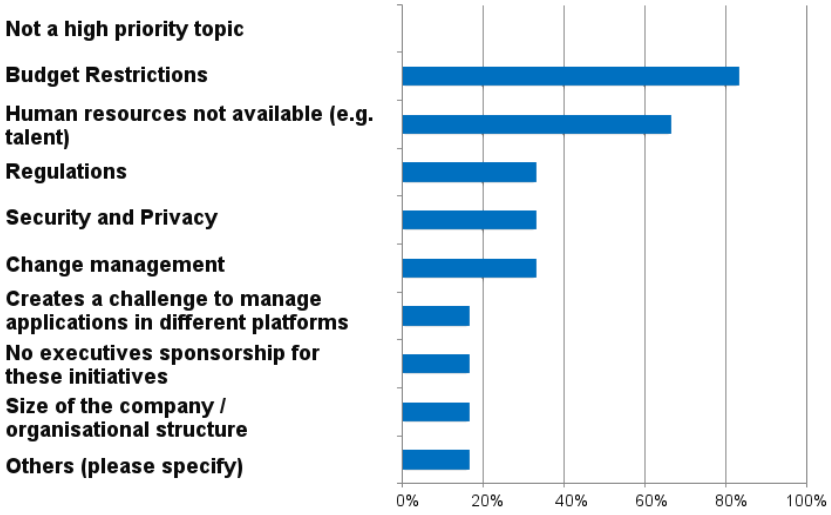


Figure 32 – Adoption barriers

Summary

A brief summary of the main conclusions is laid out below:

- A larger part of the IT budget should be allocated to education to enable decision-makers to adopt IT trends;
- Organisations are allocating budget to exploratory work showing that IT adoption and innovation matters to them;
- The demand for these trends is increasing, mainly due to IT consumerisation that the workforce is experiencing in their personal lives and want to bring into their work places;
- Security, privacy, and regulations are still the number one concern for IT adoption;
- The most common organisational operating model is Unification; however, Replication seems to be the most popular at the Business Unit level;
- The majority of respondents agree that their organisations are at par with industry standards and competition;
- IT people are seen as change agents across the organisation either due to their knowledge or because they are seen as implementation owners. However, they are not seen as data owners.

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CHAPTER V: IT TRENDS

Scope & Concepts

Increase in life expectancy, tighter competition, raise in healthcare spending, and all the reasons already alluded to, fuel pharmaceuticals to continuously invest in innovation and in technology adoption.

Cloud computing and mobility are not yet being recognised as critical capabilities in this industry. As far as BD&A is concerned, its value is known but there is still a long way to make this a top priority.

A strategic trend is “one that could have a major impact on the enterprise during the next three years" (Gartner, 2013).

A three-year period appears to be the norm: less is hype; longer is already a certainty. This timeframe should be considered when analysing the real impact of a trend in the business.

For the sake of this report, the analysis will be focused on three trends (or *mega-trends*): **cloud computing**, **strategic big data & analytics** (BD&A), and **mobility**.

Moreover, none of these can be labelled as *Emerging Trends*. For example, the Internet of Things (IoT) is an *Emerging Technology* because it is at an initial stage of development. However, IoT is powered by cloud computing, mobility and BD&A, and these are already in mature phases.

The analysis conducted here will focus on the disruption that these mega-trends will cause to businesses, specifically within the pharmaceutical industry, and on the costs and risks of their adoption.

In 2013, Gartner's report showed that mobility, BD&A, and cloud computing were the centre of all attentions when it comes to technology. Their research highlights the importance of the *impact* they cause in companies that adopt them. Not only the impact of organisational changes required to implement these initiatives; but also as a disruption to the *status quo*, markets, competition, etc. After all, the main objective of having such technologic assets is to gain competitive advantage, either by having more information and, consequently, charge premiums; or by reducing costs. To do so each company must choose the best possible approach to the trends that are believed to bring most benefits.

This report will also focus on the operating model and it will "*consider influences on individual human beings, the business or the IT department*” (Gartner, 2013) when looking at resources and capabilities.

Lastly, although it is possible to split each of these mega-trends into smaller ones, that is not in the scope of this report. Moreover, the importance of

organisations to understand their customers' sentiment is recognised, but social analytics is also out of the scope and will not be detailed in here.

Challenges

> *"This year's list reflects the increasing impact of the Nexus of Forces: mobile, social, cloud and information" (Gartner, 2013).*

The world is getting more connected; information moves a lot quicker and technology is changing the way people do things. The world has evolved from desktop computers to smartphone and tablets, cloud computing and other leading-edge technologies. With all these changes happening so quickly in the IT space, considerations must be made regarding:

- People's behaviours,
- Internal and external stakeholders expectations,
- Disruption to operations and business processes, and
- Companies' IT environment.

A trend with a positive impact in one of these dimensions often causes problems in another. Recurrently specific ideas regarding IT adoption are not well articulated or negotiated with others, and so, establishing a good relationship between business users and IT is key.

Nowadays, everyone in the organisation is a potential source of IT requests. The *Bring Your Own Device* (BYOD) concept is a great example of changes happening in a modern organisation's office. This poses security risks, data protection issues and the potential of cyber-attacks, but could also provide greater creativity, productivity and collaboration within the workplace.

Furthermore, what is a source of benefits to some users can also be a source of costs to others. For example, employees asking companies to *go mobile* often ignore the fact that this represents a burden (operational and financial) to the IT department as it requires investment, development and maintenance of different ecosystems, as well as, monitoring different sources of security threads. Ultimately, although it might bring efficiency, it also represents a significant increase in costs for the department and for the organisation overall.

The point is not to argue who (business teams or IT) is right or wrong. The example above demonstrates firstly, that all initiatives have pros and cons; and secondly, that regardless of who asks for IT changes, they might be disrupting the way others work. Thus, it is critical to highlight the importance of the marriage between all parties involved in IT adoption to, in the long run, collect the benefits of such initiatives.

As a final note, the Process-Enabled Information Technology (PEIT) model explains most of these challenges.

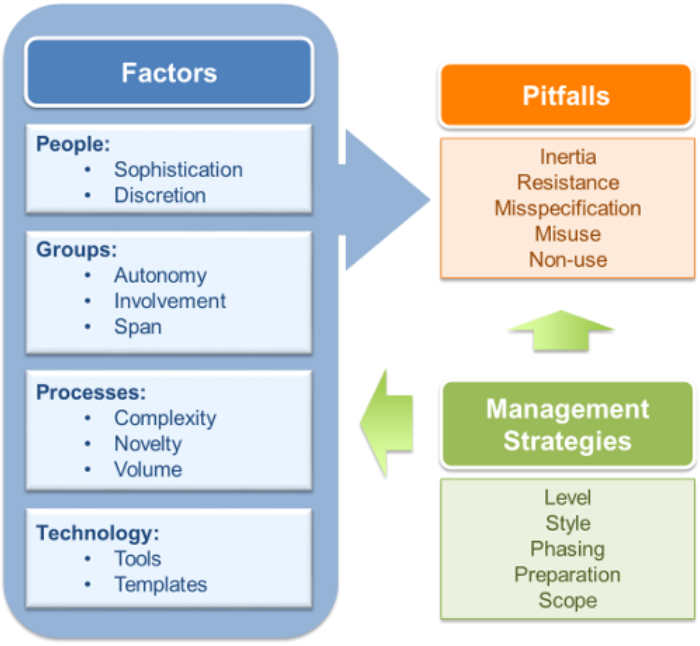

Figure 33 – PEIT model

The aim of this framework is to search relationships between all variables within people, groups, processes and technology, and to understand how they relate to each other and the pitfalls they can create. Acknowledging this will mitigate or avoid experiencing common issues such as inertia, resistance, misspecification, misuse, and non-use.

Frequently, companies do not consider, for example, people's experience or groups' behaviour that are going to be affected by the implementation and usage of technology. There is a tendency to disregard HR and technology coordination in such projects, but both need to interact. People need to feel they are part of it and their involvement rewarded.

It is critical to have management strategies in place regarding adoption scope, team involvement, processes, procedures, timelines, etc., to mitigate the risks already outlined and lead companies to achieve the competitive advantage they are looking for.

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CHAPTER VI – THREE TRENDS: CLOUD, DATA & MOBILITY

Cloud computing

> *"Just as the 80s was the era of the PC, and the 90s (and 00s, too) was the era of the Web, it's inevitable that the 10s will be the era of cloud computing" (Golden, 2013).*

Concepts & Benefits

McKinsey Global Institute (2013) defined cloud computing as "sharing services accessed or arranged over the Internet, including use of infrastructure, products, and other assets as 'services', enabling new asset-light business" (MGI, 2013).

To Forrester, this is "a standardised IT capability (services, software, or infrastructure) delivered in a pay-per-use, self-service way" (Forrester, 2012). The research company argues that to be in the cloud offers cost savings but "typically not through hard cost savings". Gains come from efficiencies that companies get on agility, speed, and valuable assets optimisation. Their study shows that 43% of the companies who answered Forrester's survey use external vendors to build their cloud environment, 14% have full pre-integrated package solutions and 31% build their own solution.

According to IDC Insights, "*by 2020 more than a third of the Digital Universe will either live in or pass through the cloud*" (IDC, 2013). In 2010, an IBM survey revealed that 80% of more than 1,500 CEOs worldwide were aware of the fact that the complexity in the IT environment would increase. Nonetheless, fewer than half believed their organisations were able to respond to it.

In his article *What Every CEO Needs to Know About The Cloud*, Andrew McAfee (McAfee, 2011) argues that Cloud computing helps fixing this challenge with its new tools and approaches. He argues that governance and sponsorship from senior executives are primarily important for the success of cloud computing implementation, as opposed to leaving this task solely to the IT department. Nonetheless, even today, executives strive to trigger the conversation and do not realise why such a discussion needs to happen outside of the IT department, why does it matter, and what the challenges are.

Many companies claim to have their own private cloud when, in reality, all they have is some kind of virtualisation. Veronica Henry (2012), described public cloud as "*resources and functionality available to business as well as the general public over the Internet*"; and private cloud in which "*an organisation's IT department effectively acts as the service provider for internal corporate customers*". The latter is preferred by many companies looking for "*more control over their infrastructures and inherently have more*

trust and confidence in their internal IT department than an outside entity" (Henry, 2012).

Most of Cloud computing benefits are unknown by the time a business case is put forward. However, "*unanticipated benefits often outweigh the intended ones*" (McAfee, 2011).

By shifting from on-premises, where IT assets (software and hardware) are kept and maintained in the company's facilities, into *the cloud* means changing the *data location* as well as the cost structure of the organisation. Effectively, the company moves away from a heavy burden in its balance sheet in the form of Capital Expenditure (CAPEX), to embrace Operating Expense (OPEX) in the income statement. One immediate advantage of such a financial move is to be able to predict when costs occur and how much will they be. The trend is often associated with subscription business models, in which companies pay agreed, upfront fees for using any form of cloud computing (Information-as-a-Service, Platform-as-a-Service, and/or Systems-as-a-Service).

Cost savings as the primarily advantage is, however, debatable.

W.S. Jevons, a Victorian economist and author of the margin value theories, concluded that the cheaper a particular commodity gets, the more applications people will find for it. As a result, its consumption increases leading individuals to spend their savings on it. This holds true with cloud computing. Today it is cheaper to run cloud-based solutions than to have the same technology in-house. However, with more options, the savings generated are spent on new applications, services, etc.

A Forrester's survey (2012) showed that 49% of their respondents looked at private clouds to reduce costs. However, agility for development and testing were considered the top benefits they would get (84%).

Moving into the cloud does represent a potential saving in the Total Cost of Ownership (TCO), which according to Gartner's online IT Glossary "*includes hardware and software acquisition, management and support, communications, end-user expenses and the opportunity cost of downtime, training and other productivity losses*". Assuming all solutions are similar and solve the company's problem, the best solution is, normally, the one that offers the lowest TCO. Sometimes, however, additional aspects such as security or compatibility must be considered when making the final decision.

The cost of losing a laptop due to theft, human error, or technical failure can be high when considering both the machine and its content lost. Having the information in the cloud allows companies to reduce the recovery costs.

Cloud computing is also a driver for agility and an accelerator for the implementation of other trends.

Organisations are not static and they need to adapt themselves to the environment that surrounds them. Scaling up or down is a major advantage of cloud computing, and mergers and acquisitions (M&A) is perfect to demonstrate how this trend can add value. Integrating IT assets is much

simpler, faster and cheaper if solutions are cloud based due to their flexibility. Likewise, the time it takes firms to spin-off specific businesses varies dramatically if they have their technology in-house or in the cloud.

Lastly, cloud computing accelerates other technologies deployment while reducing the cost of adoption. This technology provides support for mobility and BD&A as a storage place not only for the data itself but also for all the tools required to treat, analyse and use it.

Challenges

The first challenge, as seen in the Survey Analysis chapter, is data ownership, location and security. Who owns the data? Where is it located? Is it safely stored? These are frequent questions asked when companies move into the cloud.

Finance data does not belongs to the CFO nor does customer data belong to marketing or sales, but all data belongs to the company that, as best practice, should share it throughout the organisation to meet strategic goals.

And what about security? Is it a real problem?

Golden (2012) believes it is not. From his perspective, “The battle about how to do cloud computing is not going to be fought over security. [It] is going to be about how well a given cloud environment helps users.” (Golden, 2012)

Having specialised vendors providing cloud computing solutions should bring confidence to organisations to adapt to technology. After all, they have expertise and treat security as a key component in their business, which cannot be matched by pharmaceutical firms.

However, examples such as the National Security Agency (NSA) case, where information on the cloud was made available to governmental institutions, is raising questions about the safety of information. Security is not only about keeping hackers out, it is also to control internally who can see and do what with the data. This is still something that most cloud vendors are learning how to do and improving their offers. Few though have yet added these features to the products they are selling.

Often, security and privacy are closely linked to regulations, which in this industry can be a barrier for further exploration of cloud computing solutions (see Survey Analysis). For example, European legal requirements make it difficult for finance systems to be on the cloud, as servers and data must be kept in the European Union. Global companies are affected most as they find it difficult to consolidate their data in just one place.

Cloud computing adoption success should, therefore, be linked to business agility rather than security. Its business case should highlight shorter timelines, usability, implementation costs and finance predictability – i.e. investing in quicker, flexible, and upgradable IT assets as opposed to long-term legacy systems.

Another challenge is to find the right IT skills within organisations. Having applications, infrastructures and platforms on the company's premises implies a different vision and problem solving than to have it *as-a-service model*. It is a shift in the mind-set and operations for IT.

The lack of governance and sponsorship for cloud computing implementations might as well represent a challenge that, if not monitored carefully, leads to an *IT spaghetti* trap.

Usually companies focus their energy on keeping control of their information. It is also interesting to observe how attached IT departments are to *their* IT infrastructures. Breaking this link or reducing it to empower business users might cause disruptions within the normal functioning of these departments if not processed carefully.

Impacts: Industry and Operating Model

> *"If you'll pardon the pun, the near-term forecast for corporate computing is only partly cloudy." (McAfee, 2011)*

The preferred operating model of the industry tends to be the Unification model. Having all the organisations' processes standardised and integrated is amazingly difficult. Running them as a service in any form or shape enables companies to become more agile whilst using an operating model that does not allow a great span of freedom.

Cloud computing is a key driver for this to happen and yet it is not recognised as such by the workforce. "Cloud computing can provide new levels of security, collaboration, agility, speed, and cost savings for businesses of any size and type" (IDC, 2013).

An immediate consequence of shifting towards this trend is to have fewer assets in operation and, therefore, fewer costs maintaining them. Moreover, it simplifies the enterprise architecture, leaving more time for IT departments to focus on activities that truly add value to organisations, such as innovation, deployment of new solutions and so forth.

Cloud computing is a capability that pharmaceuticals want to embrace but still see as a concern either in terms of potential risks or as a barrier to overcome. The challenge in adopting this trend is not only to have the IT department changing their mind-sets, but also to convince those who sponsor these initiatives to support and advertise them internally.

Cloud-computing implementation and usage is highly related to individuals' perception of it. In other words, although all surveys (including the one run as part of this research) show that employees (and employers) do not trust the cloud to store information, most companies today are running their businesses and storing their information on it. It might be private, hybrid or public, but no organisation in the industry keeps everything on their premises.

Having all the information in-house would create an enormous roadblock for organisations to act globally. For example, R&D is one of the industry's most critical components and its innovation and progress would be heavily affected if information, services and platforms would not be widely available and connected throughout the organisation.

Use Case

Figure 34 - Pistoia Alliance

Strategic Big Data & Analytics

> *"Not everything that can be counted counts and not everything that counts can be counted," (Albert Einstein)*

Concepts & Benefits

Researchers often mention BD&A as the number one trend in IT and the most desired by senior executives.

MGI (2013) defines this trend as a "growing ability to collect, analyse, experiment with, and act on ever-larger and more complex data sets; harnessing real-time data flows (…) for nuanced insights that improve decision making and results" (MGI, 2013).

In one of his articles, Carr (2012) refers to it as "very large data sets, particularly those not neatly organised to fit into a traditional data warehouse" (Carr, 2012).

BD&A is made of two parts that complement and depend on each other: *Data* and *People*.

In fact, data has always existed in companies' servers. The trend, however, enables companies to combine and analyse different types of data (raw files, formatted documents, audio/video, and so many other formats).

Analytics play an important role in the organisational culture transformation by enabling firms to *predict* future questions rather than to *react* to past problems. This is what differentiates it from traditional Business Intelligence.

Big does not mean high volume only; it also means high variety of data coming from different sources and in different formats to be processed quicker. *Data* is referring to quality and value of the information to be analysed. Thus, creativity is now key to foresee challenges even before they happen, as opposed to use data to resolve existing business questions as it was done in the past.

> *"As our world becomes more networked and our activities more digital, data is more abundant, more diverse, and more available in real time," (MGI, 2013).*

All the initiatives surrounding BD&A, from adoption to analysis, are about change – "business processes, data sources, infrastructures, architecture, skills, organisational structures, and economies" (Laney and Beyer, 2013).

Senior leadership team sponsorship is critical for a successful implementation, with studies showing that these run smoother than those, which are not. This is mainly because it facilitates adoption at all levels, and supports changing a data-driven culture embedded in organisations to a more *experiential, decision-making* approach based on analytics. Accurate, actual and treated data is therefore available to the entire organisation, rather than chunks of loose and non-compliant data stored in individual departments.

Research by Deloitte Analytics (2013) shows that 80% of the respondents use BD&A, and 96% of the total population surveyed referred to it as a trend that will become more important in the next three years, mainly because it is not yet fully utilised for decision making. In its report, Deloitte states that analytics should "*solve a problem, be predictive, and be implementable*" (Deloitte, 2013).

In the same year, research by Gartner predicted that Big Data will fade away, leaving room for "*strategic, predictive and prescriptive analytics*" (Gartner, 2013) to emerge.

Another study, by Tata Consulting Services (TCS, 2012), surveyed more than 1,200 executives from large organisations (with revenue in excess of US$1bn) and concluded that those that spent more in BD&A gained competitive advantage over those that were slowly adopting, or not investing at all.

Such studies support the results in the survey in this research. Collecting data *per se* is not enough. It is critical to have technology that enables this data to be processed and analysed in the shortest amount of time. Technology like *in-memory computing* (e.g., SAP HANA) is critical for this part of the process.

It is also fundamental to have business needs well defined to make these analyses usable.

In short, computing memory, storage and software costs are decreasing and, therefore, more organisations are embracing BD&A, leading to a significant increase of technology consumption. In fact, one study showed that these costs are dropping 1% each year, while consumption is increasing 20%. Thus, from a business standpoint there are no real savings.

Challenges

Challenges are related to resources and capabilities within enterprises, namely governance, talent and knowledge.

Data is coming so fast, and in so different formats, that lack of talent, shortage of proper technology to support analytics, deficient buy-in and distrust in the data available are challenges that organisations face.

BD&A is not only about data mining but, more importantly, about data analyses. Until recently, companies focused on collecting information and hired or trained their resources to do so. There is, however, a change in the skills required and, therefore, data scientists are becoming popular in the job market. MGI (2013) forecasts that by 2018 there will be a shortage of 140,000 people with such skills in the United States alone.

According to MGI research, it is key to have the best talent performing specific roles within the analytics team. Many companies fail to do that and they end up having a dysfunctional team that is not able to cope with what is required of them: to produce analytics that give companies a competitive advantage.

The challenge is not only to find supply in the labour market, but also a matter of having *the right people*. Harvard Business Review (2013) defines five roles required in *the right team*:

- Data Hygienists (responsible for data quality)
- Data Explorers (to discover which data is needed)
- Business Solution Architects (to organise the data)
- Data Scientists (responsible for data modelling)
- Campaign Experts (to turn models into results)

In theory, this would allow potential powerful alliances between businesses and their customers and vendors. It also creates a business opportunity for companies regardless of their industry. Pharmaceuticals could, for example, share (or sell) their least sensitive data to medical equipment organisations so they could develop better and more useful instruments. However, as seen in

the survey carried out for this research, sharing information is not yet something that organisations do too often, if at all.

Another challenge is that numbers and analysis used for strategic decision-making very much depend on the models and algorithms that organisations create, and therefore, invest in. Decision makers should not blindly trust the data given by analytics as it is spit out by an algorithm; instead they must look at the information and put it into context. It is thus critical to involve the business teams in data modelling.

Moreover, managers are pushed to take quick decisions and often they tend to rely on short-term data, which can be misleading. For example, if the end-question is budget definition, it is not enough to look at previous month's data but rather to a longer period to have the best outcome. This gives managers a view of patterns and trends, and hence long-term data driven models are often better predictors.

Regulation is a constraint that cannot be ignored, and patient's data protection one of its critical pillars. This is the most important data for pharmaceuticals, but also one being closely monitored by the authorities.

Different data sources contain personal and sensitive information and, even if it is not possible to identify the individual, there is still the risk of data triangulation with other databases. Ultimately, it can lead to data being stolen and used for the wrong purposes, or to invasion of privacy. In any industry, and in particular in the pharmaceutical one, there are terrible consequences for misuse of data that involve ethical issues.

Impacts: Industry and Operating Model

As already mentioned, awareness within pharmaceutical organisations is increasing with regards to the importance of analytics for their operations. Most of them have been collecting data but only a few have been analysing it in a consistent way.

Technology improvements allow organisations to design their data models and run as much iterations as required to achieve the best possible model. All this happens in a matter of hours or days, depending of its complexity.

Deloitte Analytics (2012) states that many companies are starting to centralise their BD&A lines of business, so data can be accessed by the entire organisation. The survey identifies a trend where companies are moving the treatment of data to SSC or CoE to then distribute it across the firm, in a centralised manner, and without involving political games. Such an approach is leading towards the unification model, which is the operating model of choice in this industry.

This, however, raises the challenge of talent, data ownership and politics inside organisations.

Data ownership is one of the common challenges that organisations face, and it is different from organisation to organisation, especially in larger ones.

Finance departments allocate more time to deal with large chunks of data. Research by Deloitte (2012) identifies Chief Financial Officers (CFO) as those demanding more from analytics. Nonetheless, this information can be a source of competitive advantage if also used by other areas (e.g. by the Chief Marketing Officer in marketing campaigns and market segmentation strategies).

Moreover, trends are evolving and organisations in this industry should start using historical data and data models to project future trends and invest accordingly (i.e. predictive analytics).

Use Case

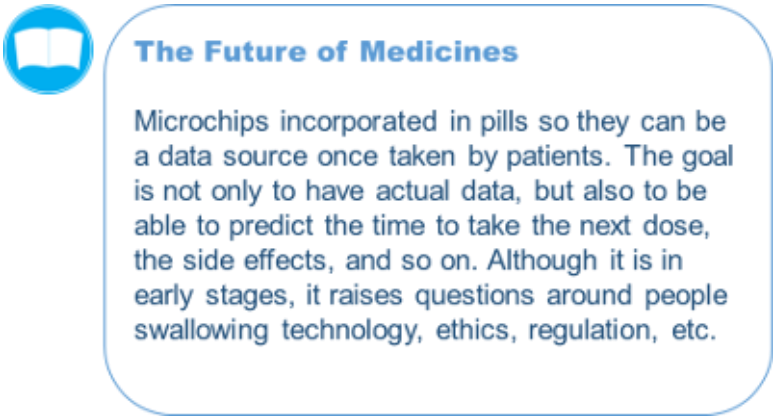

Figure 35 - The future of medicines

Mobility

> *"Mobile isn't a trend. It's a new state of mind." (Schadler and Bernoff, 2013).*

Concepts & Benefits

Schadler and Bernoff (2013) defined mobile mind-shift as "the expectation that any desired information or service is available, on any device, in context, in a person's moment of need" (Schadler and Bernoff, 2013).

This trend has a major impact on pharmaceuticals, especially when in interaction with macroeconomic tendencies such as increase in life

expectancy, population growth, etc. Mobility will allow more data to be produced, collected, and used, potentially leading to sales increase in the industry. In fact, both sides of the economy, supply and demand, will benefit from mobility. A forecast by Cisco (2014) noted, "*Global mobile data traffic will increase nearly 11-fold between 2013 and 2018. Mobile data traffic will grow at a compound annual growth rate (CAGR) of 61% from 2013 to 2018*" (Cisco, 2014).

MGI (2013) forecasts that by 2025 the greatest impact of mobile internet will be seen in developing countries, where more than three billion new users choose this as their preferred way to connect to the internet, with a predicted "economic impact of US$10 trillion to US$20 trillion annually in 2025, including consumer surplus". The research firm also says, "China and India now have more than one billion handsets and are among the largest number of Internet connections in the world." This is explained by the continuous growth of the purchasing power that the middle class is gaining.

The benefit for organisations is that it increases employees' productivity and share of knowledge, a fact not yet recognised by CIOs as shown in a recent study by MobileHelix (2013).

Challenges

Most of the challenges described for cloud computing and BD&A equally apply to mobility, and so they will not be detailed in this chapter. Among these, talent, cost, security and privacy are those factors stopping companies from embracing more mobility opportunities.

Complexity and accessibility are also barriers noteworthy of discussion.

The MobileHelix study shows that nearly 90% of CIOs believe their employees want to use mobile apps and data. The study identifies a potential productivity increase of 36% if companies get mobile solutions for their core applications; it also states that only 86% of the companies have web applications, out of which 53% are browser-based apps, but only 22% can be accessed on mobile devices. The reasons highlighted by the survey for such a small percentage are: delays on development (63%); security concerns (63%); increase in support and maintenance costs (48%).

Finally the concept of mobility can be very confusing and result in different definitions across industry or even within the same organisation. Mobility might refer to simply distributing smartphones (which some companies do not include under the mobility umbrella) to large mobile software implementation such as ERP solutions.

The aforementioned factors prevent innovation and productivity to increase within organisations and should not be overlooked.

Impact: Industry and Operating Model

In this industry, business processes are very much standardised and, more often than not, well integrated. Mobile working means opening the door to a wide range of possibilities, which can act against such integration and standardisation. Further, the impact of IT consumerisation is a game-changer and companies must adapt and embrace to this new reality.

Mobility is also creating new opportunities in research solutions especially for developing markets. Mobile Health (i.e. *mHealth*) is one example of how this trend is impacting the industry.

Use Case

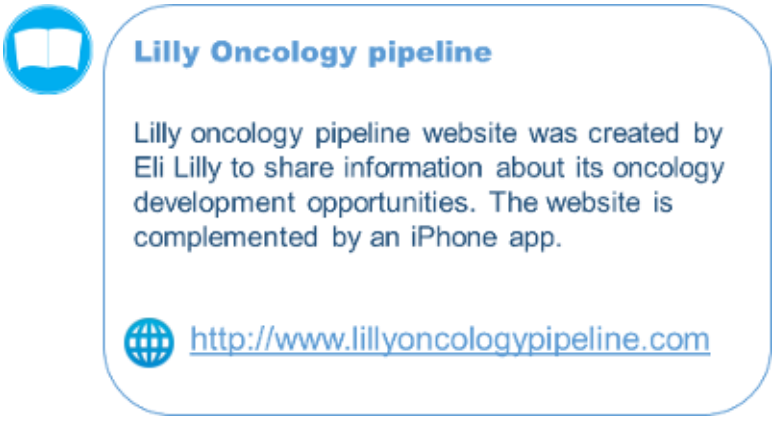

Figure 36 – Lilly oncology pipeline

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CHAPTER VII: SO WHAT?

Is the pharmaceutical industry ready to accept and adopt the latest IT trends? What lessons can be learned from this report and applied from/to other sectors (and their operating models)?

Although the industry is ready to adopt these trends, they are not yet seen as top priorities. This is not to say that pharmaceuticals have not yet embraced technology or are not innovating, because they are and must do so in order to survive in this market. However, there is still a long way to go, especially regarding regulations, intellectual property, and adoption of the required mind-set.

One of this report's findings is that organisations need to spend a larger amount of time and money on educational and hiring programs. Equally important, is the fact that none of the respondents see their organisations to be ahead of industry standards. This can be due to the fact that legal restrictions, security and industry regulations are hurdles for these trends to be fully utilised, and/or because there are no standards clearly defined.

Resistance to using IT is often due to a lack of knowledge and/or security and privacy concerns (as seen in the in the adoption barriers under the *Survey Conclusions* section). Cloud computing and mobility are not perceived as critical capabilities in these organisations but more as security threats. However, these might as well be the key for providing a better education, and in turn shift the existing mind-set, as they enable quick and better information sharing, decreasing IT costs and making knowledge available when and where it is needed. Ultimately it generates productivity gains, and facilitates cross-departmental collaboration (as seen in this reports' survey).

Cloud computing, BD&A, and mobility are not going to fade away; they are already evolving rapidly and there is great potential for them in the pharmaceutical industry. In fact, 67% or the survey respondents mentioned that decisions are already being made based on some sort of analytics.

Solid and stable companies, especially large players, should not lose focus on these trends and, instead of reacting to them, they must use them proactively to their benefit, not only to go to market but also to innovate internally. In order to do so, the appropriate operating model has to be rightly selected to complement companies' business models. IT can be the catalyst for innovation and the engine for delivery if the right model is in place. Unification was proved to be the preferred option by this research.

Further, the right enterprise architecture across the organisation enables processes to be changed in a controlled way, avoiding disruption. By deploying consistent platforms, innovation can propagate throughout the organisation.

The IT trends covered in this report are not temporary or techie words. All three are currently part of most of the population's daily life and they are

powerful enough to disrupt businesses and force organisations to operate and/or embrace different business models.

The question today is no longer about the value added by each of these trends, but how to combine them and to create more value. All three are inter-linked. For instance, BD&A will not deliver full benefits if cloud computing is not implemented and results are not available immediately. Also, Strategic Big Data & Analytics requires in-memory computing to enable data crunch, and mobility for decision-makers to quickly access it, wherever and whenever the data is needed.

Noteworthy is that such disruption can occur overnight and with immediate effect. Thus, companies need to react quickly so that all potential risks are mitigated. To work at full steam, all the IT trends mentioned in this report (and its various sub-categories) must interact with one another to produce full benefits for companies implementing them.

Furthermore, they allow companies to use multi-layer IT strategies. For example, a typical scenario in ERP implementations would be to have a first layer running the main ERP (e.g. SAP or Oracle) on-premises, and multiple cloud layers built upon the core one, to run specific business units' systems (financials, CRM, etc.).

Similarly, by implementing these technologies, companies reduce their shadow IT costs. By providing users with compliant technology, companies divert them from using their personal tools at work, which can cause security breaches, expose corporate data, etc.

Return on Investment is also relatively simple to demonstrate to stakeholders due to its shorter implementation lifecycle. Cloud computing, BD&A or Mobility solutions are fast to build, maintain and support, and typical projects require limited resources.

BD&A is the trend facing the greatest number of implementation barriers (see *Chapter IV* for further details). Of relevance is the fact that budget and, especially, lack of talent, are key questions to be considered when discussing this topic.

… in the Pharmaceutical Industry

Operating Model

Unification and replication models are those preferred by companies in this industry and within their business units. These two models have a high level of process standardisation supported by technology in common, but they differ in the process integration level, which allows divisions to be more or less independent. This is also the variable that costs more time to monitor.

It raises the question of how agile and flexible companies must be in order to avoid unnecessary barriers to IT adoption, whilst protecting sensitive information and enjoying the benefits of standardization (e.g. cost reduction, knowledge transfer, etc.).

One operating model is not better or worse than any other, however companies must ensure they chose and stick to the one that best delivers their business. Technology is a driver for competitiveness and it is as good as the investment made in it and the strategy defined for its use.

Pharmaceuticals have realised this for a number of years and have adjusted accordingly by integrating and standardising specific functions, processes and systems (e.g. ERP). Now it is time to take this game to a new level, and companies are aware of this need. For example, they have realised the importance of data modelling as a source of information, and hence the investment in centralising such activities by using different parts of technology – i.e. although better analytics is the end result, cloud computing and mobility are the means to achieve it.

Consequently, data models are more accurate because they are built upon different case-scenarios, and results are widely and quickly distributed allowing organisations to resolve their business problems. Also, risks of model and data manipulation (e.g. through political games) are being mitigated.

Specific resources and capabilities are required to identify and also to implement the relevant operating model. The ones highlighted as a result of this research, are described below:

Talent & Knowledge

One of the most important resources and capabilities that organisations count on is human resources, and adopting cloud computing, mobility and BD&A brings organisations a significant problem of talent supply.

Trends adoption requires a new mind-set that companies often do not have in-house. They can either hire externally or, alternatively, create conditions for their own staff to adapt and change into this new mentality. Otherwise, they will not be able to overcome their competition.

This leaves firms with a paradigm to resolve. Experienced hires, who have the knowledge, will resist change and will do things as they always have; whereas youngsters have these trends well embedded in their minds, but lack professional skills.

Organisations, small or large, need to be agile to take this journey, which requires courage, a well-defined strategy, and leadership buy-in. A strong Governance model to monitor these initiatives and ensure the key benefits are achieved must also be in place.

Technology

The second most important capability is technology. Not only do regulations act as external roadblocks for trends' adoption, but also the industry is very sensitive to information coming out of the companies premises, especially concerning R&D. This makes the industry resistant to technology and use it because of the need to innovate and, therefore, to survive in a tough competitive environment.

Outsourcing

A capability that pharmaceuticals could make more use of, and which is more frequent in other industries, is outsourcing of functions that don't add value. However, this is changing. Cost pressures are pushing companies to increasingly outsource non-differentiator IT and business functions. The dominant model is multi-sourcing – i.e. "*use different outsourcers for project development and for IT operations and rarely outsourcing the entirety of IT to a single provider*" (Forrester, 2009).

… In Other Sectors

The pharmaceutical industry is unique in many ways; the most important being that it directly impacts peoples' lives and wellbeing. As a result, it has a lengthy product lifecycle, is heavily regulated, and greatly dependent on patents, prone to ethic risks, etc. All these are potential barriers that can slow down its readiness for technology.

Sectors such as financial services or insurances, where such externalities have a considerable weight in the business, face similar challenges and, therefore, could learn from *pharma*, even though the cash flow differs substantially between these two industries.

Others, such as consumer goods, technology or telecoms are, by their nature, more dynamic and their operating models tend to be very different. The principals, however, could be drawn from the analysis in this report and adapted to the sector's reality.

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CHAPTER VIII: RECOMMENDATIONS

There is not a single way for companies to get ready for new technology waves, and each must access where they are at in this journey. There are, however, recommendations to be implemented to either trigger thoughts or even actions from decision makers to lead their companies towards IT adoption.

- Re-allocate budgets and be proactive: Organisations in this industry must take a more proactive approach towards IT trends than they have done thus far, and invest more in them. Firstly by identifying the *real* restrictions and constraints; and secondly by running more *as-a-service* pilots in key areas of the business, even when these are smaller propositions. In order to achieve the desired outcomes, companies must put in place appropriate governance structures and focus on educational initiatives.

- Re-access the operating model: Companies must re-assess their target operating model and decide whether it still makes sense in the new digital era, or whether it needs to be re-defined. The investment in technology and, most importantly, in the adoption strategy, must be aligned with the chosen operating model.

- Collaborate: Organisations must talk more to their IT vendors in order to have a greater knowledge of their plans and the future of these trends. Equally important is sharing information with vendors, customers and other organisations (e.g. insurance companies) so everyone works towards a common goal, which ultimately is to develop better products and help people to live better lives. For example, by contributing towards emerging technology such as pills with microchips to provide data and help with developing new treatments.

- Re-access IT value proposition and act as business partner: IT departments must think (and a few already do) as technology *service providers* rather than constantly reinventing the wheel. Having such conversations with the business helps to increase adoption rates as well as diffusing knowledge within organisations. In the long run people become less afraid to use technology and more keen to adopt it.

- Take the next wave but be aware of risks: It is not advisable that companies implement the latest technology just for the sake of it. Ensuring that it has been tried out and tested in other industries or by other companies can be the secret for better results. This is nevertheless a double-edged sword as companies risk losing the right timing and, therefore, competitive advantage. It is extremely important that they phase and plan implementation deliveries, ensure stakeholders engagement through the process, and IT investments are economically suitable for their purpose.

It is important to recognise that each methodology (i.e. Agile, Waterfall, etc.) has its own advantages and disadvantages. Nonetheless, regardless of the methodologies used, firms must ensure they follow a number of required steps to be successful in IT adoption:

1. Establish an approach and be specific when selecting standards (i.e. choosing a methodology should not be done randomly);
2. Ensure project environment supports the chosen methodology;
3. Establish meaningful metrics for the approach;
4. Establish continuous improvement (e.g. keep a record of lessons learned);
5. Invest in tools after deciding on the methodology.

These recommendations come at a cost, mainly impacting budgets and impacted by resources restrictions. It also involves changing behaviours, most of the time deeply ingrained in organisations. However, the return from these investments outweighs their expenditures, especially in times where technology is getting cheaper and more accessible, and the results obtained are proved to affect firms positively.

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FURTHER RESEARCH

This paper discussed specifics about three *mega-trends*' impact in the pharmaceutical industry, and in its operating models. This is, however, a broader subject, with many areas to explore – especially regarding trends and their future.

Further research would be suggested in the following areas:

- The industry is very conservative in terms of data sharing. However, sharing data accelerates the pace of innovation, ultimately resulting in better healthcare and quality of life. What needs to change for companies to start sharing data with business partners? What advantages and disadvantages will that bring?
- This industry is heavily regulated which is a main constraint to fully embrace these trends across the whole organisation. Could this be loosened without compromising patients' health or ethics?
- Mobility is the trend that is foreseen to grow more in the medium-term. How will it impact the industry, especially with regards to *mHealth*? What does it mean to work from home *versus* being in the office, now that employees often have better IT tools at home?
- The required BD&A skills are scarce in the market. What will be the industry's approach to avoid this gap?

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NB: Should you like to collaborate in pursuing such investigation or giving me feedback about what you have read, please feel free to contact me at stratimpactbook@gmail.com or visit http://www.stratimpactbook.com.

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ABOUT THE AUTHOR

André Correia is a senior IT professional with over 15 years of Corporate IT Strategy and Business Transformation delivery experience, most of which working in an international environment leading multi-national teams, in countries such as the UK, Switzerland, Portugal, Angola, and Singapore to name but a few.

For more than 4 years, he was privileged to be part of a large business transformation initiative in the Pharmaceutical industry, where he had the opportunity to learn about its culture, operating model and its readiness for adopting IT trends.

Such experience gave him the motivation to write his Executive MBA dissertation at Cass Business School (London, United Kingdom). The project was focused on the "*Strategic Impact of IT Trends in the Pharmaceutical Industry*", and it was finally submitted in March 2014, nine months after it has begun.

The report marked a key milestone, the successful completion of the MBA, but it was never seen as the end of the project. The ambition was to publish a refined version of the submitted report, ultimately to share both research and conclusions with a wider audience.

This work is intended for professionals on the pharmaceutical industry, but also, everyone with an interest in Cloud Computing, Mobility and Strategic Big Data and Analytics, as conclusions to other industries can be (and are) drawn upon those found for Pharma.

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CONNECT WITH ANDRÉ CORREIA

Dear Reader,

Thank you for reading my book.

Should you like to collaborate in pursuing further investigation or giving me feedback about what you have read, please feel free to connect.

Thank you,

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ENDNOTES

[1] **Generics**: According to the Food and Drug Administration (FDA) definition, generics are “comparable to a brand/reference listed drug product in dosage form, strength, route of administration, quality and performance characteristics, and intended use.” [back]

[2] **BYOD** is a firm’s policy that allows employees to use their own devices and IT tools in their workplace. [back]

[3] “**IT spaghetti**" is created by a myriad of local important IT projects that add some value but also add to overall complexity and cost, and work against providing a great end-to-end customer experience and business agility (Quaadgras et al., 2013) [back]

[4] **Shadow IT** refers to software and hardware not supported by the organisation’s policies, for example, using services such as Dropbox, a storage cloud-based application. [back]

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APPENDICES

Appendix 1: Cloud information

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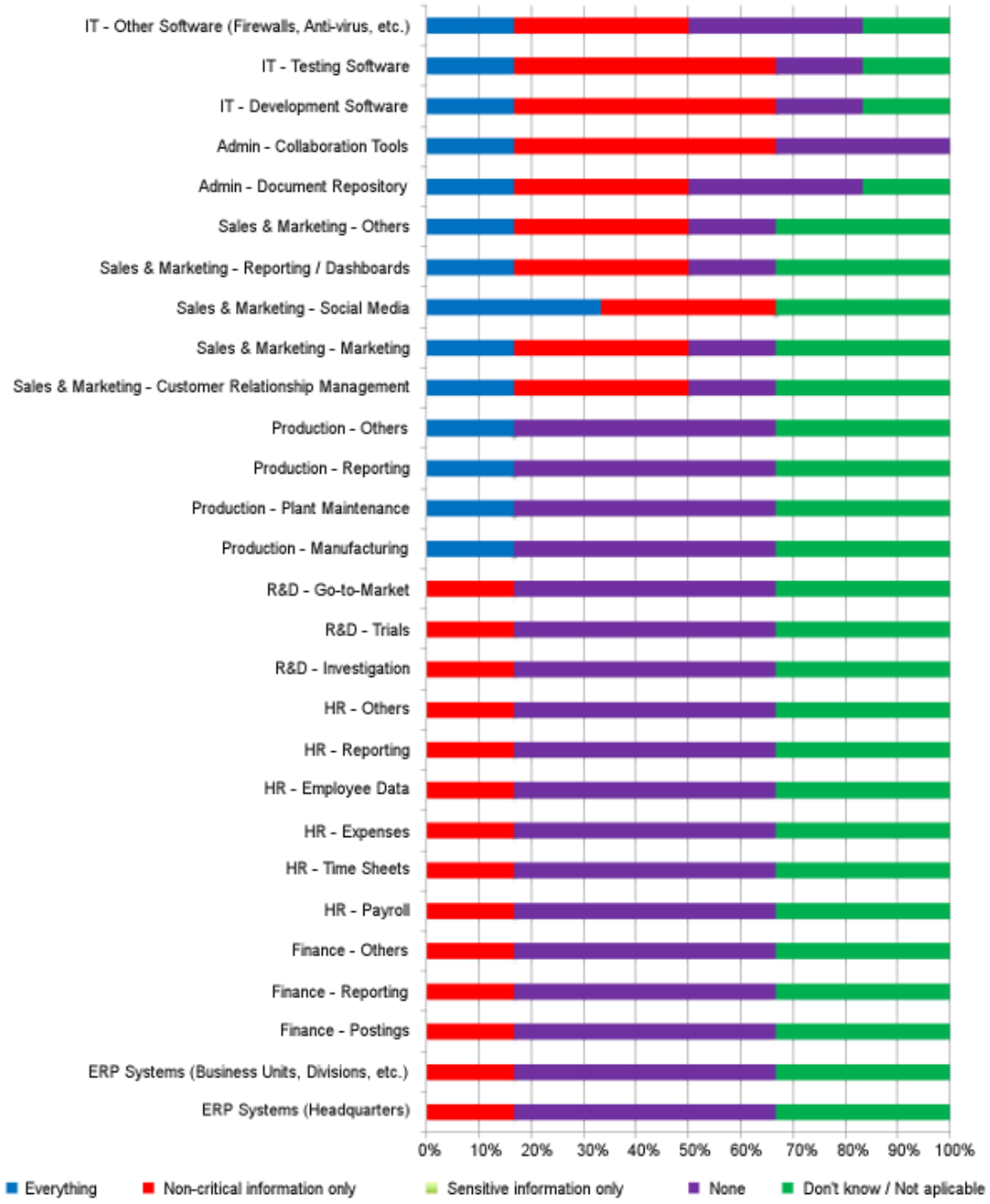

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