

Segmentation



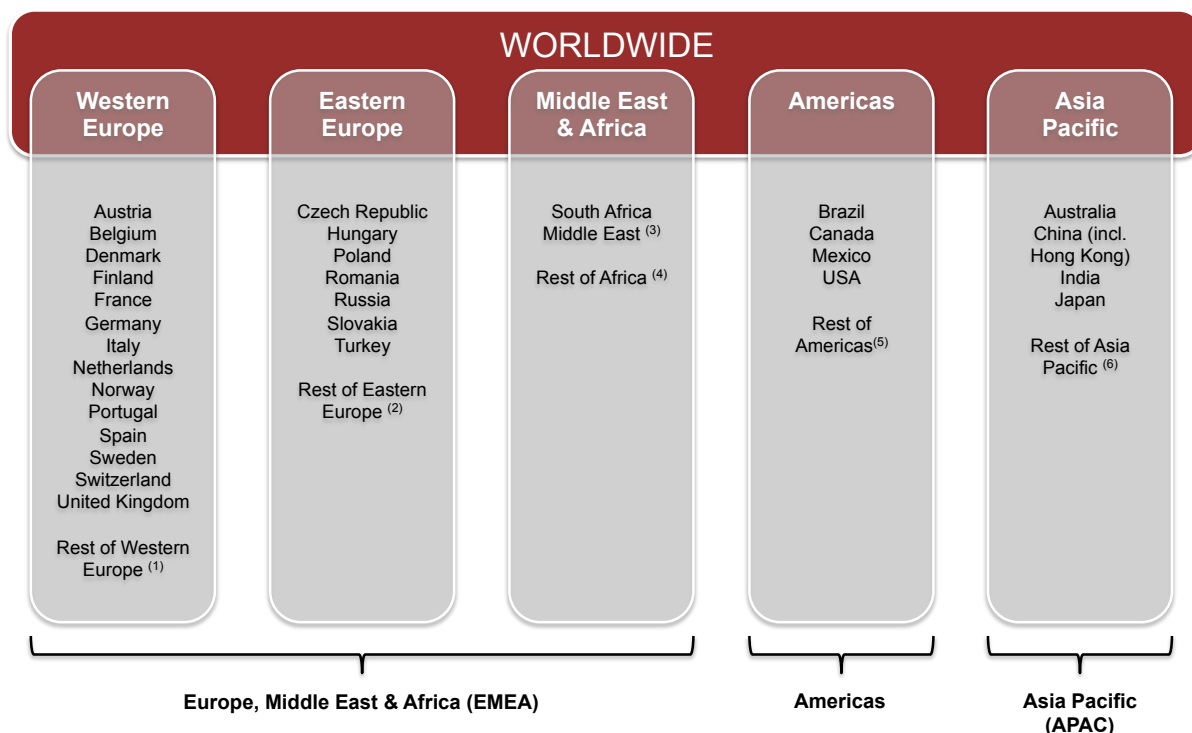
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1. GEOGRAPHICAL MARKET COVERAGE



(1) Rest of Western Europe incl. Greece, Iceland, Ireland, Liechtenstein, Luxembourg, Malta

(2) Rest of Eastern Europe incl. Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Estonia, Georgia, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Serbia, Slovenia, Ukraine

(3) Middle East incl. Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen

(4) Rest of Africa incl. Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Cote d'Ivoire, Democratic Republic of the Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Republic of Congo, Rwanda, São Tomé und Príncipe, Senegal, Sierra Leone, South Sudan, Sudan, Suriname, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe

(5) Rest of Americas incl. Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, Uruguay, Venezuela

(6) Rest of Asia Pacific incl. Afghanistan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, Fiji, Indonesia, Kazakhstan, Kiribati, Korea, Kyrgyz Republic, Lao, Macao, Malaysia, Maldives, Marshall Islands, Micronesia, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Palau, Papua New Guinea, Philippines, Samoa, Seychelles, Singapore, Solomon Islands, South Korea, Sri Lanka, Taiwan, Tajikistan, Thailand, Timor-Leste, Tonga, Turkmenistan, Tuvalu, Uzbekistan, Vanuatu, Vietnam

2. IT EXPENDITURE



Important notes

- **Captive IT activities** include all activities of captive IT suppliers with their parent or sister companies, i.e. internal revenues and revenues with associated companies.
- *teknowlogy* considers exclusively non-captive revenues in rankings and market figures. Captive revenues are booked as internal IT expenditure (mainly personnel and hardware).

Personnel

It includes all personnel-related costs:

1. IT salaries
2. Other staff costs

Hardware

It refers to all IT equipment (see section “Hardware”) and includes the purchase value.

Software and IT Services (SITS)

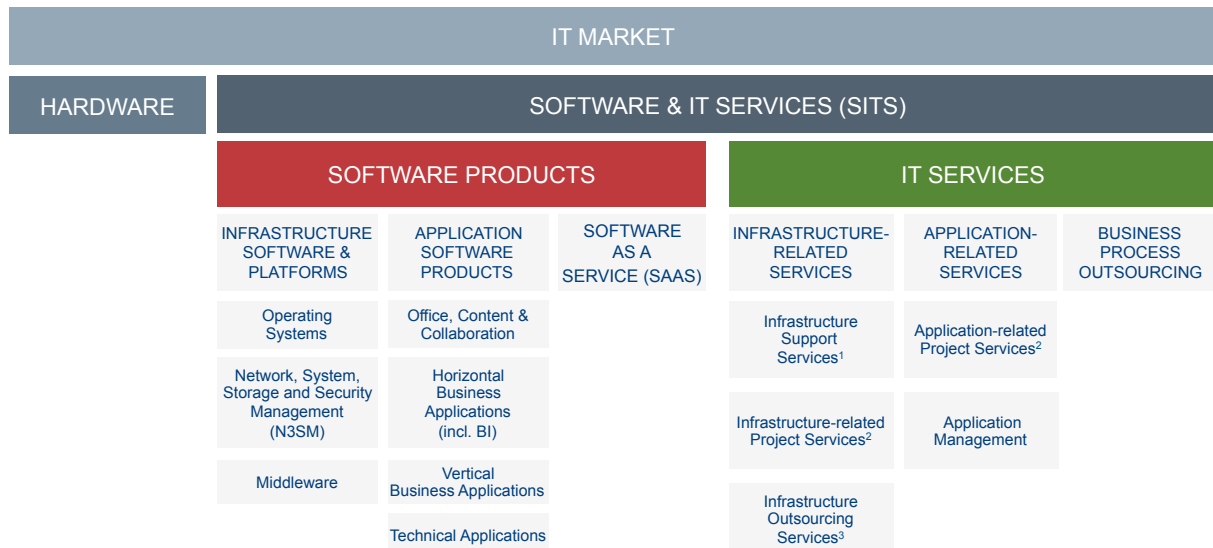
It refers to all Software and IT Services (see following sections) and includes the purchase value.

Miscellaneous

It includes all other costs related to the IT that are not part of the previously mentioned three categories:

- Data-related telecom equipment and services (e.g. routers, leased lines, X25, etc.);
- Consumables, energy, offices, etc.
- Financing costs (for the purchasing of Hardware, Software and IT Services).

3. IT MARKET



¹ Hardware Maintenance; Field Services and Services Desk

² Consulting; System Integration; Training

³ End-user Devices Outsourcing; Server Outsourcing & Hosting

HARDWARE

...refers to the purchase value of:

- 1 Mainframes
- 2 Servers
- 3 PCs
- 4 Workstations
- 5 Storage
- 6 Monitors
- 7 Printers
- 8 Other terminals (e.g. ATM's, cash registers)
- 9 Networking equipment (LAN, switches; excl. WAN).

4. SOFTWARE PRODUCTS

SOFTWARE PRODUCTS		
INFRASTRUCTURE SOFTWARE & PLATFORMS	APPLICATION SOFTWARE PRODUCTS	SOFTWARE AS A SERVICE (SAAS)
Operating Systems	Office, Content & Collaboration	
Network, System, Storage and Security Management (N3SM)	Horizontal Business Applications (incl. BI)	
Middleware	Vertical Business Applications	
	Technical Applications	

4.1 Infrastructure Software and Platforms

Important notes

- teknowlogy figures for Infrastructure Software and Platforms include only revenues from licenses and maintenance/ support. All related revenues from **implementation services** (consulting, implementation/ customization, training) are booked as **infrastructure-related services revenues**.
- teknowlogy considers highly industry-specific Infrastructure Software as Application Software Products as they really are at the core of the respective applications. This, for instance, applies to software products dedicated to the telecom sector in areas like billing, telecom network management or platforms for enhanced services. Telecom network management clearly is an application area for a telecom operator, while traditional systems and network management software products are designed to help run an IT system and are as such considered as Infrastructure Software by teknowlogy.

4.1.1 Operating Systems

Operating System (OS)	Product / Supplier Examples
Operating systems & sub-segments	IBM OS (system i, system z), Unix (AIX, HP UX, Sun Solaris), Linux (Red Hat, Novell, Ubuntu), Mac OS X, Windows OS, etc.
Networking software System utilities	IBM, Sun (Oracle), HP, Dell, Fujitsu, EMC, Novell, Red Hat, but also Alcatel, Ericsson, Nokia, Motorola
Virtualization engines & environment	VMware (EMC), Microsoft, Amazon, Google

4.1.2 Network, System, Storage and Security Management (N3SM)

Network, System, Storage & Security Management (N3SM)	Product / Supplier Examples
Network and system management	Tivoli (IBM), CA, Patrol / BSM tools, BMC
Output/input and performance management	HP Software (former OpenView), Microsoft
Incident, problem, change & configuration and release management	LANDesk, Beta Systems, BDNA, ASG Software, NetIQ, Paragent, Hyperic, Rocket Software, Novell, Red Hat, Netgear, Orsyp, Dynatrace
Service level management, financial, capacity, IT continuity, availability management	Nokia, Alcatel, Cisco, etc.
Cloud/laaS platforms	Parallels, Vmware (EMC), Novell, Citrix
Storage management	EMC, Symantec, IBM, Sun (Oracle), HP, Beta Systems, Hitachi, NetApps, etc.
Security & ID management	Symantec, McAfee, Check Point Software, Novell, IBM, Microsoft, CA, Sun (Oracle), Panda Software, Arkoon, OpenTrust, Cryptolog, etc.

4.1.3 Middleware

Middleware	Product / Supplier Examples
Data engines and databases	Oracle 11g, DB2 (IBM), SQL Server (Microsoft), Sybase, Adabas (Software AG), Teradata, Tamino (Software AG), Caché (Intersystems), Sun (MySQL)
Information integration tools: extract, transform, load (ETL) engines, product information management (PIM), master data management (MDM) and enterprise information integration (EII)	IBM, Informatica, Oracle, SAP, Talend, Teradata, Fair Isaac, Composite Software, Orchestra Networks, Tibco, Sybase, ASG, etc.
Enterprise architecture tools Analysis, modeling & design	IBM, Microsoft, Sybase, MEGA, IDS Scheer (Software AG), Casewise
Portals	Autonomy, IBM, BEA, Liferay, Microsoft SharePoint
Rich Internet platforms	Google, BlueWiki, Adobe's Flex, Microsoft's Silverlight, Adobe AIR, Autonomy
Message-oriented middleware	IBM, Tibco, Progress, Microsoft
Software engineering tools & environments (incl. 3GL, 4GL, RAD, OO, etc.) Code and application generators	Microsoft, IBM, Oracle, Sybase, Progress, Magic Software, Eclipse, NetBeans, 4D, Netfective, Serena, Micro Focus

Middleware (continued)	Product / Supplier Examples (continued)
Rules engines	Fair Isaac, Corticon, Pegasystems, IBM, Tibco
Migration tools	Micro Focus, MetaWare, Ateras, Mia-Software
Automated software quality, test tools and configuration management	IBM, Serena, HP, ASG, Compuware, CA, Micro Focus, Perforce Software, Axios Systems, McCabe Software
Portfolio and IT project management tools and platforms	Microsoft, IBM, CA, HP, Planview, Oracle
BPM (business process management) / BAM (business activity monitoring) engines	BEA, IBM, Tibco, Software AG, Intalio, Inubit, Pegasystems, Systar, SAP, Metastorm
Application servers	IBM WebSphere, Oracle, Tomcat, Red Hat, SAP
Software & SOA components management tools	Oracle, SOA Software, IBM, Software AG, HP
Connectors, EAI, ESB	IBM, Tibco, Software AG, PolarLake, Vitria, Axway, Red Hat, Progress, Information Builders, Fiorano Software, MuleSource, Microsoft, Oracle, SAP
Transaction engines: EDI, FTP, distributed transaction processing middleware, business-specific products, etc.	BEA, IBM, Axway, Sterling Commerce, Seeburger, Edicom, Indra, Trading Metrics, Aneo, Cisco, Reuters

4.2 Application Software Products

Important notes

- Application software products can be either out-of-the-box solutions, such as most productivity software products and business applications for the small office/ home office market, or more complex/ process-oriented solutions that require implementation and customizing services, such as business applications for the mid-market and for large enterprises.
- Application software products are often sold as packaged solutions including hardware and services, e.g. implementation services. The value of the hardware and services resold is excluded if it can be determined.
- teknowlogy's figures for Application Software Products include only revenues from licenses and maintenance/ support. All related revenues from **implementation services** (consulting, implementation/ customization, training) are booked as **application-related services revenues**.
- teknowlogy considers highly industry-specific Infrastructure Software as Application Software Products as they really are at the core of the respective applications. This, for instance, applies to software products dedicated to the telecom sector in areas like billing, telecom network management or platforms for enhanced services. Telecom network management clearly is an application area for a telecom operator, while traditional systems and network management software products are designed to help run an IT system and are as such considered as Infrastructure Software by teknowlogy.
- teknowlogy does not consider gaming/ entertainment software as part of Application Software Products.
- SaaS (Software as a Service) revenues such as those from providers like Salesforce.com, NetSuite, and Workday are not included in teknowlogy's application software products segmentation as these companies sell much more than the mere application software: the subscription fee refers to both the software maintenance / license AND the hosting of the application. It means the fee also refers to the underlying hardware & (infrastructure) software AND to the operational costs (operation/ monitoring, energy, premises...).

4.2.1 Office, Content and Collaboration

Office Automation includes software like word-processing, data spreadsheet, and/or presentation software;

Content includes Document management, Web content management, Archiving (documents, e-mails, ERP/FI data), Digital asset management, Document-based workflow;

Collaboration includes messaging and groupware systems, platform-independent UC applications and software to enhance and connect VoIP and UC platforms via telephony systems and groupware specialists.

Office Automation	Product / Supplier Examples
Office automation	Microsoft, Corel, iWorks (Apple)

Content	Product / Supplier Examples
Document management / document workflow	Documentum (EMC), FileNet (IBM), Lotus Domino (IBM), Microsoft, W4, Global 360, Savvion, iflow (Fujitsu), OpenText, Docubase, Doc@post, Docuware, etc.
Web content management	Thomson Reuters Phoenix Platform, vBulletin, Adobe Scene7, Adobe CQ, etc.

Collaboration	Product / Supplier Examples
Messaging and groupware systems	Microsoft, Novell, IBM
Platform-independent UC applications	Esnatech, Estos

4.2.2 Horizontal Business Applications (incl. BI)

Horizontal Business Applications includes Accounting & Finance, Supply Chain Management, Distribution & Purchasing, Human Resources Management, CRM / Sales Management / Sales Force Automation, Supplier Relationship Management, Procurement, Product Lifecycle Management, Enterprise Asset Management.

Business Intelligence (BI) includes software tools for reporting, analytical applications, corporate performance management and GRC (Governance, Risk and Compliance); some of the core functions of BI solutions include: Reporting & query, Analysis, Balanced Scorecards, Dashboards, Planning, Budgeting and Forecasting.

Horizontal Business Applications	Product / Supplier Examples
Accounting & finance	SAP, Oracle, Sage, Microsoft, Infor
Human resources management	SAP, Oracle, Sage, Meta4
CRM / sales management / sales force automation	Oracle, SAP
Supplier relationship management, procurement	SAP, Oracle

Business Intelligence (BI)	Product / Supplier Examples
Multi-dimensional analysis, statistics and technical data analysis tools, data mining	Oracle, SAP, SAS, IBM, Microsoft, Informatica, Information Builders, Fair Isaac, Tibco, JasperSoft, Pentaho, SpagoBI, etc.
BI reporting and decisional tools (front-end)	SAS, IBM/Cognos, SAP/BusinessObjects, Oracle/Hyperion

4.2.3 Vertical Business Applications

This includes specific Vertical Business Applications, such as:

- **Manufacturing:** Material Resource Planning (MRP), Quality Mgmt., Manuf. Execution Systems, Supply Chain Mgmt. (SCM), Logistics, Distribution & Purchasing, Product Lifecycle Management (PLM)
- **Banking:** Account Management, Payment Transactions, Credit Management Systems
- **Insurance:** Policy and Product Management, Claims Mgmt., Commissions and Partner Mgmt.
- **Public Sector:** Tax & Revenue Management, Grant Mgmt., Clinical, Patient Mgmt.
- **Telecom/Utilities:** Billing/Metering, Network Maintenance Mgmt.
- **Retail & Wholesale:** Point of Sales, Merchandising, Supply Chain Mgmt. (SCM), Logistics, Distribution & Purchasing
- **Services:** Services Automation
- **Transport:** Booking Systems, Traffic Control Systems, Supply Chain Mgmt. (SCM), Logistics, Distribution & Purchasing

Vertical Business Applications	Product / Supplier Examples
Supply chain management, logistics, distribution & purchasing	SAP, Oracle, Infor Global Solutions, Manhattan Associates, i2
Material resources planning	SAP, Oracle, Infor Global Solutions, QAD
Product lifecycle management	Siemens/UGS, SAP, Dassault, PTC
Process manufacturing	SAP, Aspen Tech
Discrete manufacturing	SAP, Infor Global Solutions, Oracle, QAD
Banking	Sungard, Oracle, S1, FIS, Temenos
Insurance	Misys, Tieto
Healthcare	Siemens Medical, Cerner, McKesson, Allscripts
Government	SAP, Oracle, local players
Telecom	Amdocs (Cramer), Convergys, Oracle (Portal Software), Comverse, HP, LHS
Utilities	SAP, Oracle, local players
Retail & wholesale	SAP, Oracle, Aldata, Wincor Nixdorf, JDA
Transport	Amadeus, local players

4.2.4 Technical Applications

This includes technical and graphical software, incl. CAD, GIS, command control and SCADA (e.g., plant management in manufacturing or utilities, network management in telecom, utilities or transport, C3I in defense...).

Technical Applications	Product / Supplier Examples
CAD / CAM	Dassault, Siemens/UGS, PTC, Autodesk
GIS	Aspen Tech, ESRI
Network control systems	Siemens, ABB, PSI
Visualization and simulation systems	MSC, Thales
Graphical software	Adobe, Quark

4.3 Software as a Service (SaaS)

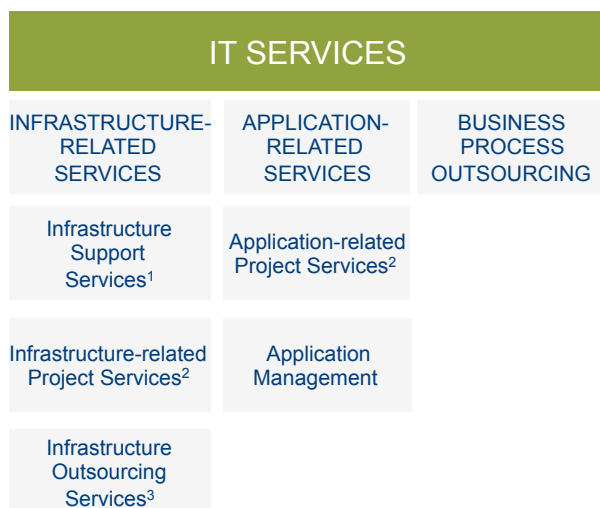
Software as a Service (SaaS) includes Network, System, Storage and Security Management (N3SM), middleware, as well as applications (e.g. business applications, BI, office, content and collaboration, etc.) sold “as a service”.

Important note

- teknowlogy figures for SaaS include the Software part (licenses and maintenance), as well as the hosting part (operation of the solution and related infrastructure) of a SaaS agreement.

SaaS Software	Product / Supplier Examples
N3SM and Middleware	Oracle, IBM, ServiceNow, BMC, CA, HP
Office, content & collaboration	Office365 (Microsoft), Google Apps, BlueKiwi (Atos), IBM
Front office: sales, service and marketing	Salesforce.com, Microsoft CRM, SugarCRM, Oracle CRM on demand, RightNow
Back office: finance, accounting, HR, procurement and SCM	SuccessFactors (SAP), SilkRoad, oneSCM.com (TAKE Solutions)

5. IT SERVICES



¹ Hardware Maintenance; Field Services and Services Desk

² Consulting; System Integration; Training

³ End-user Devices Outsourcing; Server Outsourcing & Hosting

5.1 Infrastructure-related Services

In terms of technology, infrastructure-related services relate to:

- Infrastructure Software & Platforms: Operating Systems, N3SM, Middleware;
- Hardware products and IT equipment.

5.1.1 Infrastructure Support Services

Hardware Maintenance - Repair and support, for all types of hardware (from mainframe to PC) and related system software (proprietary or open systems).

Field Services and Service Desk - Field Services (installation, configuration and roll out of infrastructure, operational support; on customer's site) and (stand-alone) Service Desk

Important note

- teknowlogy figures for Infrastructure Support Services do not include maintenance, field services and service desk that are embedded into an outsourcing agreement.

5.1.2 Infrastructure-related Project Services

5.1.2.1 Infrastructure-related Consulting

In terms of services, infrastructure-related IT consulting includes:

- Consulting on the architecture of information systems: all services related to the architecture of equipment, systems, networks, and, more generally, the technological design of information

systems;

- Consulting on the selection/ implementation of technology and technical packages: All services (selection of solutions, design, implementation, benchmarking, evaluation, preliminary studies, audits, etc.) related to the preparation and implementation of Infrastructure Software & Platforms, such as OS, middleware technologies, etc;
- Consulting on technical and miscellaneous project management: services for managing and supporting infrastructure-related projects;
- Also includes infrastructure-related consulting services related to industrial information systems, control/ command/ supervision, simulation, and embedded software in the areas of defense, transport, energy, telecommunications etc.

5.1.2.2 Infrastructure-related SI

SI includes both types of IT services invoiced on a time & material (also known as T&M, contract staff, staff augmentation, body shopping, etc.) basis as well as fixed-time/fixed-price basis.

In terms of services, infrastructure-related system integration includes:

- Assistance regarding the architecture of information systems;
- Assistance in the selection/ implementation of IT equipment, Infrastructure Software & Platforms;
- Deployment and integration of distributed systems (workstations, PCs, LANs);
- Fixed-price support services for computer operations and users;
- Integration of telecom networks and systems;
- Integration of corporate networks and systems;
- Integration/ projects for the design/ development/ deployment of infrastructures;
- Also includes infrastructure-related system integration services related to industrial information systems, control/ command/ supervision, simulation, and embedded software in the areas of defense, transport, energy, telecommunications etc.

5.1.2.3 Infrastructure-related IT Training

Infrastructure-related IT training can focus on either end users or IT professionals, and includes two types of delivery:

- Standard infrastructure-related IT training, including all multi-customer seminars;
- Customized infrastructure-related IT training, including on a one-on-one basis.

The infrastructure-related IT training market is broken down into two segments:

- Technical infrastructure-related IT training;
- Professional infrastructure-related IT training.

5.1.3 Infrastructure Outsourcing Services

According to teknowlogy's segmentation, outsourcing is characterized by:

- Long-term contracts (3 to 10 years or even more);
- Often takeover of the outsourcing customer's assets (human resources and/or infrastructure) by the outsourcer;
- Takeover of responsibility by the supplier: performance of defined services, fulfillment of defined service level agreements – not only provision of staff and/or infrastructure;
- Payment: still very often on a fixed-price basis, but modular in order to respond to the changes in customers' requirements. Payment conditions are increasingly variable, e.g. dependent on the degree of utilization (keyword: "outsourcing on demand"). Additionally, the price may also be based on non-IT measurements ("business metrics").

Infrastructure refers to any type of hardware (servers, desktops, storage, printers, ATMs, POS...) and related software (infrastructure software & platforms)

5.1.3.1 End User Devices Outsourcing

In terms of services, this outsourcing segment includes:

- Outsourcing of mostly large PC installations and PC networks, as well of other end user devices; incl. operation, help desk, software distribution, etc.

This also includes the operation of decentralized infrastructure like ATM/ cash dispensers and POS/ point of sales.

5.1.3.2 Server Outsourcing & Hosting

In terms of services, this outsourcing segment includes:

- Outsourcing of the data center (in mainframe environment and/or in client/server environment), most of the time including the transfer of both human resources and infrastructure assets;
- Hosting of an application, including server / mainframe and basic system operation, but excluding application management;
- Web hosting - hosting of a customer's web site
- Managed Services: (Remote) Managed Services for IT on client's premises and/or third-party cloud services
- Legacy & Hosted Private Cloud: Traditional outsourcing/hosting services (legacy or private cloud)
- Public IaaS/PaaS: Resources (infrastructure and/or platform) based on a Cloud architecture are hosted by a provider and made available to several customers ("one-to-many" model) over the Internet.

- Backup/ disaster recovery services on a stand-alone basis will be booked as Data Center Outsourcing. Managed Security Services on a stand-alone basis will be booked as Hosting. However most often these services are embedded in a more comprehensive outsourcing agreement.

5.2 Application-related Services

In terms of technology, application-related services relate to:

- Application software (custom development or packaged software);
- Any application: office/ collaboration/ ECM, BI, Horizontal Business Applications, Vertical Business Applications, Technical Applications.

5.2.1 Application-related Project Services

5.2.1.1 Process & Application-related Consulting

In terms of services, process & application-related consulting includes:

- Process definition, design, assessment, improvement or re-engineering as well as process/ IT alignment;
- Consulting on the organization of information systems: all preliminary services, such as studies prior to the development and/or implementation of new applications, overhaul of processes and procedures involving information technology, preparation of changes in application systems, etc;
- Consulting on the selection/ implementation of application software and packages: it covers consulting on application software products, such as enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM), human resources management (HRM), point of sales, core banking systems, etc;
- We consider both commercial and administrative processes and related applications, such as ERP, CRM, SCM, HRM, point of sales, core banking systems, as well as technical processes and related applications, such as industrial information systems, control/ command/ supervision (SCADA), simulation, and embedded systems

5.2.1.2 Application-related SI

SI includes both types of IT services invoiced on a time & material (also known as T&M, contract staff, staff augmentation, body shopping, etc.) basis as well as fixed-time/fixed-price basis.

In terms of services, application-related system integration includes:

- Design/ development of customized management information systems or applications;
- Design/ development/ implementation of packaged-based information systems or applications (ERP, CRM, etc.);

- Maintenance of applications (customized or package-based) on time & material contracts;
- Integration projects for customized and package-based applications;
- Also includes application-related system integration services related to industrial information systems, control/ command/ supervision, simulation, and embedded software in the areas of defense, transport, energy, telecommunications etc.

5.2.1.3 Application-related IT Training

Application-related IT training can focus on either end users or IT professionals, and includes two types of delivery:

- Standard application-related IT training, including all multi-customer seminars;
- Customized application-related IT training, including on a one-on-one basis.

The application-related IT training market is broken down into two segments:

- Technical application-related IT training;
- Professional application-related IT training.

5.2.2 Application Management

According to teknowlogy's segmentation, Application management (AM) is characterized by:

- The maintenance and enhancement of existing applications (custom development and/or customized software products), sometimes even their initial development
- Long-term (multi-year) contract with a commitment to fulfilling pre-defined service level agreements (SLAs) on a fixed-price basis.
- Often, specialized IT staff is transferred.

Important note

- teknowlogy figures include both "stand alone AM" (dedicated AM contracts) and "embedded AM" (AM embedded in comprehensive outsourcing contracts).

5.3 Business Process Outsourcing (BPO)

According to teknowlogy's segmentation, **Business Process Outsourcing (BPO)** is characterized by:

- The takeover of responsibility for an entire business process (or parts of it)
- The transfer of the specialized administrators besides the related infrastructure and application management.

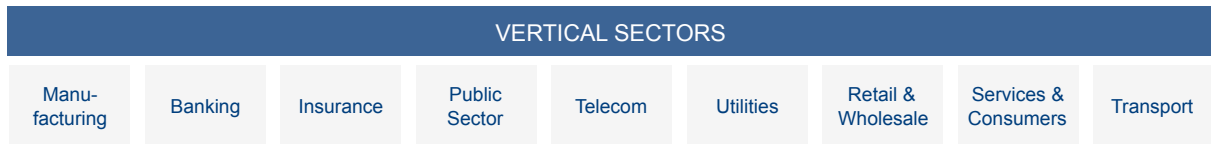
Important notes

- BPO also includes processing services such as payroll, card or transaction processing.
- teknowlogy only considers processes that are to a significant degree supported by IT (e.g. accounting, human resources, logistics, billing, card processing, etc.).

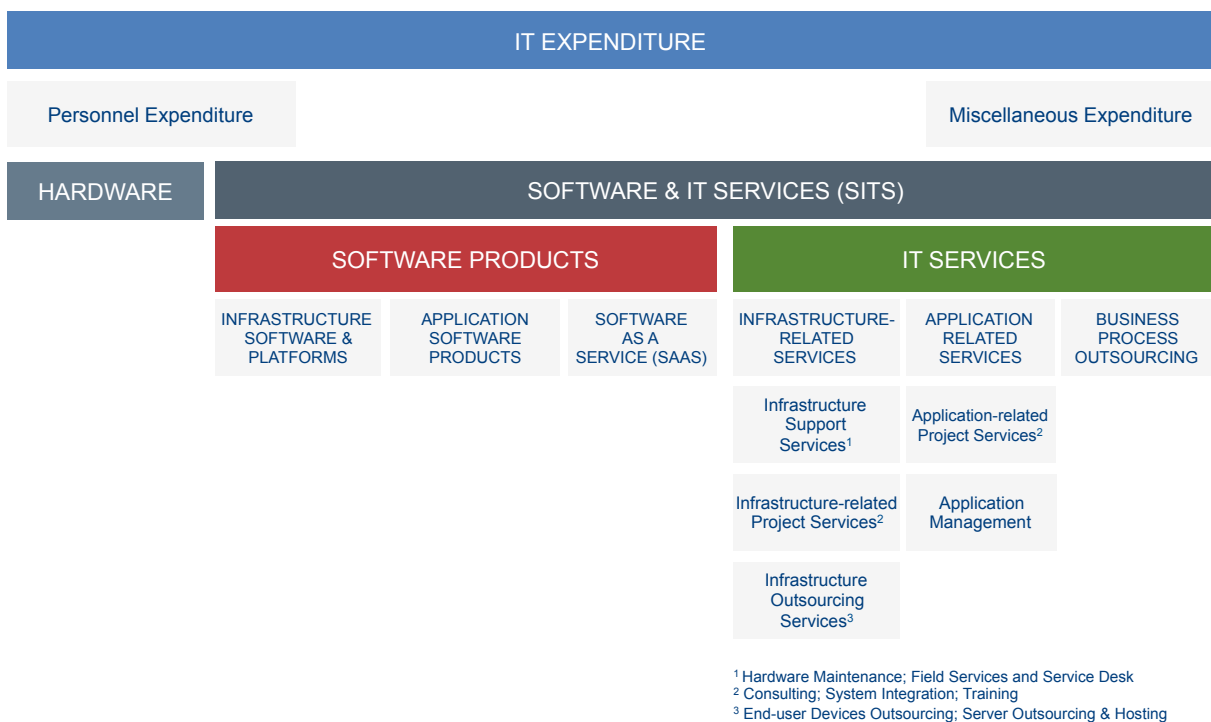
Process cluster	Process	IT share	To be considered
HR	Payroll	70% - 90%	Yes
	Travel expense accounting	20% - 30%	No
	Recruiting, separation/compensation, training	80% - 90%	Yes
	Benefits administration	80% - 90%	Yes
Sales/ CRM/ billing	Billing/invoicing	70% - 90%	Yes
	Loyalty card processing	80% - 90%	Yes
	Clearing	70% - 80%	Yes
	Call center	20% - 30%	No
Financial accounting	Customer care	30% - 80%	Case by case
	Purchase-to-pay (incl. accounts payable)	80% - 90%	Yes
	Order-to-cash (incl. accounts receivable)	60% - 70%	Yes
	Record-to-report (incl. general ledger, fixed assets, reconciliations, inter-company accounts)	60% - 70%	Yes
	Revenue collections (3rd-party collections)	20% - 30%	No
Logistics / SCM/ procurement	Fin. planning and analysis (incl. performance analysis, internal audit, treasury and risk management)	50% - 60%	Yes
	Procurement (incl. sourcing, catalog management, indirect procurement administration)	60% - 70%	Yes
	Inventory planning & management	80% - 90%	Yes
	Supply chain BPO (incl. order management, transportation management fulfillment, A/R)	20% - 80%	Case by case
Document management	Logistics execution (incl. transport)	10% - 20%	Yes
	Inbound print/ mailing services	70% - 100%	Yes
Financial processing	Outbound print/ mailing services	70% - 100%	Yes
	Check processing	80% - 90%	Yes
	Payment & credit card processing	80% - 90%	Yes
	Transaction processing/ credit & loans & mortgages	60% - 80%	In most cases
	Transaction processing/ securities (excl. bank-to-bank services)	70% - 80%	Yes
Other verticals	Claims processing	50% - 70%	Case by case
	Policy management	70% - 80%	Yes
	R&D	10% - 20%	No (if SW engineering, then ITO!)
	Manufacturing	0% - 10%	No
	E-government	30% - 70%	Case by case
	Road charging	50% - 80%	In most cases
	Billing (for telecoms, utilities)	50% - 90%	Yes
	Information brokerage	10% - 70%	Case by case
	Reservation services (platform, excl. call centers)	50% - 90%	Case by case
	Passenger revenue accounting for airlines	50% - 90%	Yes
	Fleet management	20% - 30%	No
	Facility management, security, catering, cleaning etc.	0% - 20%	No
	Smart metering	60% - 80%	Yes
Pharmacovigilance	50% - 90%	Yes	
Clinical data management	60% - 90%	Yes	

Note: We exclude intra-industry BPO (e.g., bank-to-bank payment operated by a bank for another bank).

6. VERTICAL SECTORS



teknowlogy provides market figures for each of the above mentioned nine vertical sectors, for the following 18 IT Expenditure and IT Market segments:



To download an Excel document matching the NACE 2.0 classification with teknowlogy’s vertical segmentation, please click [here](#).

Manufacturing

- Automotive & Discrete Manufacturing incl.
 - Aerospace & Defense
 - Electrical Engineering & High Tech
 - Mechanical & Plant Engineering
 - Construction
- Process Manufacturing incl.
 - Metal
 - Chemicals
 - Pharmaceuticals
 - Oil, Gas & Mining
 - Food & Beverages, Tobacco
 - Textile, Paper, Others

Banking

- Retail Banking
- Wholesale/Corporate Banking
- Investment Banking
- Private Banking

Insurance

- Life & Pension
- Property & Casualty
- Private Health
- Reinsurance

Public Sector

- Government (incl. federal, regional, and local administration, education, etc.)
- Health and Social Services (incl. payers and providers)
- Defense

Telecommunications

- Fixed carriers
- Mobile carriers
- Virtual Network Operators (VNO)
- Internet Service Providers

Utilities

- Electricity
- Water
- Gas
- Waste disposal
- Heat

Retail & Wholesale

- Wholesale
- Retail (food)
- Retail (non-food)

Services & Consumers

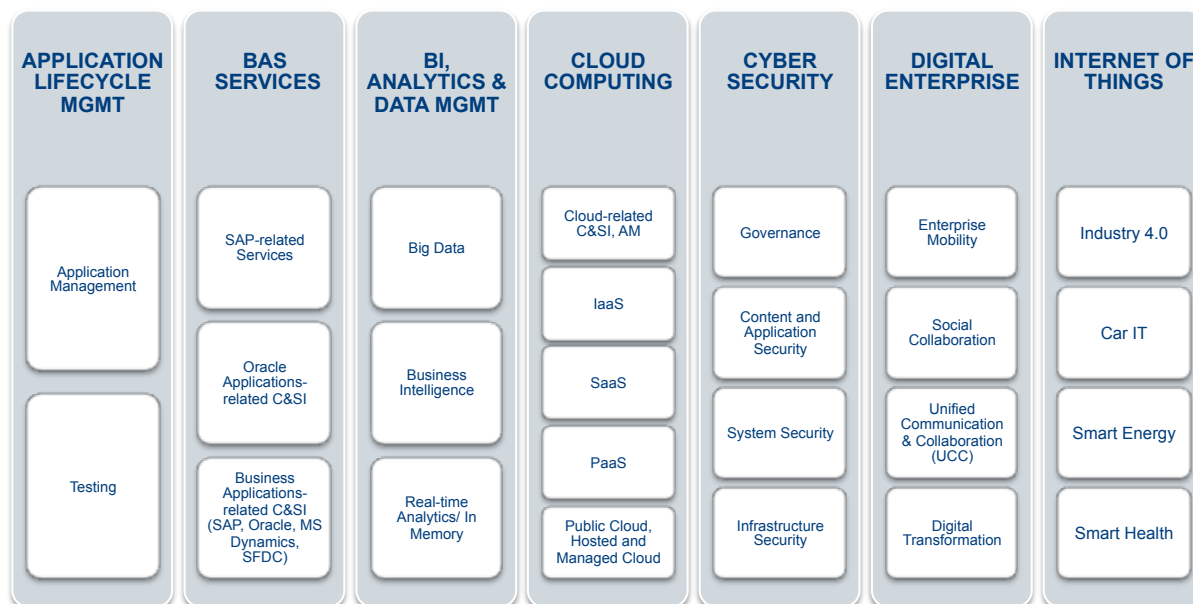
- Media
- Professional Services
- Facility Management
- Tourism

The **Consumers** segment refers to the use of IT in households. It covers individual consumers, usually in a multi-person environment (e.g. a family), with a possibly differentiated use of IT products and services.

Transport

- Rail and Public Transport
- Freight
- Aviation
- Postal Services

7. TOPICS



7.1 Application Lifecycle Management (ALM)

Application Management (AM)

Application Management (AM) describes the maintenance and enhancement of existing applications (custom development and/or customized software products), sometimes even their initial development, under a long-term (multi-year) contract with a commitment to fulfilling predefined service level agreements (SLAs) on a fixed-price basis.

For this report teknowlogy considers “stand-alone application management” (also “dedicated AM contracts”) as well as “embedded application management” in complete or application outsourcing deals.

Testing

Testing can be performed throughout the application development lifecycle, but in reality is often performed at the conclusion of the development phases, prior to go-live.

Organizations are increasingly aware that in order to deliver truly effective testing, it needs to be considered at the very start of development in order to ensure that the systems is tested in a way that truly meets the business requirements.

As in other areas of the IT services market, buyers are increasingly looking to contract out testing as a separate service ‘tower.’ teknowlogy makes a distinction between testing that is performed as part of a broader externalized application development project (‘embedded testing’), and testing that is delivered by a third party supplier as a discrete service (‘stand alone testing’). This latter area is emerging as the fastest growing area of the testing market as clients look for a best-of-breed service.

7.2 Business Applications Software (BAS)-related Services

Includes Consulting and System Integration (C&SI) revenue related to the implementation, customization, integration and evolution of:

- **Oracle Applications including**
 - Agile
 - ATG Web Commerce
 - Auto Vue
 - Eloqua
 - Endeca
 - Haley
 - Hyperion
 - InQuira
 - JD Edwards
 - MetaSolv Software
 - Oracle CRM on Demand
 - Oracle E-Business Suite
 - Oracle Fusion Applications
 - Phase Forward
 - Portal Software
 - Primavera
 - PeopleSoft
 - RightNow
 - Siebel
 - Taleo
 - iFlex
 - Retek
 - Vitruve
 - WebCenter

- **Microsoft Dynamics including:**
 - Microsoft Dynamics CRM
 - Microsoft Social Listening (Netbreeze)
 - Microsoft Dynamics Marketing
 - Microsoft Dynamics AX (Axapta)
 - Microsoft Dynamics GP (Great Plains)
 - Microsoft Dynamics NAV (Navision)
 - Microsoft Dynamics SL (Solomon Software)
 - Parature

- **SAP including**
 - SAP Business Suite
 - SAP Business All In One
 - SAP Business One
 - SAP Business ByDesign
 - SAP Business Objects
 - SAP InfiniteInsight (KXEN)
 - SuccessFactors
 - Ariba
 - Fieldglass
 - Hybris
 - Camillion
 - JAM

- **Salesforce.com including**
 - Sales Cloud
 - Service Cloud
 - Marketing Cloud
 - Work.com
 - ExactTarget Marketing Cloud
 - Community Cloud
 - Salesforce Chatter

...as well as upcoming acquisitions and brands.

SAP-related Services

Cloud and HANA Segmentation

SaaS-related

Related to the implementation, customization and integration of SAP's SaaS solutions (e.g. SuccessFactors, Ariba, Cloud for Customer, Concur, ByD, etc).

IaaS-related

Related to the migration of on-premise SAP solutions to run in an IaaS model (hosted private and/ or public IaaS)

HANA-related

Related to the implementation, customization and integration of SAP's HANA solutions and platforms.

- **HANA Platform-related:** C&SI Services related to the implementation of the HANA platform and custom development on the HANA platform.
- **HANA Applications-related (SoH & S/4):** C&SI Services related to the implementation of Suite on HANA (SoH) and S/4 HANA (S/4).

Topic Segmentation – SAP Topics

for more details please go to the SAP solution explorer on <http://sap.com>

Financials: Financial and Management Accounting, Financial Supply Chain Management, Treasury Applications, GRC (Governance, Risk, and Compliance).

HCM = Human Capital Management: Workforce Analytics, Talent Management, Workforce Process Management, Workforce Deployment, End-User Service Delivery

CRM = Customer Relationship Management: Marketing, Sales, Service, Partner Channel Management, Interaction Center, Web Channel, Business Communications Management, Real-time Offer Management

SRM = Supplier Relationship Management: Procure To Pay, Catalog Management, Centralized Sourcing, Centralized Contract Management, Supplier Collaboration, Supplier Evaluation"

Analytics: Analytic applications, business intelligence, data warehousing, enterprise information management, enterprise performance management, governance, risk, and compliance

Database & Technology: Application foundation & security, business process management & integration, content and collaboration (portals), database (including Sybase ASE, Sybase Anywhere, Sybase IQ), in-memory computing (Hana), etc.

Mobility: mobile applications, mobile analytics, mobile platform (Sybase unwired platform, Afaria, Sybase 365)

Cloud: SAP's SaaS solutions (Business ByDesign, CRM on demand, SuccessFactors, Ariba, etc.)

ISS Manufacturing: Manufacturing resource planning (production planning, production control, material management), supply chain management, manufacturing execution systems, quality management, dispensing management, recipe management, laboratory information management, dangerous goods management, production data acquisition, batch management, product lifecycle management (life-cycle data management, program and project management, life-cycle collaboration, quality management, enterprise asset management, environment, health and safety), etc.

ISS Banking: Risk control, payment transactions, processing, account management; credit loans, mortgages; securities, corporate finance, insurance, deposits, risk management, treasury management; mobile-, Internet-, self-service banking; branch banking

ISS Insurance: Collection & disbursement, risk management, policy management, product management, claim management, asset management, management of provisionary systems, customer data management.

ISS Utilities: Energy trade, energy data management, billing, supply chain management.

ISS Telecom: billing, network lifecycle management, service fulfillment, supply chain management.

ISS Public: E-government, education, healthcare systems, supply chain management.

ISS Retail: Merchandise management, supply chain management, trade management, risk management.

ISS Services: Project management, supply chain management, partner management, facility management, media systems.

7.3 BI, Analytics & Data Management

Big Data

Defining Big Data

One of the thorniest problems with this market is actually defining it. When does a large dataset become “big data”? Most people indistinctively “know it when they see it” but pinning down a definition is something that the industry has been arguing for over some time.

So, most people plump for some variant of the “three ‘V’s” definition originally suggested about a decade ago in a somewhat different context: i.e. that Big Data is a data set with **Volume**, **Variety** and **Velocity**. Others add a fourth ‘V’, even a fifth, with a number of suggestions for what those should be. teknowlogy believes the best definition uses four ‘V’s, where the fourth characteristic is “**Value**”.

The Volume part of the definition is self-explanatory, although putting a precise figure on it is difficult: Big Data starts with terabytes and stretches up to petabytes – and beyond. What makes it Big Data is the combination with **Variety**, we (and others) are referring to its structure: Big Data problems generally relate to the data with freeform text, photos or other media where the structure is loosely defined and likely to change. **Velocity** means the speed of data generation and thus processing speed – this is particularly an issue with machine-generated data (like commodity trades and prices); but where millions of users are concerned, they also generate large data volumes at high velocity. Often, techniques for pre-filtering and discarding unwanted data without storing unnecessarily large quantities are needed or desirable. And the **Value** characteristic is an essential part of defining the new market. Big Data is all about providing *cost-effective* solutions to big data problems using tools and techniques different from the those that have been developed over the last 20-30 years for analyzing the highly-structured, aggregated and generally numeric data relating to business operations.

So to be more precise, we see the Big Data market as comprising “**solutions for problems where the volume of data, and its variety OR volume means that they cannot be cost-effectively managed and analyzed with traditional database tools and techniques.**”

Most often, Big Data solutions start with the data storage in non-relational databases, commonly using Apache Hadoop tools, the open source data storage solution derived from work at Yahoo, Google and others. Several alternatives to this approach are also in use, and indeed many of them are more mature, robust and usable by the average nosiness than the Hadoop-based solutions. These often start from a more traditional, but massively parallel database – such as EMC-Greenplum or Teradata’s Aster Data.

Market segments

We segment the Big Data software market into:

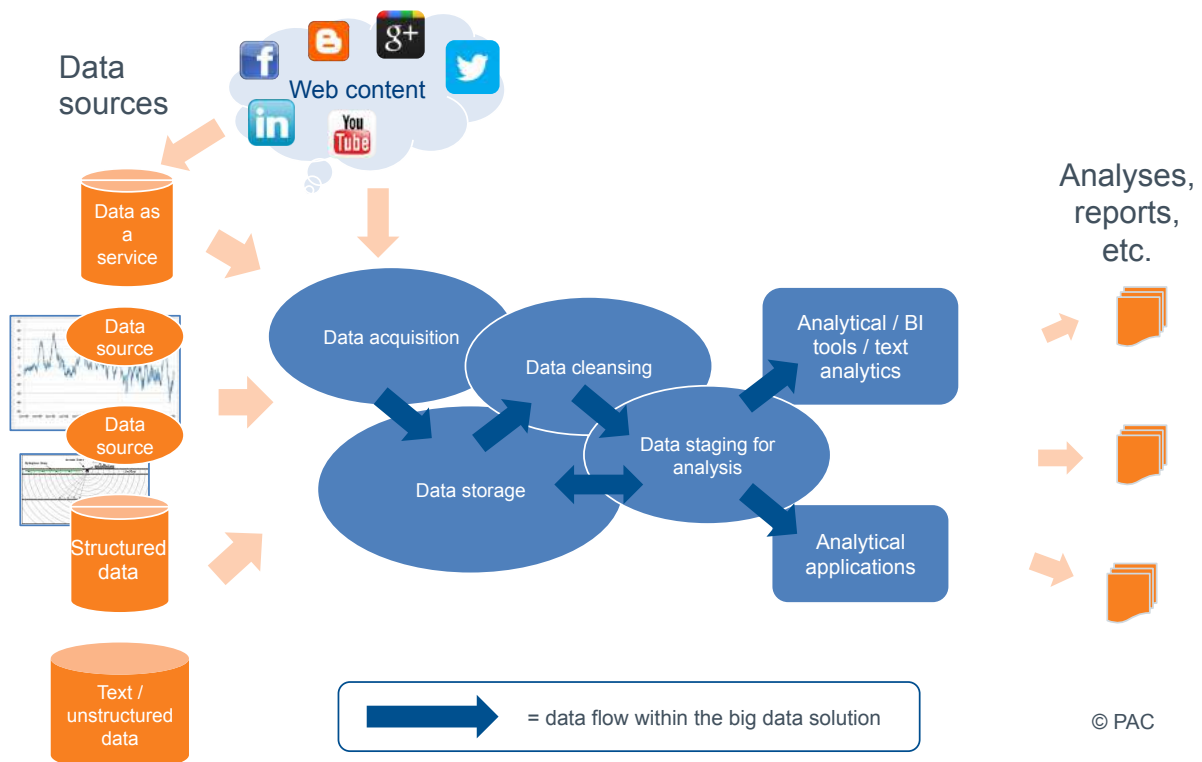
1. data infrastructure that is concerned with collecting, storing and retrieving the data. Many of these are open source tools based around the Hadoop dataset, but increasingly these are being bundled in commercial offerings alongside storage, integration and other facilities from large and small vendors
2. applications & analytics – these are the tools to make use of the big data, which range from established business intelligence tools to dedicated applications for retrieving and analyzing data in proprietary social media sets, such as Twitter “firehose”.

Note: we consider Software as a Service (SaaS) in our software figures.

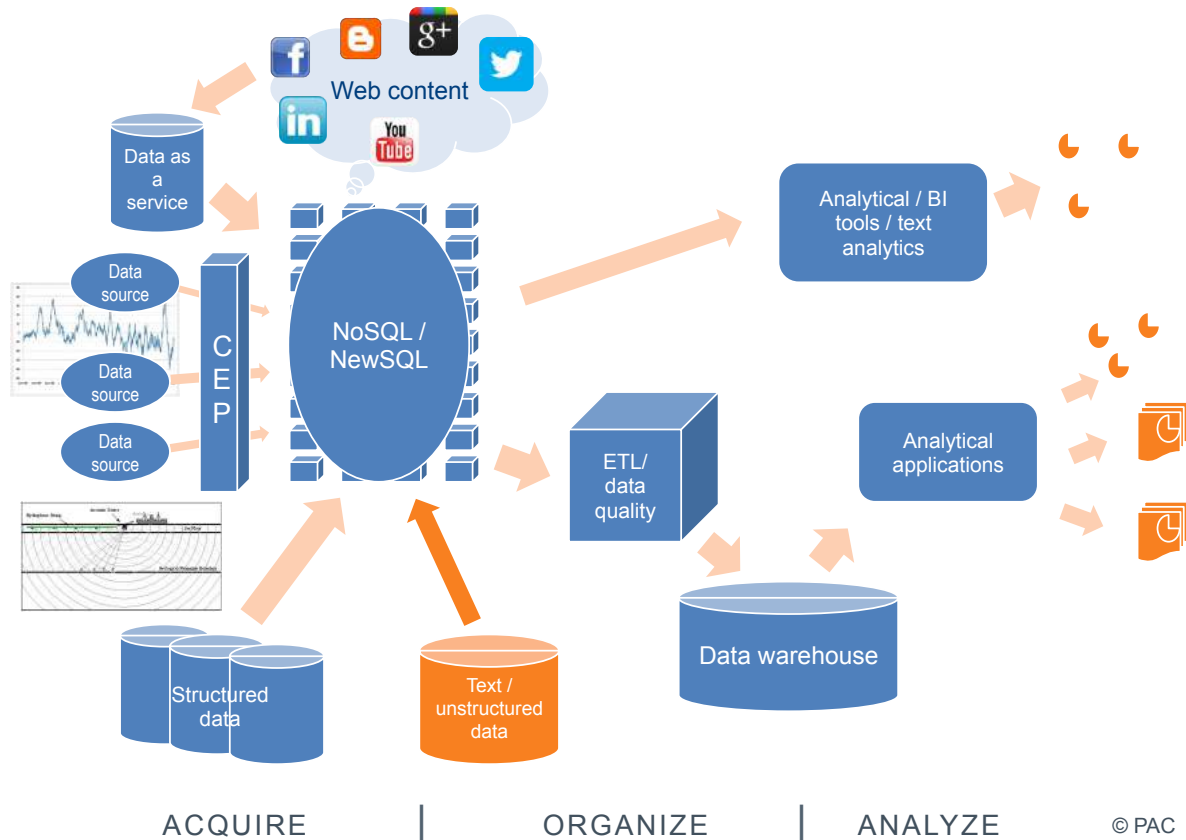
We segment Big Data Services market into:

1. Consulting, Systems Integration, Training and Application Management related to data infrastructure software; it includes services relate to the selection, implementation, customization and integration of standard software as well as to the development, implementation, integration and maintenance of custom software
2. Consulting, System Integration, Training and Application Management related to applications & analytics software; it includes services relate to the selection, implementation, customization and integration of standard software as well as to the development, implementation, integration and maintenance of custom software
3. Hosting and Support: Hosting of Big Data solutions, selection, deployment, integration and maintenance of the related servers and storage.

Big data supplier landscape – functional view



The big data landscape – process view



Business Intelligence (BI)

From the software point of view, BI is a generic term that embraces a large variety of software tools for reporting, analytical applications, corporate performance management and GRC (Governance, Risk and Compliance). In addition, a number of infrastructure components belong to BI, including data management systems (data integration, data quality and data governance), databases and data warehouses.

BI solutions are often offered as part of a BI suite. But, there are many specialized tools available for specific functions, such as reporting or data integration. In addition, many business applications suites include BI functions – also referred to as ‘embedded for BI’. For instance, there is almost no solution for customer relationship management (CRM) that does not include reporting.

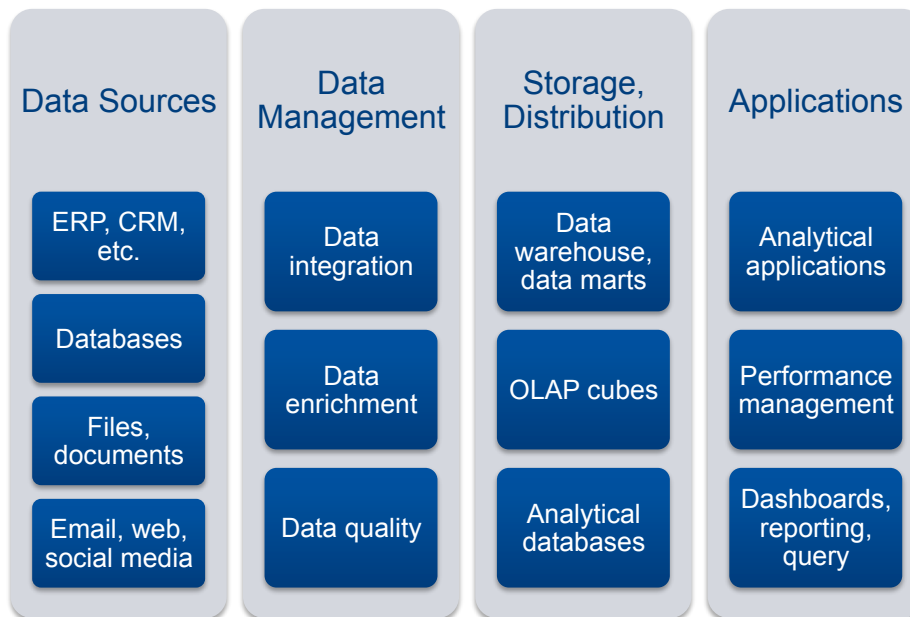
Some of the core functions of BI solutions include:

- Reporting & query
- Analysis
- Balanced Scorecards
- Dashboards
- Planning, Budgeting and Forecasting

More specific feature includes:

- Statistics
- Predictive analysis
- Optimization
- Complex Event Processing
- Text-mining and sentiment analysis

BI key components are:



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- Data Warehouse (DWH) = Data Warehouse Systems
- Analytical DB = Analytical Databases such as HP Vertica, Teradata, Oracle Exalytics, SAP HANA or IBM Netezza
- Data Management (DM) = Data Integration, Data Quality and Master Data Management
- Reporting = Reporting, Ad-hoc Reporting
- Analysis and Advanced Analysis = Among other things Data Mining, Text Analysis, Predictive Analytics
- Planning & CPM = Planning Systems, CPM, Consolidation, GRC

7.4 Cloud Computing

Cloud computing refers to the operation of a virtualized, automated, and service-oriented IT infrastructure that allows the flexible provision and usage-based invoicing of resources, services, and applications via a network or the internet.

The cloud computing concept means a way of provisioning and using technology, not a technology in and of itself. Generally, it does not refer to a specific technology, but rather to a set of combined technologies and concepts. That is why there are still many different definitions of cloud services in the market.

Moreover, the cloud concept is not entirely new. It rather combines a number of IT trends from the past, such as automation, centralization, shared services, service orientation (SOA), virtualization, and externalization (outsourcing, managed services).

However, cloud computing has particular characteristics that distinguish it from classic IT resource and service provisioning – or characteristics that are at least commonly associated with cloud services, even though most of the following are only 100% true for a few public cloud offerings.

Most existing cloud offerings include the following aspects – to a greater or lesser degree:

- Massive scalability
- Shift of costs from CAPEX to OPEX
- Per usage pricing (per user and/or per volume/transaction)
- No long-term commitments
- Self-service-based (normally realized within public clouds, partly still restricted within private clouds)
- Service-oriented (reusable services are loosely coupled and orchestrated as required)
- Multi-tenant architectures (normally the basis for public clouds, but not always provided within private clouds)
- Virtualized infrastructures
- Rapid provisioning (normally realized within public clouds, partly still restricted within private clouds)
- Shared single instance (not in the sense of one single data center but one application instance/release, centralized support, further development, management, etc.)
- Standardized
- Easy-to-use/easy-to-consume, leveraging B2C concepts (B2C/ B2B convergence)

In this document, cloud services will be considered in a broader sense (e.g., not necessarily multi-tenant), ranging from widely dedicated single-tenant architectures (a dedicated database, middleware, one single application instance) to multi-tenant architectures (a core SaaS model with a shared infrastructure, one single application instance). There is also a multitude of mixed architectures (e.g. a dedicated application instance and database, running on a virtual server).

Private vs. public cloud

In-house private cloud: Implementation and operation of cloud architecture within a company or organization.

Hosted private cloud: Operation and provision of cloud architecture by an external provider, specifically for one customer. This cloud model is very close to traditional hosting concepts but based on cloud architecture. An external provider is in charge of managing and running the customer's private cloud (normally built by the provider in charge of the operation). The cloud is basically dedicated ('private') but the provider, nevertheless, has the possibility to share resources like staff or facilities across several customers.

Public cloud: Resources based on cloud architecture are hosted by a provider and made available to several customers ('one-to-many' model) over the internet.

Managed cloud: Managed services for in-house private clouds, and/or (third-party) public, or hosted private cloud solutions (IaaS, PaaS, or SaaS). The provider typically takes over responsibility for ongoing services around automation, integration, governance, and security, identity and access management (IAM), etc. for one or several cloud solutions (but not for the operation of the cloud solutions themselves in the case of third-party cloud solutions).

Cloud computing services (public cloud and hosted private cloud)

IaaS (infrastructure as a service): this is the basis of cloud architecture. It is the dynamic provisioning of computing, storage, and network resources. IaaS users, in particular system administrators and IT architects, can access these infrastructure resources as required.

Cloud computing provides access to computational resources, i.e., CPUs. So far, such low-level resources cannot really be exploited on their own so they are typically found as part of a 'virtualized environment' (not to be confused with PaaS below), i.e., hypervisors. Cloud-computing providers, therefore, typically provide their customers with computing resources (i.e. raw access to resources, unlike PaaS that offers full software stacks to develop and build applications), typically virtualized, in which to execute cloud services and applications. IaaS (infrastructure as a service) offers additional capabilities over a simple computing service.

Data & storage clouds deal with reliable access to data of potentially dynamic size, weighing resource usage against access requirements and/or quality definitions.

PaaS (platform as a service): this sits on top of the IaaS architecture and comprises the middleware and/or development platform, which enables IaaS users - in particular application developers and IT architects - to develop applications within the cloud and/or operate them.

It provides computational resources via a platform upon which applications and services can be developed and hosted. PaaS typically makes use of dedicated APIs to control the behavior of a server-hosting engine that executes and replicates the execution according to user requests (e.g. access rate). As each provider presents their own API based on its respective key capabilities, applications developed for one specific cloud provider cannot be moved to another cloud host. There are, however, attempts to extend generic programming models with cloud capabilities (such as MS Azure).

SaaS (software as a service): SaaS includes Network, System, Storage and Security Management (N3SM), middleware, as well as applications (e.g. business applications, BI, office, content and collaboration, etc.) sold “as a service”.

Note: teknowlogy figures for SaaS include the Software part (licenses and maintenance), as well as the hosting part (operation of the solution and related infrastructure) of a SaaS agreement.

BaaS (business process as a service): this goes beyond the traditional IT cloud architecture. Also known as platform-based business process outsourcing (BPO), it offers an externally provisioned service for managing an entire business process, such as claims processing, expense management, or procurement (internet-enabled). Unlike traditional BPO, which often requires the service provider to take over an existing software installation, the ‘process cloud’ uses a SaaS platform to automate highly standardized processes.

It differs from SaaS in that it provides end-to-end process support, covering not just software but also processes supported by people, such as contact centers. These processes are typically priced on a per-transaction rather than per-seat basis.

Cloud-related C&SI

Cloud-related C&SI		
Segment	Cloud deployment	Description
SaaS-related	Total cloud-related C&SI	Implementation (including data migration), customization, orchestration and integration of SaaS solutions
Infrastructure transformation	Public & hosted private cloud-related	Implementation, orchestration, and integration of IaaS services (public & hosted private)
Infrastructure transformation	In-house private cloud-related	Implementation, orchestration and integration of in-house private cloud infrastructure, including infrastructure deployment
Application transformation	Public & hosted private cloud-related	Migration of on-premise applications (custom software as well as standard software such as SAP or Oracle Applications), and their implementation, customizing, and integration to run on IaaS services (public & hosted private)
Application transformation	In-house private cloud-related	Migration of on-premise applications (custom software as well as standard software such as SAP or Oracle Applications), and their implementation, customizing, and integration to run on in-house private cloud infrastructure

7.5 Cyber Security



Cyber security: broad segmentation of products, technologies and services	
Cyber security products/solutions	Sub-segments
Governance, risk management and compliance	<ul style="list-style-type: none"> Information security management systems SIEMS: Security information and event management
Identity and access management (system)	<ul style="list-style-type: none"> Electronic access control (identification and authentication), SSO, Tokens systems for ICT hardware, systems and networks
Data (content) security	<ul style="list-style-type: none"> Encryption, cryptography and digital signature solutions Public key infrastructure solutions Digital rights management solutions Content filtering and anti-spam Data loss/leak prevention, secure data deletion, secure archiving, data recovery solutions
Applications security	<ul style="list-style-type: none"> Application security, design, coding development and testing
Infrastructure (network) security	<ul style="list-style-type: none"> System and network security software (firewalls, anti-virus, intrusion detection, tracking and tracing) Terminal security (fixed or mobile) solutions and endpoint hardening solutions Vulnerability scanners Secure communications: email, phone, video-conferencing and messaging systems
Hardware infrastructure (device/endpoint) security <i>Not considered in our cyber security scope</i>	<ul style="list-style-type: none"> Secure personal portable devices and identity documents Hardware security modules Enrolment and issuance systems (for access control and identity management) Biometrics systems Network cryptologic systems, special casings etc. for IT hardware
Cyber security services	
Auditing, consulting planning and advisory services	<ul style="list-style-type: none"> Security audit, vulnerability and intrusion testing, and risk and threat assessment Security strategy, planning and management advice Security certification and conformity/compliance assessment Digital forensics: post-event (incident/intrusion) analysis, investigation and proof preservation
System integration and implementation	<ul style="list-style-type: none"> Security engineering, design and architecture development Implementation and integration, interoperability testing Implementation support (technical assistance/expert support services)
Management and operations services	<ul style="list-style-type: none"> Operational support (technical assistance/expert support services) Managed security services, security system management and operations Secure outsourcing Continuity and recovery management Trusted third party, e-content and e-reputation services
Security training	<ul style="list-style-type: none"> IT/cyber security education and training

SITSI Cyber Security segmentation by type of cyber security

Please note that:

- *The segmentation is based on products and solutions. Thus services are segmented only by type of services.*
- *SITSI figures do not include hardware figures for Cyber security.*
- *C&SI figures do not include services related to the hardware part of Cyber security.*

7.6 Digital Enterprise

Enterprise Mobility

In teknowlogy's definition, enterprise mobility includes all technology solutions used to optimize internal and external business processes including communication and collaboration, as well as to provide customer-facing mobile applications. In the market analysis at hand, we considered software, project services, outsourcing as well as hardware related to enterprise mobility solutions.

We do not consider market segments and revenues related to mobile network provisioning, connectivity, and mobile voice and data access services.

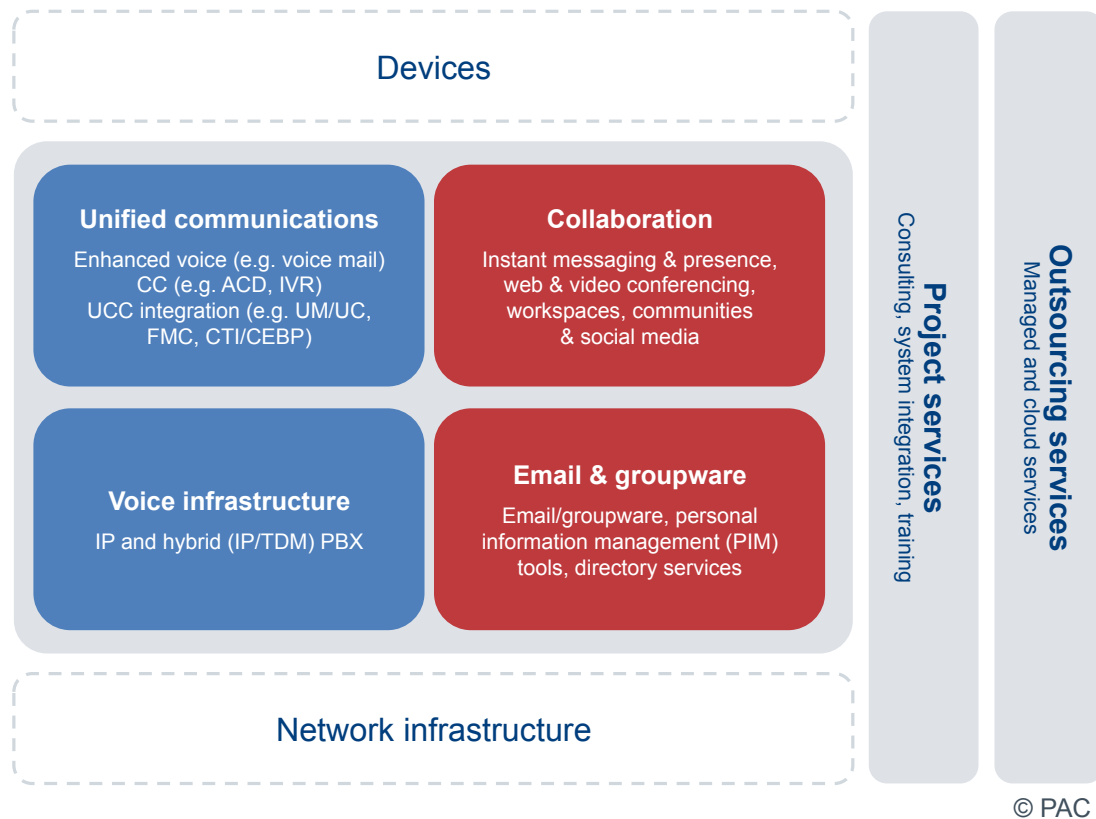
The enterprise mobility market as defined by teknowlogy includes:

- Mobile enterprise process applications: e.g. mobile ERP, CRM, SCM or BI, including mobile app development, provisioning and integration platforms and technologies with respective building blocks, middleware and security components.
- Mobile customer-facing applications: i.e. the development and provisioning of mobile customer apps (e.g. mobile commerce, payment, marketing, customer interaction etc.), including mobile app development, provisioning and integration platforms and technologies with respective building blocks, middleware and security components.
- Mobile device, application and content management (also Enterprise Mobility or Unified Endpoint Management): including middleware for remote management and security of mobile devices, and applications and content, including respective assets and security management functions needed for a unified endpoint management.

Unified Communications & Collaboration (UCC)

Generally, UCC software, project services and outsourcing as defined by teknowlogy refer to the following technology segments:

- Voice infrastructure, including:
 - IP PBX and
 - Hybrid IP/TDM PBX
- Unified communication, including
 - Enhanced voice applications (e.g. audio conferencing, softphones)
 - Contact center applications (e.g. ACD, IVR)
 - UCC integration (e.g. UC/UM server; CTI, FMC, integration, multi-directory services)
- E-mail & groupware infrastructure, including
 - E-mail/groupware server and clients, including mobile mail access
 - Personal information management (PIM) tools (e.g. calendar)
 - Directory Services
- Collaboration tools and applications, including
 - Instant messaging and presence (online)
 - Web and videoconferencing
 - Workspaces, communities and social media (e.g. portals for document sharing, wikis and [micro]blogs)



Digital Customer Experience

Digital Customer Experience Segmentation	
1. Software Products (topic view)	
1.1. Digital Content & Applications	Development & delivery platforms Website development platforms Cloud & Mobile Apps Development platforms WCM (web content management) solutions Product Information Management (PIM) – Catalog Management Digital / Media asset management solutions (MAM)
1.2. Digital Sales & Commerce	Multi-channel commerce platforms & suites (Social, mobile, web, POS) Omni-channel commerce platforms & suites (web, mobile, social, POS) Order Management & fulfillment solutions, digital payment solutions Analytics and reporting related to sales & commerce
1.3. Digital Marketing	Digital marketing platforms & suites

<p>1.4. Digital Customer Experience & Service</p>	<p>Digital marketing platforms & suites Multi-channel campaign management Marketing automation & marketing process management Social media analytics, customer & marketing analytics</p> <p>Customer experience platforms & suites Customer experience platforms & suites Social customer experience Multi-channel contact center & customer service Customer portals & community management solutions</p>
<p>2. Services (topic view)</p>	
<p>2.1. Digital Content & Applications</p>	<p>Services related to development & delivery platforms</p>
<p>2.2. Digital Sales & Commerce</p>	<p>Services related to multi-channel commerce platforms & suites (social media, mobile, web, POS)</p>
<p>2.3. Digital Marketing</p>	<p>Services related to digital marketing platforms & suites</p>
<p>2.4. Digital Customer Experience & Service</p>	<p>Services related to customer experience platforms & suites</p>
<p>3. Services (services view)</p>	
<p>3.1. Digital Consulting</p>	<p>Technology and business consulting related to digital projects Digital strategy consulting Digital technology consulting Organizational transformation</p>
<p>3.2. Digital Technology Implementation</p>	<p>Technology sourcing or development and implementation related to digital projects Technology selection Solutions design and development Front office implementation</p>
<p>3.3. Digital Technology Integration</p>	<p>Integration with existing systems of technologies related to digital projects Backend integration of marketing and commerce platforms Data integration Content management integration</p>
<p>3.4. Digital Operations & Management</p>	<p>Operations and management of digital infrastructure and applications Digital solutions hosting & managed services Infrastructure support services & application management Business process outsourcing</p>

7.7 Internet of Things (IoT)

Contexts

Connected vehicles

Connected cars, trucks, buses, ships, trains and other vehicles can continuously and bi-directionally communicate with ecosystems (e.g. owners, drivers, OEMs, insurers, garages) and environments (traffic signals, other vehicles, smart home, etc.). IoT-related technologies enable smart services like traffic management, predictive maintenance, convenience services, after-sales solutions, etc.

Includes, among others, the following use cases:

Use case	Description
Connected service chains	Digital technologies like mobility, sensor, artificial intelligence and innovative driver interfaces are paving the way for connectivity-related smart services like remote diagnostics and (predictive) maintenance, automated garage service, situation-based insurance, driver assistance or extended mobility services.
Contextual services	Services based on context-aware applications, providing personalized services to each individual user according to their particular needs and interests at any given point in time. A contextual service adapts to changing circumstances of users in real time (emergency, access, tracking).
Smart parking	Smart parking solutions support the reduction of (urban) traffic volumes by monitoring & managing available parking spaces on-street & off-street (e.g. car park facilities). Solutions include technologies (e.g. RFID/sensors), mobile apps for user (incl. space reservation, payment functionalities) & management platforms (incl. analytics capabilities). Also included are autonomous off-street parking concepts and infrastructure components (e.g. smart street lights) that monitor/scan street environments for available on-street parking spaces.

Use case	Description
Infotainment	Infotainment refers to a combination of information and entertainment. It includes services as well as hardware/software products and systems, "built in" or to be added to vehicles in order to enhance driver and/or passenger experience.
Driver assistance & autonomous vehicles	Autonomous vehicles can detect surroundings using a variety of techniques (RADAR, LiDAR, GPS, odometry, computer vision) for the purpose of self-driving and navigation. Therefore, advanced control systems interpret sensory information to identify appropriate navigation paths as well as obstacles (other vehicles, pedestrians, road damages) and relevant signage. Autonomous vehicles are classified on six different levels, ranging from none to fully-automated systems.
Fleet management	Fleet management includes commercial vehicles (cars, aircraft, ships, vans, trucks, rail cars) and integrates functions like vehicle financing, maintenance, telematics like tracking & tracing, fuel and consumption management as well as driver management for e.g. health and safety purposes.

Digital factory

A digital factory uses smart products and smart services to become a highly-efficient and integrated cyber-physical production system. This covers the improvement of internal production processes, intra-logistics and the supply chain. But also the delivery of smart products and services to help others in realizing a digital factory.

Includes, among others, the following use cases:

Use case	Description
Connected worker	A connected worker uses digital worker support systems (via augmented reality or other visualization technologies) to improve working decisions, quality and efficiency. In addition, they can collect data via sensors (e.g. via wearables or cameras).
Digital twin	A digital twin allows the virtual development, testing, production and maintenance of a physical product, by using digital technologies like virtual reality. The digital product can be interacted with in the same way as would be possible with the physical product. A physical product can also gather sensor data that can be used to update a "digital twin" copy of the product's state in real time.
Traceability	Use of digital technology within the whole production process and supply chain to verify the history or the location of raw materials, components, tools, end products, etc.

Use case	Description
Mass customization	Intelligent production processes that allow the production of custom outputs/products on a (very) large scale, based on digital technologies.
Predictive maintenance	Predictive maintenance allows upfront scheduling of maintenance services (based on analytics) to prevent unexpected equipment failures, thanks to automatic alerts gathering and triggering of incident tickets.
Digital quality control	Automatic adjustment of the production process based on sample specifications and the analysis of data collected by sensors to lower the number of defective products.
Smart intra-logistics	Sensor-controlled vehicles that act as autonomous delivery systems within a factory.
Products as a Service	Usage-based pricing model for products, which guarantees a dedicated service level.

Digital finance

The digitalization of processes in the financial services industry including the creation of new paradigms and services or enhancement of existing ones, by means of technologies such as real-time analytics, mobility, blockchain or artificial intelligence (AI).

Includes, among others, the following use cases:

Use case	Description
Usage-based insurance & payment (1-click insurance)	Usage-based insurance schemes, often referred to as "pay as you drive" (PAYD) or "pay how you drive" (PHYD), have already become popular among car manufacturers and car insurers. In general, contextual insurance makes use of pay-as-you-use or pay-how-you-use accounting models, based on sensors and environmental data. This approach will penetrate many further business and personal situations (e.g. households, health, leisure activities).
Trade finance	Sensor data-based trade finance processes can synchronize the flow of physical goods with related payment transactions. Depending on the location or the current status of the goods, the trading partners are paid. This is most relevant in international trading, where many parties are involved in transportation and payment processing. IoT solutions in trade finance will most likely be combined with distributed-ledger technologies (DLT), such as blockchain.

Use case	Description
Connected insurance	Insurance companies make use of sensors for prevention and surveillance purposes to minimize the risk of damage (caused e.g. by water or fire) or of disease (by means of fitness trackers). Drones and sensors can be used for property inspection in the case of damage claims.
Mobile payment & connected payment devices	In a mobile payment scheme, the payment process is usually performed via cellphone/smartphone and is based on contactless NFC technology. Future implementations will include connected vehicles and connected devices, equipped with embedded intelligence, such as smart tokens, so they can perform automated payments at charging stations, etc. Banks can leverage the IoT to manage their assets, such as ATMs, cash registers and cash boxes.

Digital government & smart cities

Ubiquitous and transparent integration of digital IT-based systems (mobile platforms, cloud computing and connectivity modules) to improve the operational efficiency across governmental agencies and administrative bodies and enhance the citizen and visitor experience by means of data-based information and services. Based on IoT networks and platforms that can collect, secure and combine data from other ecosystems, remote equipment and mobile devices.

Includes, among others, the following use cases:

Use case	Description
Smart administrative services	Use of digital technologies to enable online and mobile self-service for citizens and increase data availability for various administrative services (for example: tax, pensions, documents, etc.).
Digital law enforcement	Digital solutions designed for integrating multiple data streams and sources to enable streamlined operations of law enforcement services such as police, security services, etc.
Smart safety systems	IT solutions based on a diverse set of technologies and platforms including IoT, cloud, analytics, video surveillance, used for improving safety and security of indoor/outdoor public and private areas (parks, stations, shopping malls, etc.). Incl. also systems for police, fire fighters, homeland security, and military forces.
Smart parking infrastructure	On- and off-street parking concepts and infrastructure components (e.g. parking sensors) that monitor/scan available parking spaces.

Use case	Description
Smart urban infrastructure	Street lights, smart benches, smart info screens and displays equipped with connected sensors can enable both real-time data gathering and serve as a channel to provide urban data to citizens, such as weather data, local services data, transport data.
Digital campus services	Digital student services enabling quicker access to relevant data and campus-based services as well as digital cloud-based solutions for efficient student and asset management within the campus.
Smart environmental solution	IoT-based solutions consist of various types of sensors and connectivity modules and serve to monitor environmental pollutants or phenomena such as noise, air pollution, radiation, etc.
E-charging infrastructure	An e-charging infrastructure enables digital payment and shows available charging spaces in cities.
Smart traffic management	Connected traffic infrastructure that delivers actionable insights to optimize the flow of traffic.

Digital health

Digital health is the convergence of the digital revolution with health, healthcare, living and society. IoT-related technologies are used to improve access, reduce costs, increase quality and security, reduce inefficiencies in healthcare delivery and make medication more precise in combination with personalized genomics.

Includes, among others, the following use cases:

Use case	Description
Wellness & prevention (personal care/ health)	Solutions to monitor and analyze as much data as possible in order to detect or prevent an aggravation of the user's health (incl. digital patient record).
Telemedicine (incl. monitoring & home-assisted living)	Tools to aid in the development of, and compliance with, treatment plans to ensure all parties in the care process remain informed and engaged. Bedside or remote monitoring of the patient status.
Diagnostics	Digital solutions that help analyze data and contribute to medical diagnostics.

Use case	Description
Treatment/ medicine customization/ personalization	Tools (data-based, analytics, AI) that contribute to the design and delivery of personalized treatments.
Smart medical devices	Collection of biometric information to provide the best, safest and most dedicated usage possible.
Fleet management and predictive maintenance of medical devices	Gathering and analysis of captured data for fleet management (tracking) or forecasting of maintenance needs, with as few consequences as possible for user and patient.
Traceability & fraud	Solution to help monitor the traceability of "every thing" (devices, drugs, people) and avoid or detect as many fraud schemes as possible.

Digital telco, media & services

The digitalization of core customer services and respective industries as well as telco, media and digitalized business services as an integral part and enablers of cross-industry ecosystems.

Includes, among others, the following use cases:

Use case	Description
IoT service enablement	Platform-based solutions that allow telecom providers to offer IoT services enabled by mobile network connectivity (SIM cards). For telecom companies, these platform-based solutions can help generate new revenue streams.
Infrastructure management	IoT-based solutions that enable monitoring and management of network infrastructure, such as base stations and antennas for telecom providers, can render operations more efficient.

Use case	Description
Connected employee	Connected, IoT-enabled solutions for improving workforce mobility in the telecom and services industry, based on which operations can be optimized.

Smart energy & resources

Usage of IoT technologies and analytics (incl. artificial intelligence, AI) to develop or optimize end-to-end energy management systems and energy exploration (oil & mining) as well as to enable new business models for energy consumption.

Includes, among others, the following use cases:

Use case	Description
Smart metering & services	Deployment of intelligent measuring systems for energy consumption (and generation in case of renewable energies), allowing two-way communication and thus enabling real-time insight into power consumption (and generation) as well as new services such as differing tariffs, energy savings initiatives, smart home services, etc.
Smart grids/ intelligent network management	Provision, management and operation of intelligent energy transmission networks able to dynamically manage decentralized energy usage over time and space according to supply and demand. Includes advanced diagnostic features to analyze in real time the state of the network, enabling a higher efficiency of the overall grid operation. Digital technologies and platforms allow a consolidated view of the grid, combining and analyzing asset information, geographical location, financial data, weather info, etc. This enables complex analyzes that improve transmission and distribution network management, asset management (thus reducing asset risks) and allow for load balancing.

Use case	Description
Intelligent operation/ automation & predictive maintenance	The use of sensors and connectivity modules (RFID, WiFi, sensors, Bluetooth, etc.) as well as analytics to identify malfunctions and optimize maintenance by improving upfront scheduling of maintenance services and asset optimization.
Digital mining & exploration	Use of analytics, automation, IoT, cloud, mobile and collaboration in mining & exploration to improve operating efficiency, develop more accurate and agile exploration/transportation planning (from "pit to port"), and collaborate more effectively with business partners throughout the value chain.
Virtual power plants	Deployment of advanced software/platforms/ systems to connect distributed energy generators and energy storage units to become VPPs. Digital technologies are needed for optimization, control and secure communication purposes to ensure effective plant management and thus reliable power supply.

Smart home & buildings

Usage of technical systems and technology in buildings (home & institutional) to increase e.g. the quality of living/working, safety, energy efficiency based on connected and tele-controlled devices and installations as well as automated processes (heating, surveillance, domestic appliances, entertainment, etc.)

Includes, among others, the following use cases:

Use case	Description
Automation & predictive maintenance	Predictive maintenance allows upfront scheduling of maintenance services (based on analytics) to prevent unexpected equipment failures, thanks to automatic alerts gathering and the triggering of incident tickets. This also includes the exchange of information between the various service providers of the building.
Entertainment, smart equipment & connectivity	All intelligent equipment that can be found in a building/home that will ease/improve the user experience (intelligent parking, elevators, touch-screens, live information on traffic, etc.)
Facility management	Augmented reality becomes an important technology in facility management, as even un-trained workers, equipped with smart-phones, tablets or AR headsets, can zoom virtually into systems for maintenance and repair purposes.

Use case	Description
Security & control	Security cameras have been used for many years to monitor activity in buildings. With IoT technology such as pattern recognition software, an intelligent system can automatically detect anomalous patterns in the video data and immediately alert authorities of a possible intrusion. Advanced/intelligent access control systems with retina/fingerprint recognition, automatic fire detection (emergency management system).
Energy management	Thermostat and multiple sensors learn about user behavior and allow remote control to optimize energy consumption. Intelligent energy management systems can be used to automatically sense when a room is unoccupied or occupied and adjust heating/cooling and lighting as needed. There could also be a platform to manage bought and "built" energy (solar panels, garbage reprocessing, ...).
Connected appliances (lighting, cooking, cleaning)	Smart appliances utilize modern connectivity technology to make functions faster, cheaper and more energy-efficient. The appliances can take advantage of an energy "smart grid," implemented by utility companies nationwide.

Smart retail & CPG

Smart retail and CPG mean the implementation of digital devices, connectivity modules, hardware and software into products, stores and warehouses to improve customer experience, customer loyalty, customer retention, in-store operations and warehouse management.

Includes, among others, the following use cases:

Use case	Description	Use case	Description
Omni-channel sales, marketing & commerce	Integration of retail channels (online, in-store, mobile) to enable diverse retail experiences. For example, a simple reorder button can be provided through a connectivity module in CPG products. Or an in-store client can be guided to a product previously searched online.	AR/VR headsets	Headsets for a virtual or augmented product/service experience can make it possible to look at various products in store or even at home.
Smart services (CPG)	Integration of connectivity modules in CPG products to enable data collection on product usage and customer behavior via platforms or mobile apps connected with the product. This can be a new channel for the customer and enable new business models.	Smart tracking & tracing	The use of environmental sensors and connectivity modules (RFID, WiFi, beacons, Bluetooth, etc.) to detect movement, temperature, noise or to create heat maps can be used for the analysis of store operations. Furthermore, connectivity modules and accompanying software platforms can be used to improve stock localization and theft protection.
Customer self-service	In-store digital devices and apps help customers locate specific products, provide instant information on the items and offer self-service payment.	Smart delivery	Use of connected vehicles and connectivity modules to improve and optimize delivery and the customer experience. Deliveries can be tracked in real time and items can be delivered to various locations, including a customer's car trunk, or even by drones and robots.
Smart agents	Smart agents and devices used to automate shopping or customer support; examples include connected buttons (dashes) for home-based shopping, AI agents and chat bots for customer support, in-store robots for welcoming customers, providing product information and taking feedback.	Smart store furniture and items (shelves, mirrors, baskets, etc.)	Use of connected furniture or items can improve in-store customer experience and retail operations. Smart shelves notice when an item is picked up and can show product details on a display. Electronic shelf labeling is enabled by QR codes or NFC, which can be linked to mobile apps. Smart baskets detect the items placed in it and enable a self-checkout concept without cashiers. Digital mirrors enable digital clothes fitting.

Smart transport

Smart transport comprises applications which, without embodying intelligence as such, aim to provide innovative services relating to different modes of transport & traffic management, and enable various users to be better informed as well as to make safer, more coordinated and "smarter" use of transport networks.

Includes, among others, the following use cases:

Use case	Description	Use case	Description
Smart infrastructure & intelligent transport systems	Solutions based on connected assets such as video cameras, toll collection points, parking sensors, induction loops, displays, traffic signs as well as cloud-based platforms that integrate the collected data from these assets and provide actionable insights for optimization of the flows of traffic and people, indoor and outdoor.	Fleet management	Fleet management includes the provision of telematics data about commercial vehicles (cars, aircraft, ships, vans, trucks, rail cars) to enable better maintenance, tracking & tracing, fuel and consumption management, vehicle health management, as well as driver health and behavior management.
Smart agents and ticketing machines	Speech recognition voice assistants, AI agents and devices capable of providing customer support and intelligent ticketing services to passengers at places such as airports and train stations.	Mobility/Transport as a service (MaaS)	The use of digital and IoT solutions to enable innovative mobility services such as multi-modal ticketing solutions consists of multiple transport means such as public transport, bike, car and truck sharing concepts.
Smart deliveries and freight transport	Apart from providing data about the fleet of vehicles used, IoT-enabled solutions can be used for monitoring the condition of the transported assets/goods. Additionally, new ways of delivery can be introduced by means of drones or robots.	Connected operations	Operations of transport companies can be improved by using IoT- and telematics-based solutions such as real-time monitoring and predictive maintenance, which can be applied not only to their fleets but also their premises such as stations, airports and garages.

Technology Domains

Local intelligence

Activities associated with the enablement of data capturing, processing and response on local devices (things)				
Technology	Description	Hardware	Software	Services
1. Local intelligence				
1.1. Sensors	Sensors for temperature, pressure, humidity, gas, acceleration, gravity, vibration, sound, electrical fields, GPS	Physical sensors (analog, digital)	Virtual sensors	Infrastructure services
1.2. Actuators & chips	Electronic components, integrated circuits or monolithic integrated circuits on small plates of semiconductor material ("chips"), being able to receive and act based on information and commands	Actuators, integrated circuits (IC), microprocessors, storage, microcontrollers	Software on chip	Infrastructure services
1.3. Embedded systems	An embedded computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing requirements	Chipsets, control units	OS, middleware, tools	Application services, infrastructure services

Enterprise processes (1/2)

Activities associated with the connection of intelligent devices to the vertical IT layer (commercial, technical IT backend systems) within a company; enabling backend systems to understand machine data				
Technology	Description	Hardware	Software	Services
2. ERP	Extending existing ERP systems or developing new solutions in order to read, store and process machine data within corporate business processes	IT hardware (server, storage, network)	ERP applications	Application services, infrastructure services
3. Industry business solutions				
3.1. SCM	Connecting IT systems/ processes across different stakeholders within a horizontal supply chain including sourcing and trade processes	Industrial PCs, IT hardware, appliances	OS, middleware, tools, platforms, horizontal/ vertical business apps	Application services, infrastructure services
3.2. PLM	Extending existing PLM systems or developing new solutions in order to read, store and process machine data within corporate business processes; PLM solutions comprise applications that help create, design, visualize, simulate, provide, and manage product data over the entire product lifecycle.	IT hardware (server, storage, network)	PLM applications	Application services, infrastructure services
3.3. MES	Extending existing MES systems or developing new solutions in order to read, store and process machine data and make this data available for business decisions	IT hardware (server, storage, network)	MES applications	Application services, infrastructure services
3.4. SCADA	Custom-specific solutions for automating industrial production processes, energy production and distribution, medical backend systems and transportation	Industrial PCs, IT hardware, appliances	OS, middleware, tools, platforms, horizontal/ vertical business apps	Application services, infrastructure services
3.5. Industry-specific MIS	Industry-specific management information systems for dedicated purposes, or value-added services	IT hardware (server, storage, network)	Horizontal business applications/BI	Application services, infrastructure services

Enterprise processes (2/2)

Activities associated with the connection of intelligent devices to the vertical IT layer (commercial, technical IT backend systems) within a company; enabling backend systems to understand machine data				
Technology	Description	Hardware	Software	Services
4. Marketing, sales & commerce, CX				
4.1. Digital content & applications	Website and mobile app development platforms Web content management (WCM), web hosting, product information management (PIM), digital asset management (DAM)		SaaS, cloud platforms, software, tools	Strategy & technology consulting, implementation & integration, hosting, managed services, BPO
4.2. Digital sales & commerce	Omni-channel commerce platforms & suites including order management, fulfillment, digital payment solutions as well as sales & commerce analytics		SaaS, cloud platforms, software, tools	Strategy & technology consulting, implementation & integration, hosting, managed devices, BPO
4.3. Digital marketing	Platforms & suites for marketing automation & marketing process management including marketing & social media analytics as well as multi-channel campaign management		SaaS, cloud platforms, software, tools	Strategy & technology consulting, implementation & integration, hosting, managed services, BPO
4.4. Customer experience integration platforms	Integrated customer experience, omni-channel content & customer service, commerce, marketing, and analytics platforms & portals		SaaS, cloud platforms, software, tools	Strategy & technology consulting, implementation & integration, hosting, managed services, BPO

Horizontal integration (1/2)

Activities associated with the horizontal integration of local (intelligent) devices and backend systems within one or multiple organizations				
Technology	Description	Hardware	Software	Services
5. Analytics	Aggregating, storing and analyzing data (from machines, humans, other systems) in order to gain business insights	IT hardware (server, storage, network)	Horizontal business applications/BI	Application services, infrastructure services
6. Machine data cloud platform	Providing a cloud-based infrastructure platform between sensors/embedded systems and backend systems for connectivity, data integration and storage	IT hardware (server, storage, network)	Virtualization engines & environment, cloud/laaS platforms	Cloud integration, operation
7. Artificial intelligence	Artificial intelligence (AI) is the combined use of algorithms, knowledge bases (big data sets), and neural networks/deep learning techniques to mimic and complement human abilities in a variety of domains.	Industrial PCs, IT hardware, appliances	OS, middleware, tools	Application services, infrastructure services
8. IT security				
8.1. Data (content) security	Security measures including encryption, cryptography & digital signature solutions, public key infrastructure solutions, digital rights mgmt. solutions, content filtering & anti-spam, data loss/leak prevention, secure data deletion, secure archiving as well as data recovery solutions	IT hardware (server, storage, network)	Middleware, tools, platforms	Application services, infrastructure services
8.2. Applications security	Includes application security design, coding development and testing	IT hardware (server, storage, network)	Middleware, tools, platforms	Application services
8.3. Infrastructure (network) security	Includes system & network security software (firewalls, antivirus, intrusion detection, tracking and tracing), terminal security (fixed or mobile) solutions & endpoint hardening solutions, vulnerability scanners as well as secure communications: email, phone, video conferencing & messaging systems	IT hardware (server, storage, network), telecom hardware	OS, middleware, tools, platforms, applications	Application services, infrastructure services

Horizontal integration (2/2)

Activities associated with the horizontal integration of local (intelligent) devices and backend systems within one or multiple organizations				
Technology	Description	Hardware	Software	Services
9. Mobility	Mobile workplace (incl. apps for the mobilization of the workplace e.g. e-mail or office applications); mobile process apps (e.g. mobile ERP, CRM, SCM or BI, including mobile app development), mobile device & apps management (incl. middleware for remote mgmt and security of mobile devices and apps); focus on human-to-machine (or human-to-human)	IT hardware (server, storage, network), telecom hardware	OS, middleware, tools, platforms, mobile business apps	Application services, infrastructure services
10. M2M connectivity	connectivity enablement, operation, SIM card integration; focus on machine-to-machine	IT hardware (server, storage, network), telecom hardware	OS, middleware, tools, platforms	Application services, infrastructure services, telecom service
11. Human-machine interaction				
11.1. UCC	Design of workstream collaboration platforms, including voice and messaging infrastructure as well as collaboration and unified communications tools and apps	IT hardware (server, storage, network), telecom hardware	Applications, middleware, tools, platforms	Application services, infrastructure services, consulting & systems integration
11.2. Interfaces	Design and implementation of human-machine interfaces; machine data extraction interfaces	Panels, exchange interfaces	OS, middleware, tools, platforms	Consulting & systems integration
11.3. I/O design	Design of new I/O concepts (e.g. augmented reality, cognitive control)	n/a	Tools, platforms	Consulting & systems integration
11.4. Roles & processes	Design and implementation of new business processes associated with IoT technologies / adjustment of existing business processes to new IoT-based opportunities	n/a	Tools, platforms, applications	Consulting, training

8. ABOUT TEKNOLOGY GROUP

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