Information Management leads top line Information Technology initiatives and contributes to bottom line targets

The Chief Information Officer is a technical innovator and custodian of the IT architecture

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by

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Mr. Rector, Ladies and Gentlemen,

Information Management[1] is pivotal in our digital economy and must be firmly embedded in any organization. Information Management is no longer focusing only on orchestrating demand and supply. We are well beyond business and IT alignment. Information Technology is an integral part of products and services and essential in creating competitive advantage. Chief Information Officers head Information Management and drive digitalization (and digital transformations[2]) to contribute to the top line ambitions. They are innovating and maintaining the IT architecture to facilitate digitalization and meet bottom line targets. This sets requirements for governance. For avoidance of the doubt the importance of Information Technology is increasing, however Chief Information Officers continue in their supporting role. The digital economy also sets challenge for the business. Business leaders need to become more tech savvy. After being in denial for decades, they also need to act. The latter is perhaps the bigger challenge. Today my focus will be on Information Management and the Chief Information Officer role.

Let me start by providing the historical perspective followed by the analyst perspectives. Next, I will share my thoughts related to digitalization and a deep dive into technology topics. In my speech today I will address first enabling technologies, cloud computing and DevOps followed by new technologies which have a direct business impact (in alphabetic order) big data, blockchain, cloud computing, DevOps, Internet of Things and robotics. Then I will address the implications of compliance. I will conclude with IT architecture and governance implications. I'm confident this agenda will support Chief Information Officers in becoming technical innovators and custodians of the IT architecture.

[1] Academics have a lively debate on Information Management versus Management of Information Systems. Piet Ribbers has addressed this is his valedictory; information is a too-critical resource and is not limited only to systems (Ribbers, 2014).
[2] Multiple, as digitization is not limited to a single transformation, it is a continuous process of increasing customer value.

1. Historical and analyst perspective

Historical perspective

Today, Information Management is different from previous decades. Let me provide a historical perspective. In the '70s, the focus of Information Management was initially on supporting the decision-making process[3] and user performance.[4] IT directors and engineers were pioneering in the field of Information Technology. The first ERP systems and relational databases were emerging. Technical limitations restricted the growth of Information Technology. The involvement of business representatives was nonexistent: they had to accept the services provided by the IT department. Within the 80s, the service orientation of Information Management emerged. Information Management started providing information management support for management activities and functions (Ives et al., 1980). Information Management became organization focused in this decade.[5] In the 90s and 2000s, the emphasis shifted towards enhancing performance by creating learning organizations.[6] Information Management facilitated this change and enabled learning organizations. Chun Wei Choo defined Information Management as 'the management of a network of processes that acquire, create, organize, distribute and use information' (Choo, 1995/2002). In the 2000s and 2010s, integration of value chains emerged and, as a consequence, business and IT alignment became a top priority for Information Management (Burn and Szeto, 2000; Cibora, 2000, Mumford, 2006, Papazoglou et al., 2000; and Tallon, 2007). The change from the internal user perspective, with focus on optimizing the value chain, to the external client perspective, with focus on creating value, is transformational and contributed to the rise of digital. Digital transformations are here there to stay (Westerman and Bonnet, 2015; Majchrzak et al., 2016; and Andriole, 2017) and make the technology landscape more complex because digitalization is adding Information Technology to any product and service (Ebert and Shankar, 2017, p. 112).

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[3] As detailed in the research models of 1. Mason and Mitroff (Mason and Mitroff, 1973) by Class of Problems, structured decisions -certainty, risk and uncertainty- and unstructured decisions, 2. Gorry and Scott Morton only focus on supporting decisions by their framework consisting of structured and unstructured decision making, paired with three levels of managerial activities and Structured Decision Systems and Decision Support Systems (Morton and Morton, 1971), and 3. Chervany et al. (1971) by factors which determine and measure the decision quality.

[4] Lucas (1973) presented a descriptive model for the use and performance of an Information System.

[5] "A complete information system is a collection of subsystems defined by functional or organizational boundaries" (Ives, et al., 1980, p. 910).

[6] Organizations that adapt their behavior.

Emerging strategies are becoming more important than planned strategies (Marabelli and Galliers, 2017). This sets the agenda for IT-architecture and governance.

Analyst perspective

Let us take a closer look at analyst reports. Let me address three elements. First, the perspectives of Line of Business managers and the Chief Information Officer's self-perspective are not aligned (IDG, 2017). According to Line of Business Managers, Chief Information Officers are, compared to their self-perspective, less actively recommending technology solutions, less successfully collaborating on building a business case, and less acknowledged in developing technical requirements. Chief Information Officers need to do better. This aligns with the two biggest challenges[7] for Chief Information Officers in the Harvey Nash and KPMG report: 1. creating a nimbler technology platform (52%) and 2. the number-one target for the next year is driving corporate revenue (32%). Additionally, Chief Information Officers will face less predictability (64%), and there will be a reduced focus on long-term planning (3 years+) (Harvey Nash and KPMG, 2017). Obviously, speed continues to be more important. Faster development cycles and rapid deployment (DevOps) becomes the norm (Ebert and Shankar, 2017). DevOps governance and tooling require the Chief Information Officer's attention, as well as maturing DevOps contracting and capabilities. However, organizations need to also spend time and effort on replacing legacy systems and improving foundational Information Technology platforms. This will also enable the need for speed. In the architecture section I will explain in more detail the need for an improved foundational technology layer.

Secondly, cyber security is addressed as a priority in nearly all analyst report. Achieving cyber resilience is a pre-requisite to staying in business and must be embedded in the IT architecture and governance. Chief Information Officers will continue to spend significant time and effort on cyber security in the years to come. Unfortunately, only one in five Chief Information Officers feels currently prepared for cyber-attacks (Harvey Nash and KPMG, 2017). Therefore, security is the number-one investment for most companies. According to Gartner, 28%[8] have already invested in digital security and 36%[9] are planning to do so on a short-term basis (Gartner, 2017a). Interestingly, Ebert and Shankar classify security and safety (quality requirements) as a mid-term priority (Ebert and Shankar, 2017). There is a lively debate about the security priority. Given the increasing impact and number of cyber-attacks, security deserves the highest priority instead of a postponing prioritization of security to the mid-term. Next to this, security departments can hold organizations hostage. Such a hostage situation can be avoided through common sense, applying security by design and implementing a proper IT architecture.

Thirdly, the social impact of technology, as described by the World Economic Forum (2015). This provides an interesting lens[10] that addresses the impact on technology, employment, and economic development. The impact of technology on employment is also addressed by Frey and Osborne from Oxford Martin School (2013). They believe over the next decade or two, 47% of US jobs will be replaced by automated processes (2013). This will not be limited to job performing rule-based activities (Brynjolfsson and McAfee, 2011; MGI, 2013). I would not be surprised if job losses in traditional professions will exceed the 50% mark prior to 2023. However, we have to acknowledge that for decades, an increasing number of traditional Information Technology jobs, such as helpdesk agents and infrastructure and application maintenance specialists, have been significantly automated. Technology dictates what qualifications are required. Information Technology reshapes the labor market instead of creating redundancies. On top of that, digitalization transforms our way of doing business. Let us take a closer look at digital transformations.

[7] Other important challenges are working with restricted budgets (49%) and investing in cyber security (45%).

[8] 53% for the top performers.

[9] 30% for the top performers.

[10] The World Economic Forum identified six trends: 1. People and Internet, 2. Computing, communications and storage everywhere, 3. Internet of Things, 4. Artificial Intelligence and big data, 5. Sharing economy and distributed trust (which includes blockchain technology), and 6. Digitalization (which surprisingly enough is defined as 3D printing).

2. Digital transformation

Digital transformation

In this day and age, digital transformation is very much in fashion. A lot of companies have embarked on digital transformations, only 10% of organizations not yet started (Harvey Nash and KPMG, 2017).[11] Digital transformations dominate the agenda of most executives. In reality, there is much skepticism[12], as most executives are risk averse (Andriole, 2017).

Digital transformations can include; enriching existing products and services; creating new services to improve the topline; making smart use of data; using mobile devices, social media, analytics, Internet of Things, and the cloud (Westerman and Bonnet,2015; Adner, 2016; Majchrzak, et al., 2016; Schoemaker and Tetlock, 2017). Digital transformations are a combined business and IT effort and are performed by joint teams. Digital transformations create new business models (Berman, 2012). Many organizations are very successful in initiating pilot projects but struggle to scale up. This is due to limited capabilities[13], a lack of governance, and the absence of a foundational IT platform. Becoming talent magnets and securing leaders with vision to lead the digital strategy and commit resources for execution are essential (Majchrzak, et al., 2016). This is a challenge for many organizations. Company culture, corporate image and brand are important. This challenge is a bigger challenge for traditional companies than for start-ups and tech giants. In my speech today I will focus on governance and IT architecture.

Except for innovative technologies, digital transformations have been around for decades. Schein (1992) defined four strategic IT visions, including ”transform”, which included “altering the products and markets.”[14] According to Andriole (2017, p. 20) organizations must prepare for a “planned digital shock”. However, don’t wait for a strategy, experimentation must run concurrently to

[11] Digital transformation adoption: enterprise wide (41%), working on strategy (27%), in individual business units (22%) and not adopted (10%) (Harvey Nash and KPMG, 2017).
[12] This sepsis is not limited to traditional organizations such as governmental organizations.
[13] Over time, the capabilities of organizations and their employees will mature. In (technical) universities, and business schools & MBAs, such as TIAS and Manchester Business School, will have to adjust their curricula if they are to contribute.
[14] See also Armstrong and Sambamurthy (1999). They explain technical assimilation is an important outcome in the efforts of firms to leverage the potential of information technologies in their business activities and strategies (page 1). They concluded that an intensity of the relationship between CIO and the top management team and sophisticated infrastructures are important to benefit the most from IT.

the traditional structured approach. Also, fail fast! Nearly all organizations I have engaged with applied short-term cycles and agile implementations of digital transformations ranging from four to thirty weeks.[15]. However integration across front, middle and back offices is important (Harvey Nash and KPMG, 2017), not only for efficiency and effectivity, but also compliance.

Pivotal for digital transformation success is combining hard data and soft judgment (Schoemaker and Tetlock, 2017). Data analytics are the heart of any digital transformation. Organizations need to keep their models simple and straight forward and have proper Master Data Management in place.

It is important to acknowledge that innovations are rarely stand-alone. Organizations need to select their partners and decide about their role in an ecosystem (Adner, 2016; Hensmans, 2017). In digital transformations, organizations need to take the lead to secure competitive advantage, select the right partners, and focus on managing the ecosystem.

Finally, the funding of digital transformations attracts interest and debate. With organizations leveraging corporate investment, self-funding and hybrid models (Kane et al., 2017). In most organizations a hybrid of self-funding via IT-cost efficiencies and corporate investment are used to initiate digital transformations. This combines the IT operations cost conscience and technology insight of the Chief Information Officer, and business sponsorship. Both are pivotal in the justification and success of digital transformations.

[15] To avoid doubt, agile transformation cycles are different from agile development cycles, which are ranging from two to four weeks.

3. Enabling technologies

Cloud computing

NIST has defined the cloud service and cloud deployment models (Mell and Grance, 2011). Most organizations have largely adopted cloud computing and embarked on their journey with a private cloud for Infrastructure as a Service (IaaS) and standalone Software as a Service solutions (SaaS),[16] such as Salesfore.com, Service Now, Dropbox or Workday. Cloud computing is reducing maintenance effort. This is predominantly favorable for SaaS, as the test effort in non-cloud environments for applications is larger than for infrastructure (Choudhary and Zhang, 2015). Furthermore, the maturity of SaaS solutions is improving. Although, as in the early days (Muller et al., 2009), the options for customizing[17] SaaS are blissful still limited to none. Fortunately, today most SaaS can be parameterized to a large extent. Also, Platform as a Service offers great opportunities to adjust functionality without compromising on the deployment frequency.

The pricing models of cloud services are pay-as-you go (Ma and Seidmann, 2015). Today's cloud computing market is an oligopoly market (Feng et al., 2014). Cloud providers need scale to be able to absorb the underutilization risks of offering cloud computing services. The oligopoly market introduces questions related to vendor lock-ins and coordination. Connecting cloud computing solutions and integrating cloud solutions with the legacy environment is a challenge for many organizations (Passacantando et al., 2016). Organizations that lack scale must be careful with contracting with multiple cloud providers for similar functionality. They have to accept the potential consequences of a vendor lock-in. As service continuity is rarely an issue for cloud computing[18] and the cloud computing market is a highly competitive market, the vendor lock-in risk is not material.

Furthermore, social media platforms generate an unparalleled amount of data: User Generated Content (GUC). This is unstructured data that have to be analyzed, which increases the need for cloud computing solutions. Cloud

[16] Previously also known as Application Service Providers (ASP) (Currie and Seltsikas, 2001; Tao, 2001).
[17] Adjusting the source code.
[18] The Amazon Web Services outage in 2012 and its impact on Netflix (cloud based streaming service) is one of the few examples. The outage caused reputational damage and business losses. Netflix offered users a discount to compensate for the reduced quality of service (Choudhary and Zhang, 2015, p. 846).

computing provides the platforms to perform analyses and provide meaningful insights (Liu et al., 2016).

Finally, tooling is at the heart of cloud computing; examples of orchestration tooling include Microsoft Azure and Kubernetes. Microsoft Azure enables the build, deploy, and manage applications. This is proprietary software. Google designed Kubernetes (K8s),[19] which was released in 2014. K8s is an open-source system for automating deployment, scaling, and management of containerized applications. It is widely used by leading tech companies, such as Red Hat in their Tectonic product, and IBM for Watson and its IBM Cloud Private product. It also supports container tools, such as Docker and Puppet. Cloud orchestration is a key capability for any organization and is led by the Chief Information Officer (Breiter et al., 2014; Sturrus and Kulikova, 2014).

DevOps[20]

No cloud computing, no DevOps. DevOps is a set of practices intended to reduce the time between committing a change to a system and the change being placed into normal production while ensuring quality (Bass et al., 2015). Agility is embedded in Dev(elopement) (Agile Manifesto,[21] 2001). Small development teams focus on continuous delivery of software in short sprints. This requires an increased deployment frequency,[22] which requires tooling. The tooling landscape is scattered (Inavat and Salim, 2016; Williams and Murphy, 2016); however, integrated PaaS solutions will overcome the issue. PaaS tooling breaks down barriers for DevOps adoption for immature and smaller organizations.

By introducing combining development and operations in a single team attention for segregation of duties is required. The control needs to be separated from operations. As an aside, the replacement of manual deployments by fully automated deployments reduces the risk level of deployments significantly (Balalaie et al., 2016).

[19] Google donated K8s to Cloud Native Computing Foundation in 2015.
[20] Dev(elopement)Op(eration)s
[21] http://agilemanifesto.org/
[22] Not all organizations require extreme deployment frequencies like Amazon, which is, on average, deploying code every 11.7 seconds, or Walmart, which deployed more than 100,000 OpenStack cores in a single year (https://techbeacon.com/10-companies-killing-it-devops).

Open source is well represented in reusable software development code as well as in DevOps tooling. The risks are pre-dominantly in the reusable software development code. This requires management attention. Frameworks like TOSCA[23] enable organizations to leverage tools, and open-source artifacts to implement automated deployment and operations (Wettinger, et al., 2016). Assessing the risks of open source is not different from an assessment of software vendors of proprietary software; however highly regulated organizations have to be more mindful in adopting open source[24]. For both, the risks are pre-dominantly in future migration to a new platform. Migration requires significant management and will hinder the introduction of new functionality during the migration. Migrations take easily three to six months.

The introduction of DevOps presents sourcing challenges. Most infrastructure outsourcing contracts include IT operations and IT infrastructure. However, carving out IT operations is not the biggest DevOps sourcing challenge. Most agile development teams are mixed teams including in-house technical experts, technical experts from multiple suppliers, and contractors focusing on implementing story points.[25] The obligations of suppliers are limited to input obligations. This transfers all the risks to client organizations. Client organizations could consider rewarding in mini competitions, development work by sprint based on fixed price per story point.[26]

The biggest challenge of DevOps is in finding the right resources, as organizations need digital natives if they want to succeed (Vodanovich et al., 2010). This is a bigger challenge in Dev(elopement) than in Op(eration)s. In Dev(elopement), the product owner role is equally pivotal as it is hard to fulfill. This role has to align the bottom-up prioritization (team level) and the top-down enterprise strategic themes (Fontana et al., 2015), and stakeholder management is

[23] Topology and Orchestration Specification for Cloud Applications.
[24] Certification of priority software is a key element in regulatory compliance. Certification of open source software is difficult to impossible, although the open source community is addressing this issue, with for example Open Source Software Quality Certification ("OSEHRA Certification"); see also Kalliamvakou et al., 2016.
[25] Story points prevail over expert opinions. The estimates can be improved by introducing machine learning techniques such as decision tree, stochastic gradient boosting and random forest (Satapathy and Rath, 2017).
[26] Beulen - forthcoming, Contracting Agile and DevOps: A survey in the Netherlands, Global Sourcing Workshop, La Thuille, February 2018.

important as well (Tamburri at al., 2016). Agile@scale is a learning curve for most organizations. Frameworks like SAFe[27] and LeSS[28] are challenged by agile purists, but for larger organizations, top-down structure, governance, and process & tooling standards are required in order to implement desirable functionality (Bass, 2016). Priorities need to be set – functional as well as nonfunctional requirements. Failing to prioritize non-functional requirements will create technical debt (Cunningham, 1992; Kruchten et al., 2012; Behutiye et al., 2017). This will be addressed in the IT architecture section in my speech.

Finally, Fitzgerald and Stol (2017) introduce BizDev to bridge the gap between business strategy and development. An integration toolset is at our disposal, but BizDev is not the solution to strengthen the emerging involvement of business representatives in the deployment of functionality. Successful introduction of DevOps requires "organizational rewiring" (Tamburri et al., 2016) led by the Chief Information Officer. This is fundamental and requires significant change management in addition to any toolset implementation.

[27] http://www.scaledagileframework.com/whats-new-in-safe-45/
[28] https://less.works/

4. New Technologies

Big data

Big data can be used to create and capture value for individuals, businesses, communities, and governments.[29] Value creation is a multistep process, including acquisition, information extraction and cleaning, data integration, modeling and analysis, and interpretation and deployment (Jagadish, et al., 2014). Big data includes information from any source, including social media (George et al., 2014; Gandomi and Haider, 2015). The focus is on identifying trends and patterns and decision making (Chen et al., 2012). Artificial Intelligence and Machine Learning are related but not synonymous with big data,[30] and it is also related to Robotic Process Automation.[31] All are powered by cloud computing and platforms. Availability of capacity is no longer an issue and there are hardly any cost constraints. I will address the impact of legislation, and specifically GDPR, on big data in compliance section.

Leveraging data and data analyses are key in digitalization (Loebbecke and Picot, 2015; Peppard and Ward, 2016).[32] Master Data Management provides structure to leverage data and data analyses and consists of a framework of processes and technologies (Berson and Dubov, 2007), regardless where the data was collected. Key in successful Master Data Management is governance. As digitalization is a combination of both bottom-up initiatives to create value, and a strategy to streamline these bottom up initiatives, so too is Master Data Management partly decentralized. Due to increasing interconnectedness and digital maturation, the central Master Data Management team will become more dominant in the next decade.

Proper Master Data Management protects organizations from the “data obese” risk. The availability of too much data negatively impacts the usability of data/insights. This issue is very apparent in the context of the “Wet op de

[29] McKinsey Global Institute, 2011 - https://bigdatawg.nist.gov/pdf/MGI_big_data_full_report.pdf
[30] Artificial Intelligence, also called Machine Intelligence, can be described as computers performing analyses and making decisions instead of human beings. Machine Learning can be described as computers learning without being explicitly programmed (Samuel, 1959; Russell and Norvig, 1995; LaValle et al., 2011; Zomaya and Sakr, 2017).
[31] In this speech, Robotic Process Automation will be addressed in the section robotics.
[32] Illustrative examples: http://www.computerweekly.com/opinion/Big-data-put-to-work-in-digital-transformation-strategies and https://www.forbes.com/sites/danielnewman/2015/12/22/the-role-big-data-plays-in-digital-transformation/#390744af75d3

inlichtingen- en veiligheidsdiensten"[33] in the Netherlands.[34] This legislation will enter into force on 1 May 2018. Despite the privacy sentiment related to this type of legislation,[35] properly processing incredible amounts of data is just impossible. This will possibly result in the reduced effectiveness of intelligence services. Potentially, machine learning will resolve this issue in the future. For now, organizations, not limited to intelligence services, have to implement strict Master Data Management policies to avoid "data obesity" and to ensure an effective value creation. In order to do so, organizations also have to use tooling smartly (Munford, 2014 – using the F1 as an example). However, Master Data Management tooling is emerging (Gartner, 2017b) but still not fully established as of 2017.[36]

Blockchain[37]

The first cryptographically secured chain of blocks was described in 1991 (Haber and Stornetta, 1991). In 1993, merkle trees were incorporated to improve efficiency by enabling multiple documents/transactions on a single block (Bayer et al., 1993). In 2008, Satoshi Nakamoto[38] solved the double spending problem without the need for a trusted administrator, and the bitcoin was born! This was the first blockchain killer app. A blockchain is a peer-to-peer network that sits on top of the internet.

In 2017, the exchange rate of most crypto currencies has sky rocketed.[39] Fortunately, the potential of blockchain technology is beyond the bitcoin and crypto currency hype. I will share some blockchain use-cases shortly. Blockchain technology can be defined as an open, distributed ledger that can record transactions between two parties[40] efficiently and in a verifiable and permanent way (Iansiti and Lakhani, 2017, p. 120). Blockchain technology enables a shift from trusting people to trusting math (Antonopoulos, 2014). Despite the potential, the investments in blockchain are limited.[41] Most organizations invest in permissioned ledgers. Permissioned ledgers use consensus Practical Byzantine fault tolerance algorithms (Castro and Liskov, 1999), like RAFT or Paxos, instead of Proof of Work mining[42]. In permissioned blockchains, all actors are known, and confidentiality & controlled access, which is not equal to privacy, are assured. Transactions can be only viewed by users who are known instead of "everyone can read everything." The market offers Blockchain as a Service solutions (market leaders are Microsoft, IBM and AWS).[43] The tech giants will determine the future of the blockchain landscape.

High profile use cases are smart-contract-based-use-cases[44] in combination with Internet of Things technology. In 2014, "Blockchain 2.0" emerged. This included a second-generation programmable blockchain introducing a programming language, such as Solidity or Serpent, that allows users to write smart contracts, beyond just transferring currencies (Turing complete - no limitation in terms of to-be-implemented logic). I will address smart contracts in more detail in Internet of Things.

We also have Decentralized Autonomous Organizations (DAO),[45] organizations based on blockchain technology and smart contracts. These are self-organizing companies, operating under a pre-defined set of business rules. The example is "The DAO" (ww.daohub.org),[46] a crowd funded investor-directed venture capital fund blockchain, founded in May 2016. It raised 150m USD from +10.000

[33] Law on intelligence and security services: http://wetten.overheid.nl/BWBR0039896/2017-09-01 (in Dutch).
[34] Also, intelligence services in other countries face similar risks.
[35] For the Netherlands : https://sleepwet.nl/
[36] Already in 2012, this was one of the key findings (Jagadish et al., 2014);, however, it is still not resolved: Research challenges abound, e.g., the tools ecosystem around Big Data – page 86.
[37] Up and until 2016 it was spelled block chain instead of blockchain.
[38] October 2008. Satoshi Nakamoto's whitepaper Bitcoin (A Peer-to-Peer Electronic Cash System) was published (https://bitcoin.org/bitcoin.pdf).
[39] In the slipstream of this hype, a large number of Crypto Funds have been established to offer crypto currency investment opportunities: https://www.forbes.com/sites/laurashin/2017/07/12/crypto-boom-15-new-hedge-funds-want-in-on-84000-returns/#4bc1e1ef416a.
[40] Blockchain can also facilitate transactions between multiple parties.
[41] Only 1% of organizations have invested in blockchain, and 6% will invest in blockchain technology in the short term (Gartner, 2017c).
[42] For example, bitcoin uses Proof of Work mining, where primary concerns are energy consumption and a 51% attack, as mining is highly industrialized.
[43] Azure's Ethereum Blockchain as a Service, Microsoft is partnering with ConsenSys and offers two development tools for Smart Contract-based applications (Ether.Camp and BlockApps). IBM Blockchain Platform Bluemix is an integrated business-ready platform that addresses the full life cycle (develop, govern, and operate) of a multi-organization blockchain network. This platform is built on the Hyperledger Fabric V1.0 code base leveraging a modular architecture. Amazon Web Services collaborates with Digital Currency Group (May 2016).
[44] A smart contract is a computerized transaction protocol that executes the terms of a contract (Szabo, 1994/1997a/1997b).
[45] Also called Fully Automated Business Entity or Distributed Autonomous Company
[46] Other examples are Dash and Digix.

investors.[47] It is too early to fully understand the business impact of DAOs. However, I expect self-organizing organizations to have a big impact in three to five years from now.

In the Goldman Sachs report,[48] the current market potential of blockchain technology is addressed. Five markets are described in detail[49]: (the sharing economy) lodging, smart grid, real estate title insurance, cash securities and anti-money laundering compliance. These are all big business opportunities to pursue.

Blockchain technology can be leveraged outside the business world as well. Blockchain for Good (blockchain4good) empowers social and economic change instead of monetary value. A good example is Fairfood[50] coconut campaign in the Netherlands.[51] In a pilot study, the blockchain was used to ensure a fair price for coconut farmers in Indonesia. The blockchain also facilitated donations of the buyers in the Netherlands to the farmers in Indonesia.

Governments[52] also use the blockchain by offering e-residency: an international digital commercial identity using a sovereign government-backed identity credential. E-residency does not provide citizenship (Sullivan and Burger, 2017).

[47] In June/July 1/3 of the value was stolen by smart contract code issues. This valid but unethical maneuver resulted in a hard fork of Ethereum.
[48] Profiles in Innovation Blockchain, putting theory into practice, The Goldman Sachs Group, Inc. (May24, 2016).
[49] Other less disruptive examples are Nasdaq – Chain Inc. capturing private securities transactions, the Australian Securities Exchange – Digital Asset Holdings capturing private securities transactions, and Circle Internet Financial Inc. and Plutus Financial Inc. capturing transferring money across the globe. These three examples of leveraging blockchain didn't introduce a new business model; blockchain technology only reduced the cost to operate and improved the quality of service (Michelman, 2017).
[50] Fairfood is dedicated to ensuring a living wage and fair prices in the food industry (www.fairfood.nl)
[51] Other examples are Donorcoin (transferring value instantly with near non-existent fees and to anywhere in the world); AgriLedger (gives small farmers in developing countries a fairer deal); Provenance (certify the provenance of fishing stocks); BitPesa (reducing the cost of cross-border payments in Africa to reduce the cost of entry for small enterprises to access liquidity and the global economy); The Safe Haven Project (helps refugees re-build their lives and with a view to help immigrants port their identities); and BVrio (tracks timber in Brazil to combat illegal logging). See also https://www.blockchainforgood.com/white-paper-1/
[52] Estonia is one of the leading countries in e-Residency (initiated Dec 2014): https://e-resident.gov.ee/. Currently, Estonia has 20.000 e-Residents from 138 countries. Also Belgium, Portugal, Singapore and Lithuania are about to implement/consider e-Residency.

In the future, blockchain technology might be used for e-voting, as it increases transparency compared to traditional voting, which is centralized by design (Takabatake et al., 2016). E-voting also can enable more dynamic voting, including changing votes during an election day to influence possible coalitions. Experimenting with technology might increase the number of voters and will stimulate populism, which does not necessarily contribute to political stability. Let us pause on the opportunity to implement dynamic e-voting up and until democratic stability has returned in the Netherlands and the European Union. Political stability prevails over populism.

Internet of Things

Internet of Things has been presented as the fourth industrial revolution, according to leading service providers like IBM and Microsoft.[53] Despite their commercial interest, we have to acknowledge the potential of Internet of Things fully. It started with RFID and wireless sensor networks (see Brave et al., 1998; Ashton, 2009). Internet of Things is a network formed by uniquely identified interconnected physical objects (Atzori at al., 2010). Processing is predominantly in the cloud in combination with processing within the connected devices.[54] Internet of Things has a high security risk, including data theft (Jernigan et al., 2017[55]; Ponemon Institute, 2017) and data processing risks (Chaudhuri, 2016). Specific measures are required to avoid these risks. Furthermore, the maintenance costs, including the required infrastructure, require management attention. We have some challenges ahead.

The investments in Internet of Things are not meeting the expectations of this promising technology. According to Gartner, only 10% of organizations have invested in Internet of Things, and only 23% expect to invest in the short term (Gartner, 2017a). Especially for organizations with strong analytics capabilities, there is a lot of value in Internet of Things (Jernigan et al., 2017). The strength of the concept of Internet of Things is in sharing data, not only with consumers but also with partners in the value chain. Integration is important (Khodadadi et al., 2017),

[53] https://www.ibm.com/blogs/internet-of-things/dawn-of-the-fourth-industrial-revolution/ and https://news.microsoft.com/europe/features/defining-the-fourth-industrial-revolution-where-iot-fits-and-the-potential/
[54] Connected devices with a low computation capacity – fog devices (Gupta et al., 2017).
[55] Including Schneier, 2014; Pettey, 2016; and Press, 2016.

which underlines the need for industry-wide APIs (Taivalsaari and Mikkonen, 2017).[56]

There are a lot of Internet of Things use cases in domotics (Piyare, 2013; Chaudary et al., 2016), wearables (Wei, 2014; Ray et al., 2016), and smart city projects (Zanella et al. 2014; Rathore, 2016), including cities such as Amsterdam.[57] Opportunities for Internet of Things will arise from the sharing economy and are in the Business-to-Consumer market. Blockchain-enabled smart contracts and Internet of Things are a powerful combination. Smart contract is a computerized transaction protocol that executes the terms of a contract (Szabo, 1994; Szabo, 1997a; Szabo, 1997b). The code for smart contracts is difficult to impossible to temper. Additionally, smart contracts facilitate involving multiple parties and create trust through 100% transparency. They are highly efficient, as smart contracts are fully automated –no middle man required – and require zero human input. Smart contacts also provide 100% contractual clarity as the contract is implemented through software code.

Legal issues are the main challenges with smart contracts. Chief Information Officers need to fully understand the legal implications to make informed decisions regarding the implementation and contracting of Internet of Things solutions. The three biggest concerns are the absence of a notion of lawfulness, fairness and protection of the weaker party. Let us take a closer look at legal issues of smart contracts. A smart contract does not create obligations in the legal sense: "will"; smart contracts only create a technical bond. Smart contracts, however, cannot be breached by a party to it. Smart contracts have a self-enforcement feature (code = law nature). There are no remedies for breach of contract, such as damages, penalties of liquidated damages, unless explicitly set in the code. Trying to specify all exceptions in a contract is difficult to impossible. Vitiated consent or intent have no impact on smart contract validity. A smart contract is the "single source of truth," and the impact of collision between intent and expression is yet not clear. Furthermore, the identification of parties and jurisdictional research of the enforcement authorities is not straight forward. In addition, smart contracts are egalitarian: there is no protection for the weaker party (such as consumers). This is even more problematical as reading and understanding the terms and conditions of a contract is a challenge. There is also the possibility of illegal smart contracts involving money laundering and finance of terrorism or being used for illegal purposes such as procuring hacker services. This is also the potential for infringement of principles of legal order. De-anonymizing is therefore essential, but difficult to impossible to implement through smart contracts. Finally, the autonomous nature of smart contracts is problematic. Smart contracts operate without an overarching legal framework[58] (Savelyev, 2017-pages 128-133).[59]

Smart contracts will make a significant contribution to digitalization as user experience, convenience and cost effectiveness are at their heart. Despite all these legal issues and concerns, there are an emerging number of use cases for smart contracts (McKinsey, 2016 and Deloitte[60]) which Chief Information Officers should understand in parallel to exploring Internet of Things opportunities.

Robotics[61]

Robotic Process Automation,[62] artificial intelligence, and machine learning are all very related. Robotic Process Automation is more rule based, pre-programmed, and deals with structured data. As a consequence, the actions and outcomes are fully predictable (Lacity and Willcocks, 2016). Robotic Process Automation can handle high-volume, repeatable tasks that previously required a human to perform. Artificial intelligence enables the execution of enhanced and complex actions, but all actions & decisions are pre-programmed (Russell

[56] Examples of standards are Industrial Internet Consortium, IPSO Alliance, Open Connectivity Forum, and Open Mobile Alliance (Taivalsaari and Mokkonen, 2017)

[57] https://sloanreview.mit.edu/article/six-lessons-from-amsterdams-smart-city-initiative/ and https://amsterdamsmartcity.com/projects

[58] Lex Informatica - Reiderlberg and Code is Law- Lessig

[59] Using oracles in smart contracts (trusted party that pushes external data onto the blockchain, the external data is input for smart contracts) introduces additional risks. 1. reliability of data, as all parties need to trust an oracle fully and 2. technical issue in APIs calling an oracle (Savelyev, 2017).

[60] https://www2.deloitte.com/insights/us/en/focus/signals-for-strategists/using-blockchain-for-smart-contracts.html

[61] Robotics is combination of engineering and computer science. Robotics includes the design, construction, operation, and use of robots, as well as information systems for the control of the robots (Rosheim, 1994).

[62] Examples of leading Robotic Process Automation tools are Automation Anywhere, Blue Prism, UiPath and Thoughtonomy (Everest, 2016 - http://www2.everestgrp.com/Files/previews/RPA%20-%20Vendor%20Landscape%20with%20FIT%20Matrix%20-%20Preview%20Deck.pdf)

and Norvig, 1995). In machine learning, the ability to learn is programmed (self-learning). The core in machine learning is in analysing capabilities (Hutter and Poland, 2005). This ability makes machine learning the most advanced of the three (McKinsey, 2016).[63]

Robotics has already been adopted by a large number of organizations: 34% are already exploring robotics and automation -investing or planning to invest- according to Harvey Nash and KPMG (2017). These are predominantly larger organizations in manufacturing, utilities, transport, and financial services.

Robotics enables productivity and cost efficiency. In the context of digitalization, driving customer experience is more important. Robots (and soft-bots) never sleep and provide a higher quality of service faster. Investing in robotics is essential for any company, as it can power new services and is at the core of digitalization.

This leaves us with ethical questions in, for example, elder care, self-driving cares, or warfare and the implications for employability.[64] Ethical implications need to be assessed on a case-by-case basis. This is not a primary responsibility for Chief Information Officers. They provide input to these discussions. Regarding job losses, the impact so far is marginal, except that employees who leave the organization are not replaced (Willcocks et al., 2015). However, if robotics will be adopted on a larger scale, this might change. Bill Gates[65] advocated for applying taxes on robots taking over human jobs: "income tax, social security tax, all those things" (2017). Bill Gate's argument is predominantly to avoid inequity. I understand and sympathize with his thinking but challenge the practicality. Stopping innovation has never been successful in history before. Furthermore, the industrial revolution created jobs instead of destroying employment and brought additional economic prosperity to our society. Time will tell the impact of robotics on employment.

[63] https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet
[64] On the contrary, robots can be used in identifying employment opportunities by using platforms such as LinkedIn, Monster.com or Glassdoor (Freedman, 2017)
[65] https://qz.com/911968/bill-gates-the-robot-that-takes-your-job-should-pay-taxes/

5. Compliance

Compliance

Compliance was also important prior to digital transformations. Compliance includes legislation as well as internal guidelines and policies. This is reflected in the IT architecture, which includes security requirements. I consider security requirements as a specific architectural requirement. In most organizations, Chief Information Security Officers are appointed to ensure such non-functional requirements are acknowledged (Whitten, 2008; Alexander and Cummings, 2016). Closely monitoring the adherence to the non-functional requirements in general is critical and reduces the origination of technical debt.

The unpredictability of legislation has always caused significant concern for information technology. Organizations have no other option than adjusting and implementing the necessary changes. In the context of digitalization, upcoming GDPR[66] legalisation will have an unprecedented impact.[67] The focus of this legislation is on personal data. The legislation protects EU citizens ("rights and freedom of natural persons," article 32.1). It is an EU regulation regarding data privacy, which is much broader than the 1995 EU Data Protection Directive (and the 1998 UK Data Protection Act). The regulation passed in April 2016 and will become effective on 25 May 2018. No EU countries,[68] amongst others, Canada van Argentine, are about to implement this regulation. GDPR is expected to be the global standard for data protection. The legislation describes the accountability for both the data controllers and processors (article 5), defines use cases and managing consent (article 6), describes the right to be forgotten (article 17), data portability (article 20[69]), and principles, including data protection by design and by default (article 25). State-of-the art and future proof implementation data minimization principle (both article 25) and data transfer obligations (article 44-50) are embedded in this legislation. This upcoming regulation triggers a review of the IT architecture and master data management at a minimum. The implementation of single platform to avoid fragmented data stores might be advisable from a GDPR perspective. However, this does not

[66] General Data Protection Regulation (http://ec.europa.eu/justice/data-protection/reform/files/regulation_oj_en.pdf)
[67] Other legislation has an impact on digitization, however most of this legislation is sector specific.
[68] Despite Brexit, the UK will convert the GDPR into full U.K. laws (https://www.v3.co.uk/v3-uk/news/3002725/brexit-theresa-may-sets-out-plan-to-make-uk-the-best-place-for-science-and-innovation).
[69] Organizations must show users the user data in a machine-readable format at all times.

fully support digitalization requirements, as it limits bottom-up creativity. Existing successful digital initiatives might require adjustments to ensure GDPR compliance. Organizations also have to appoint Data Protection Officers to be compliant with this regulation. On top of this, there are extremely high fines for non-compliance with this legislation.[70] In short, the protection of natural persons with regard to the processing of personal data and on the free movement of such data is necessary and important, but many organizations, including governmental organizations, will have to provide a large investment to be compliant and will have to revisit their envisioned digital transformations.

[70] The higher of 4% of the annual revenue or 20m Euro, and for non-technical infringements, only 50% of these fines. Although the general understanding is that organizations that have started the implementation of the required changes will not be fined in the initial period after the effective date of this new law.

6. IT-architecture and governance

IT-architecture

Two-speed IT, also called "bimodal" IT, enables organizations to leverage the latest technologies that achieve competitive advantage and innovation (mode 2), combined with traditional technologies, ensuring stability (mode 1). In the early days of the digital transformation, this was Gartner's approach to introducing agility (Gartner, 2014). BCG declared two-speed IT dead: two-speed IT doesn't enable "all-agile work" (2016).[71] The issue with two-speed IT is more on stability and coherence of the IT-estate than in hindering the flourishing of the agile hype. Architecture ensures this required stability and coherence. Software generators and today's low-code applications, such as Outsystems and Mendix, undermine stability and coherence as bottom up software development dominates over the enterprise and IT architecture. Organizations have to focus on implementing and maintaining a foundational infrastructure that enables agile instead of creating an agile legacy by having a short-term focus only. An agile legacy will cause issues in the mid-term which are more difficult to resolve than traditional legacy issues, as this "fast functionality" lacks sufficient IT architecture guidance[72]. Chief Information Officers must include IT architectural capabilities in their CIO-office to maintain and guard the architecture, including protocols and data models, in conjunction with enabling agility and adopting concepts such as DevOps.

Unfortunately, many organizations lack a proper Enterprise and IT architecture. Enterprise Architecture is defined by Ross et al. (2006) as "organizing logic for business processes and IT infrastructure." Enterprise Architecture can help to reduce complexity through integration and standardization (Smith et al., 2012) but goes well beyond a technology-centric view (Boh and Yellin, 2006). Well-established Enterprise Architecture frameworks include Zachman[73] (Zachman, 1987; Nogueira et al., 2013; Lapalme, et al., 2016) and TOGAF, including Archimate[74] (Hornford, 2011; Taleb and Cherkaoui, 2012; Mueller et al., 2013). In the Enterprise Architecture, "design structure matrices" detail architectural components and dependencies between architectural components (Tamm et al., 2011). An IT architecture is the organizing logic for applications, data, and in-

[71] https://www.bcgperspectives.com/content/articles/technology-digital-people-organization-end-of-two-speed-it/
[72] In this debate also universities need to adjust their curricula. Additional focus on enterprise and IT-architecture is required.
[73] www.zachman.com
[74] www.opengroup.org/togaf/

frastructure technologies, as captured in a set of policies and technical choices, intended to enable the firm's business strategy (Ross, 2003). Security (Rudra and Vyas, 2016) and compliance, including data processing and data privacy, are an integral part of architecture. Architects "must guide and harmonize" and are "community shepherds" (Tamburri et al., 2016, page 70). Organizational learning is important (Vallerard et al., 2017). Chief information Officers have to facilitate architecture organizational learning. This sets requirements for the capabilities of architects beyond profound technical knowledge. Business sense and change management capabilities are of equal importance.

In IT architecture, microservices are in many ways a best-practice approach for realizing service-oriented architecture (Pautasso et al., 2017a, page 92; Newman, 2015 and Ebert et al., 2016). A microservice architecture is a cloud-native architecture. Each microservice is independently deployable on potentially different platforms and technology stacks and communication via RESTful[75] or RPC-based APIs[76] (Balalaie et al., 2016). In adopting micro services, organizations will face challenges in versioning and error handling issues, as this is more complex in distributed systems (Pahl, 2015). For Internet of Things, mircoservices are pivotal (Ashton, 2009; Khodadadi et al., 2017; Garcia-de-Prado et al., 2017).

In the IT architecture, technical debts need to be addressed (Cunningham, 1992; Abrahamsson et al., 2009; Kruchten et al., 2012; and Elbanna and Sarker, 2016). Kruchten's definition of technical debt[77] has an IT-architecture lense: ".... Technical debt is a contingent liability." We need to distinguish between intentional and non-intentional technical debt[78] (Fowler, 2009). Only non-intentional technical debt is concerning. Chief Information Officers need to set maximum levels and continuously measure and report on technical debt. They need to decide wisely on refactoring (Hanssen et al., 2010), but more importantly, ensure the implications of technical debt are taken into account in

[75] Representational State Transfer (REST)
[76] Remote Procedure Call (RPC)
[77] Definition of technical debt: "in software intensive systems, technical debt consists of design or implementation constructs that are expedient in the short term, but set up a technical context that can make a future change more costly or impossible. Technical debt is a contingent liability whose impact is limited to internal system qualities, primarily maintainability and evolvability." - https://philippe.kruchten.com/2016/04/22/refining-the-definition-of -technical-debt/
[78] Non-intentional technical debt equates to poor quality services.

priority setting by business representatives (Bellomo et al., 2013; Behutiye et al., 2017). Chief Information Officer and the CIO-office provide input to the prioritization by pointing out the impact of different scenarios. However, a conscious decision creating technical debt, combined with accepting the consequences of this decision, is the right decision.

Governance

Governance of digital transformations requires further research.[79] I'm about to kick off a research program focussing on this. Let me share my initial thoughts on the topic.

Let us first take a closer look at leadership roles. Some organizations have appointed a Chief Digital Officer next to the Chief Information Officer. The Chief Digital Officer is responsible for the digital transformations and the Chief Information Officer for the ongoing Information Technology. Digital is a companywide responsibility. Appointing a Chief Digital Officer in addition to a Chief Information Officer does not do justice to this companywide responsibility. However, appointing a Chief Digital Officer helps organizations to embark on a digital journey, to have sufficient focus, and ensures the availability of digital capabilities. In the midterm, responsibility for digital will be transferred to Chief Information Officer.[80]

Let us continue with the organizational embedding of digital. The maturity of an organization drives digital governance, and measuring digital maturity is important (Gartner, 2014; Kane et al., 2017). Less mature organizations might still have a separate digital unit, where more mature organizations have fully adopted digital and differentiate no longer. The suggestion to have a digital service catalogue (Fitzgerald et al. 2014) has a technical orientation and is slightly outdated, as digital transformations are driven by business initiatives. Digital transformations require tech- savvy business representatives. Most organization don't have sufficient qualified business representatives to participate in digital transformations (Majchrzak et al., 2016). This creates opportunities for Chief

[79] This includes a research project on High Performing Digital Organizations (HDO challenge) in conjunction with Informatica and ICT Media and an Alvarez & Marsal research project on digital transformation.
[80] We can have a lengthy debate about the label of this role. However, labeling is not highly relevant. The Chief Information Officer holds the end-to-end responsibility for IT.

Information Officers to own the digital training agenda.[81] Digital leading companies have implemented online digital transformation trainings and master classes by external means, through thought leaders to educate and inspire their top management group. The content of the training needs to be tailored to the type of company, as engineers are more tech savvy than marketers (Peppard and Ward, 2016).

Digital also requires a change in mindset. Change management and communication are important and benefit from input from Chief Information Officers. Recalibrating business and information technology roles is also required. Digital transformations require an adjusted skill set and experience. A possible implication is that some of the current staff becomes redundant (Westerman and Bonnet, 2015).

To approve new technologies, Chief Information Officers are co-chairing an innovation committee with the business. IT architects have a strong voice in innovation committees to guard the IT architecture. Mature organizations approve digital transformation budgets at corporate levels and, depending on the coherence of product/service and market overlap, partly at the Business Unit level. They manage digital transformations as a portfolio, including a mix of "easy initiatives" (low-hanging fruit), "difficult initiatives" (to prove the added value to criticasters), and "true impact initiatives" (major contribution to the top line – to be relevant).[82] Business representatives and the Chief Information Officer need to have a seat at the table. It is also important to apply rigor in killing initiatives that don't meet expectations, typical up to four to six months max: "fail fast and acceptance of failure are important."

Finally, Chief Information Officers need to set a strategy to engage with partners. Chief Information Officers must implement and maintain an ecosystem consisting of start-ups, scale-ups, tech giants, and universities as essential for digital transformation success.

[81] Aloys Krechting – Chief Information Office Akzo Nobel. HDO challenge, Amsterdam, October 31, 2017.
[82] Bart Luijten – SVP Global Head of Enterprise Information Management Philips. HDO challenge, Amsterdam October 31, 2017.

7. Conclusion

Conclusion

Organizations have to acknowledge that reducing the IT spend is a matter of discipline. Not paying attention to IT cost efficiency can never be justified. IT savings can be used for funding top-line initiatives.

Chief Information Officers must focus on these top line initiatives. Top line initiatives leverage new technologies, such as big data, blockchain, Internet of Things, and robotics. Architecture, governance, cloud computing, and DevOps are enablers for adopting these new technologies with compliance, including legislation, setting the prerequisites for adoption.

Demoting Chief Information Officers by making them responsible for managing datacenters and laptops/PCs is out of the question. Chief Information Officers are more essential for the implementation of digital transformations. Business executives need technical innovators and custodians of the IT architecture.

Chief Information Officers maintain and guard this architecture. Prior to finalizing my speech, I received a suggestion from thought leader Daan Rijsenbrij to change the subtitle of my speech from '... and *custodian* of the IT architecture' into '... and *propagator* of the IT architecture.' I acknowledge the importance of IT architecture very much; however, IT architecture is only a means to achieving digital transformation. Digital transformations put customer experience first, not technology. Technology, and therefore IT architecture, has an enabling role.

In addition to architecture, governance is also important. Chief Information Officers compose a balanced team and invest in career development of individual team members. In CIO-offices technical insights, as well as business feeling, need to be present. Partnerships have to be built and maintained in the context of the business strategy and technical opportunities. Furthermore, a focus on processes will pay off.

Finally, in the next decade, the importance of technology leadership will continue to grow. Chief Information Officers are technology leaders; however, their role remains a supportive one. As the Academic Director of the executive MSc Master of Information Management at TIAS Business School and consultant at Alvarez & Marsal, I look forward continuing contributing my 50 cents to maturing Information Management and the Chief Information Officers' community.

I have spoken.

Word of thanks

Word of thanks

Now that my second inaugural[83] speech is coming to an end, I would like to thank a few people. I will start with my partner. Jennifer, thank you for your unfailing support during the past years. I'm proud to be your partner.

I would also like to thank my parents. You have always stimulated and supported me – an amazing feat of commitment, which you have kept up for 48 years already! I am thankful you are here today.

Then there are my friends. We have shared so much, done so many things together, and I am happy that you are here now, too.

In the professional field, I would like to thank Pieter Ribbers and Jan Roos. You have taught me and enabled me to reach where I am now and have been very instrumental to my academic career. Together, we have had the pleasure of contributing to science through many international publications. Pieter and I have an upcoming book on managing digital outsourcing. The three of us are also about to deliver a third edition of our book on managing outsourcing. It is simply great to work with you both.

Of course, my thanks also extends to my colleagues in the Information Management department of Tilburg University. I've enjoyed working with you for nearly 15 years. It has been very inspirational to work with many researchers from other universities too. I have written publications with and lectured with, in alphabetical order, Aubert Benoit, Egon Berghout, Erran Carmel, Wendy Currie, Paul van Fenema, Rob Fijneman, Wim van Grembergen, Steven de Haes, Brian Nicolson, Suzanne Rivard, and Vinay Tiwari. Thank you, too, for your support.

As many of you know, I have always combined my scientific work with a job in the business world. At Atos Origin, Accenture, KPGM, BCG and, since 2017, at Alvarez & Marsal, through which I acquired the experience I needed to be able to write academic papers. There have been many inspiring colleagues and I thank them all.

[83] I held my first inaugural speech on October 17,2008, when I was appointed as an endowed professor for the Accenture Global Sourcing chair at the department of Information Management of Tilburg University. In 2010, this chair became the KPMG Global Sourcing chair.

Also, the remarks of Lielle van Laren and Tom Vollebergh made this inaugural speech better than it would otherwise have been. Thank you!

I would like to thank Profs. Koedijk, ter Horst and de Roon, the selection committee members, the department's managers, and the university's board of directors for their faith in me.

And finally, a thank you for everyone who has, in whatever way, contributed to my appointment here. I cannot mention everybody separately, but you are not forgotten!

Thank you.

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