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shaping tomorrow with you

Management Information Systems (37C00100)

Department of Information and Service Management

March 19th, 2019, Aalto University School of Business, Espoo Finland

ERP and Business Applications [Enterprise Applications]

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Fujitsu

A global Japanese ICT company

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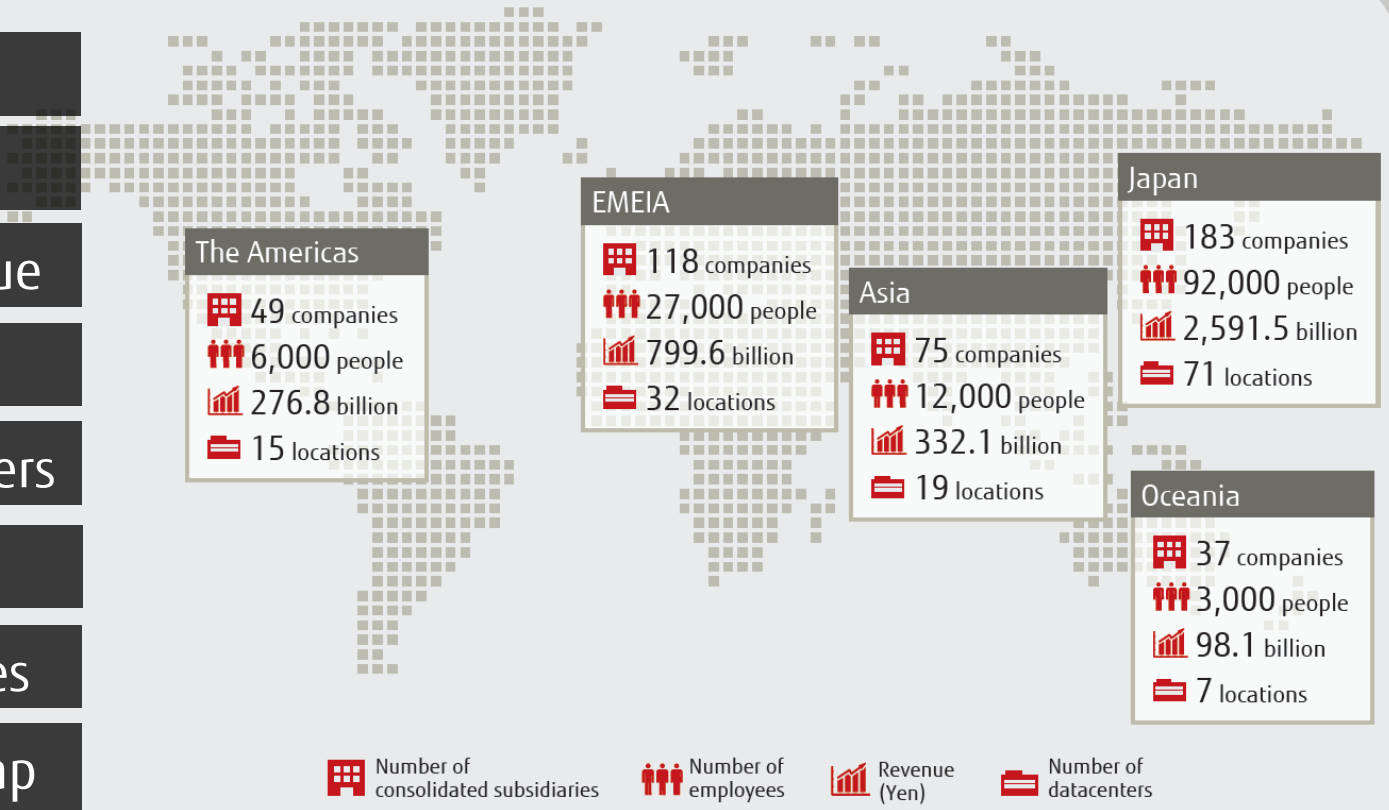
1935	Founded
100	Countries
39	B$ revenue
2	B$ R&D
1,400	Researchers
78,000	Patents
140,000	Employees
14B$	Market cap



Responsible technology

Dow Jones Sustainability World Index
1999–2010, 2012– Present

The UN Global Compact 100
2013– Present

FTSE4Good Index Series
2002– Present

The Carbon Performance & Disclosure
Leadership Index, 2012– Present

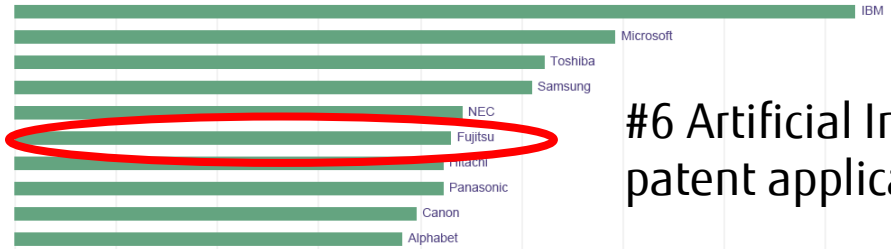
Fortune Worlds Most Admired Companies
2013– Present

IFI CLAIMS Ultimate Patent Owners Dec 31st 2018*

1	Samsung Electronics Co Ltd
3	International Business Machines Corp
4	General Electric Co
7	Siemens AG
8	Microsoft Corp
9	Intel Corp
11	Nokia Oyj
13	Alphabet Inc
15	**Fujitsu Ltd**
18	Toyota Motor Corp
23	Telefonaktiebolaget LM Ericsson AB
31	Oracle Corp
32	HP Inc
35	Apple Inc
40	Huawei Investment and Holding Co Ltd
44	Cisco Systems Inc

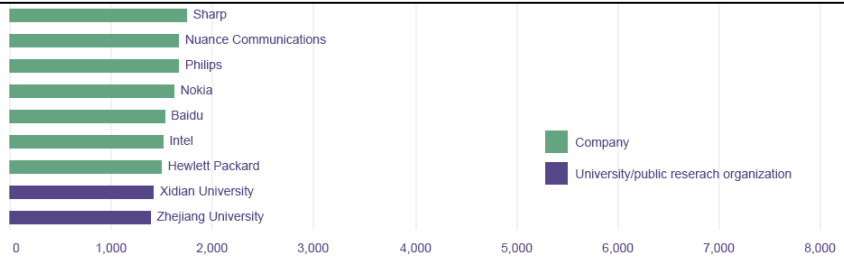
*) World's largest active patent holders, including subsidiaries, by Active Families

Cutting-edge research



#6 Artificial Intelligence patent applicant in the world

	Transportation	Personal devices, computing and HCI	Telecommunications	Document management and publishing	Life and medical sciences	Security	Business	Industry and manufacturing	Physical sciences and engineering	Energy management	Arts and humanities	Networks	Education	Cartography	Entertainment	Computing in government
Fujitsu	299	200	253	326	401	351	173	110	55	25	73	54	66	8	22	34



Source: World Intellectual Property Organization, Technology Trends 2019, Artificial Intelligence

Quantum-Inspired Computing (Digital Annealer)

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Quantum-inspired technology solving real world combinatory optimization problems:
minimum time, minimum risk, maximum throughput, maximum earnings,...

Quadratic
Unconstrained
Binary
Optimization

$$E(X) = \sum_{i=1}^{N} b_i x_i + \sum_{i=1}^{N} \sum_{j=1}^{i-1} w_{ij} x_i x_j$$

for a binary vector $X=(x_1,x_2, \ldots x_N) \in \{0,1\}^N$
and coefficients $b_i \in \mathbb{R}$, $w_{ij} \in \mathbb{R} (i,j=1,\ldots N)$,
find $X_{min} \in \{0,1\}^N$ with $E(X_{min}) \leq E(X)$ for all $X \in \{0,1\}^N$

Portfolio optimization

Traffic optimization

Grid optimization

Process optimization

Cancer treatment

Drug molecule mathing

Malacca Strait: 1,500 ships travel along it every day

Fujitsu in Finland

HEAD OFFICE HELSINKI

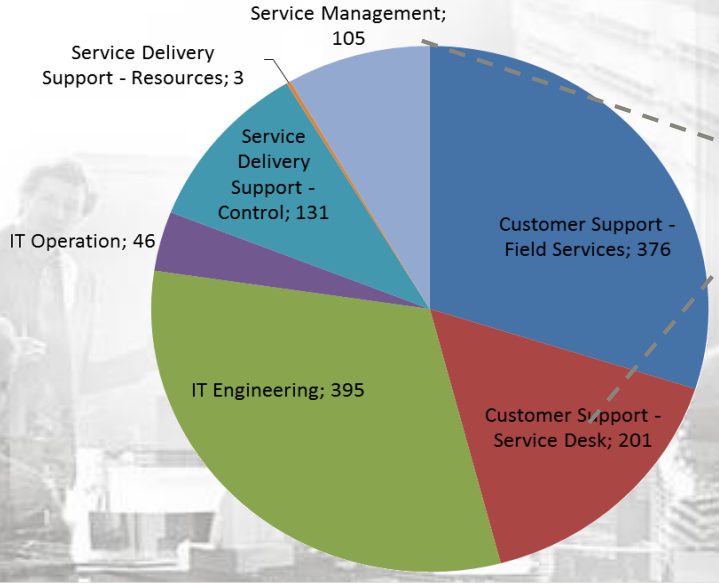
LOCATIONS 24

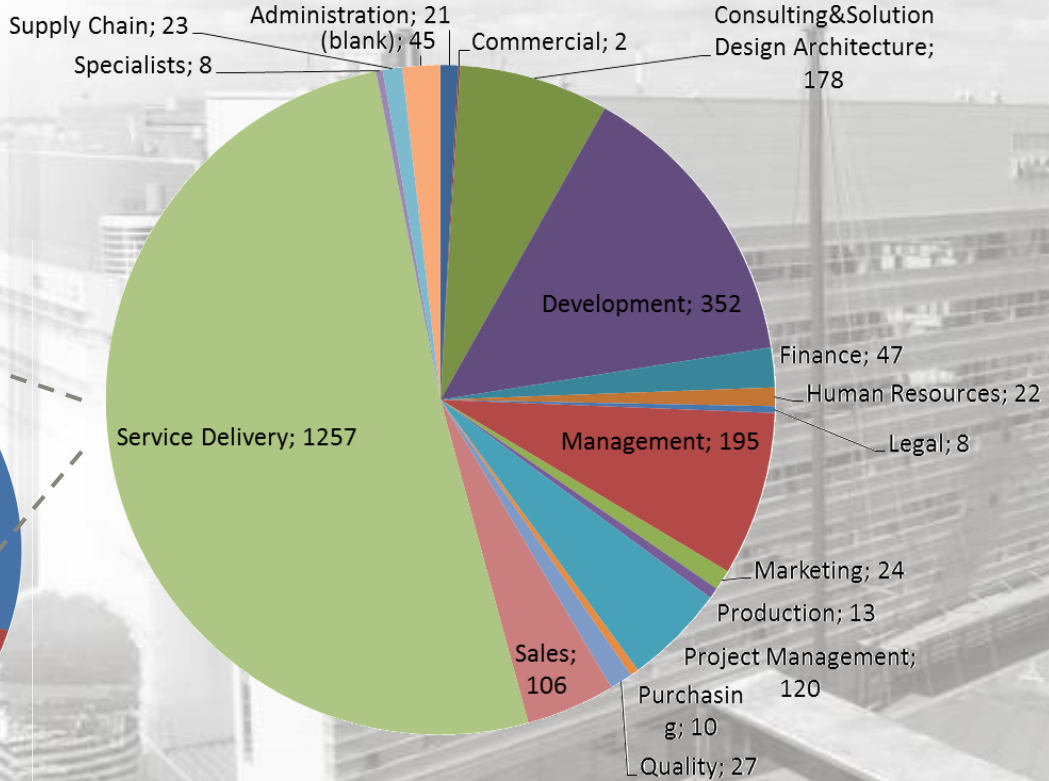
REVENUE €420M

EMPLOYEES 2,300

50 years of Finnish IT history
(Nokia Information Systems, Datasaab-Valmet, Dava, Nokia Data, ICL Data, Fujitsu Siemens Computers, ICL Invia, Nice, Isoworks, Fujitsu Technology Solutions)

Skills we are looking for...





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Introduction to ERP and Business Applications

ERP, CRM, SCM, HRM, BI, FRM, SRM, MRP, PLM, MES, BI/BA, POS, CMS, BPM,...

Essential to the core of a business

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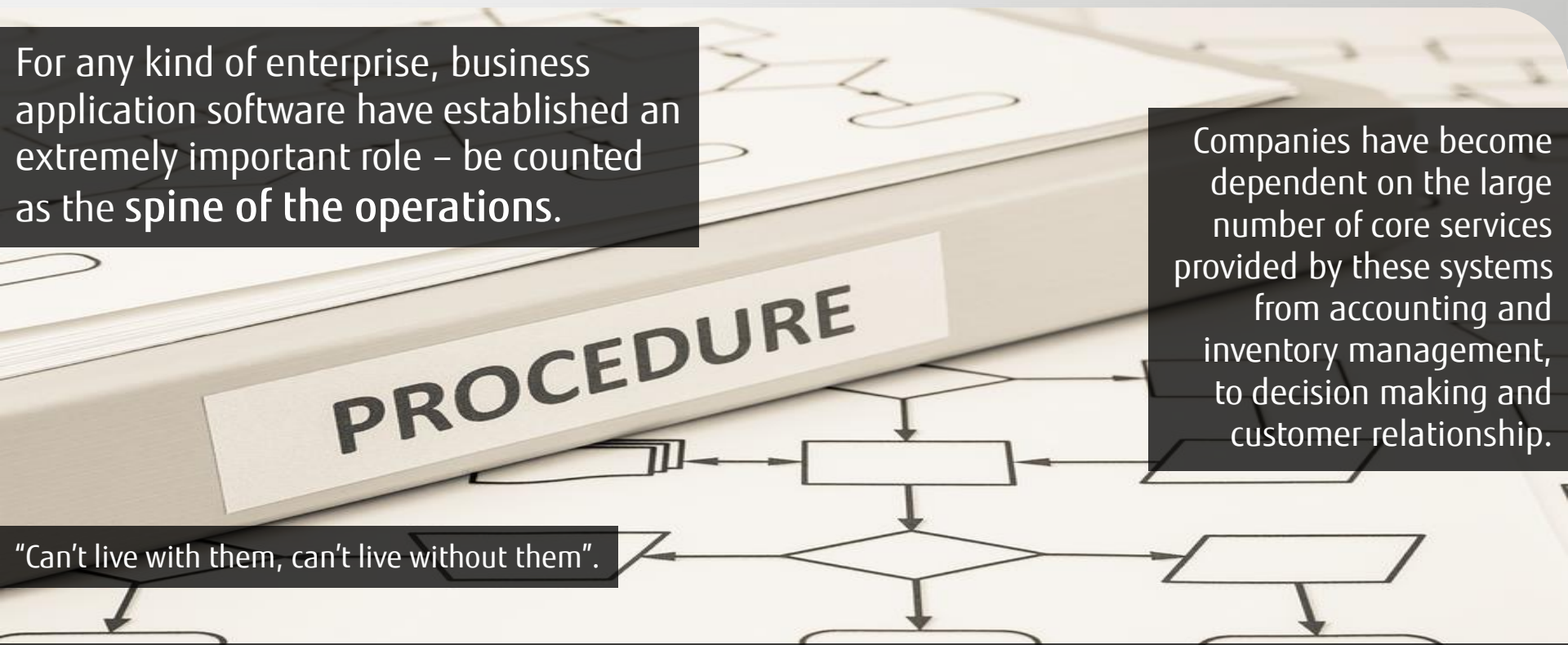

For any kind of enterprise, business application software have established an extremely important role – be counted as the **spine of the operations**.

Companies have become dependent on the large number of core services provided by these systems from accounting and inventory management, to decision making and customer relationship.

"Can't live with them, can't live without them".

Business processes are collections of standard operating procedures on commercial apps

Learning objectives

Identify and give examples to illustrate the following aspects of customer relationship management, enterprise resource management, and supply chain management systems:

Business processes supported
Customer and business value provided
Potential challenges and trends

By the end you hopefully….

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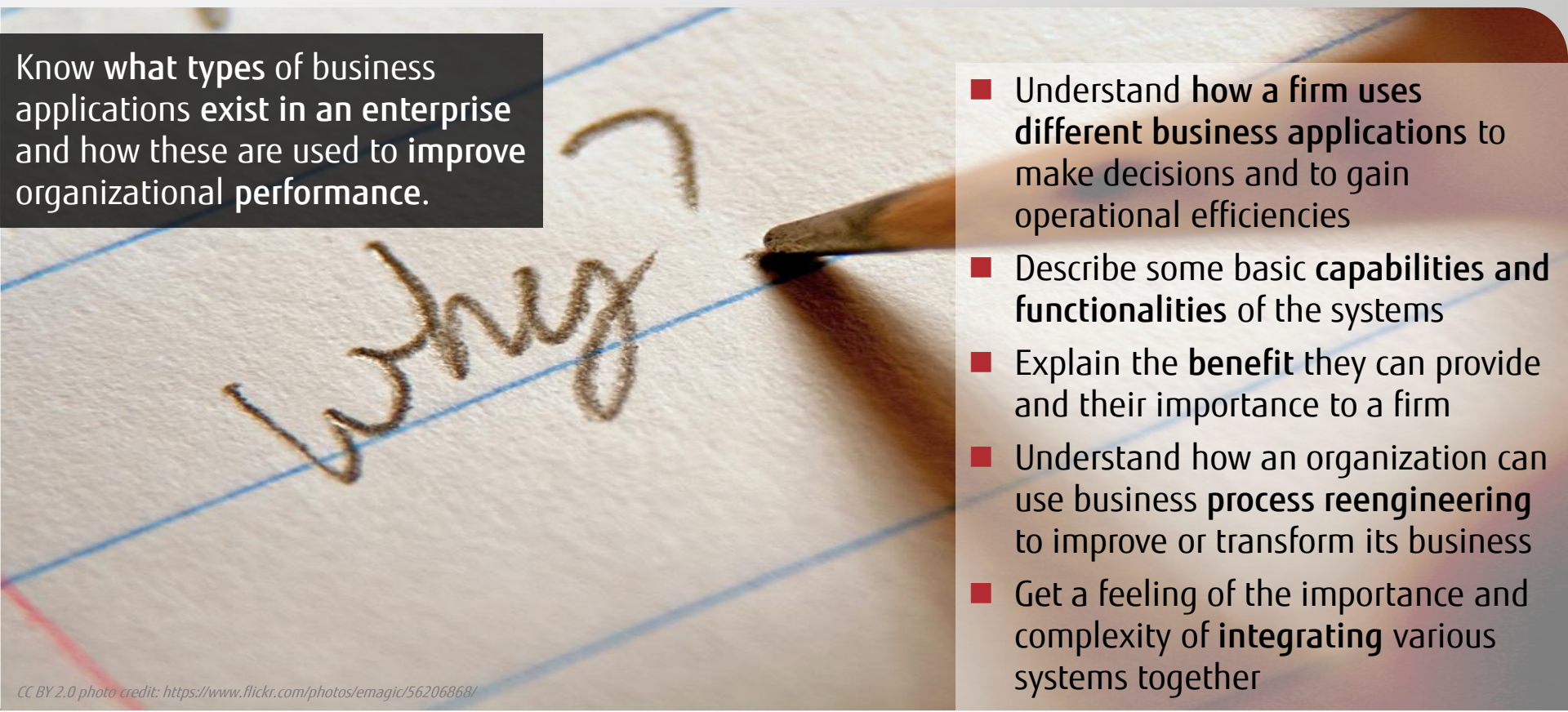

Know **what types** of business applications **exist in an enterprise** and how these are used to **improve** organizational **performance**.

- Understand **how a firm uses different business applications** to make decisions and to gain operational efficiencies
- Describe some basic **capabilities and functionalities** of the systems
- Explain the **benefit** they can provide and their importance to a firm
- Understand how an organization can use business **process reengineering** to improve or transform its business
- Get a feeling of the importance and complexity of **integrating** various systems together

To get your “school of business” attention…

Global spending expected to reach $575B by 2024

Worldwide Enterprise Software Revenue 2010-2017 ($M)

Consulting
Implementations
Licensing
Roll-outs
Upgrades
Enhancements
Support
Modernization
Customization
Integration
Extensions
Testing
Healthchecks
Migrations
Consolidation
Assessment
Development
Management
Maintenance

Continuous annual growth despite overall economic market conditions

Example: SAP

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Financials

- Basic cost accounting
- Budget management
- Banking and reconciliation
- Multicurrency support

Sales

- Quotation and order processing
- Invoicing, payment, delivery
- Returns and crediting
- Sales and pipeline forecasting

Warehousing

- Stock transfers
- Inventory valuation
- Picking, packing, delivery
- Serial and lot management

CRM

- Opportunities and pipelines
- Contacts and activities
- Warranty and service contracts
- Service calls

Operations

- Reporting and analytics
- Workflow-based alerts
- Employee data management

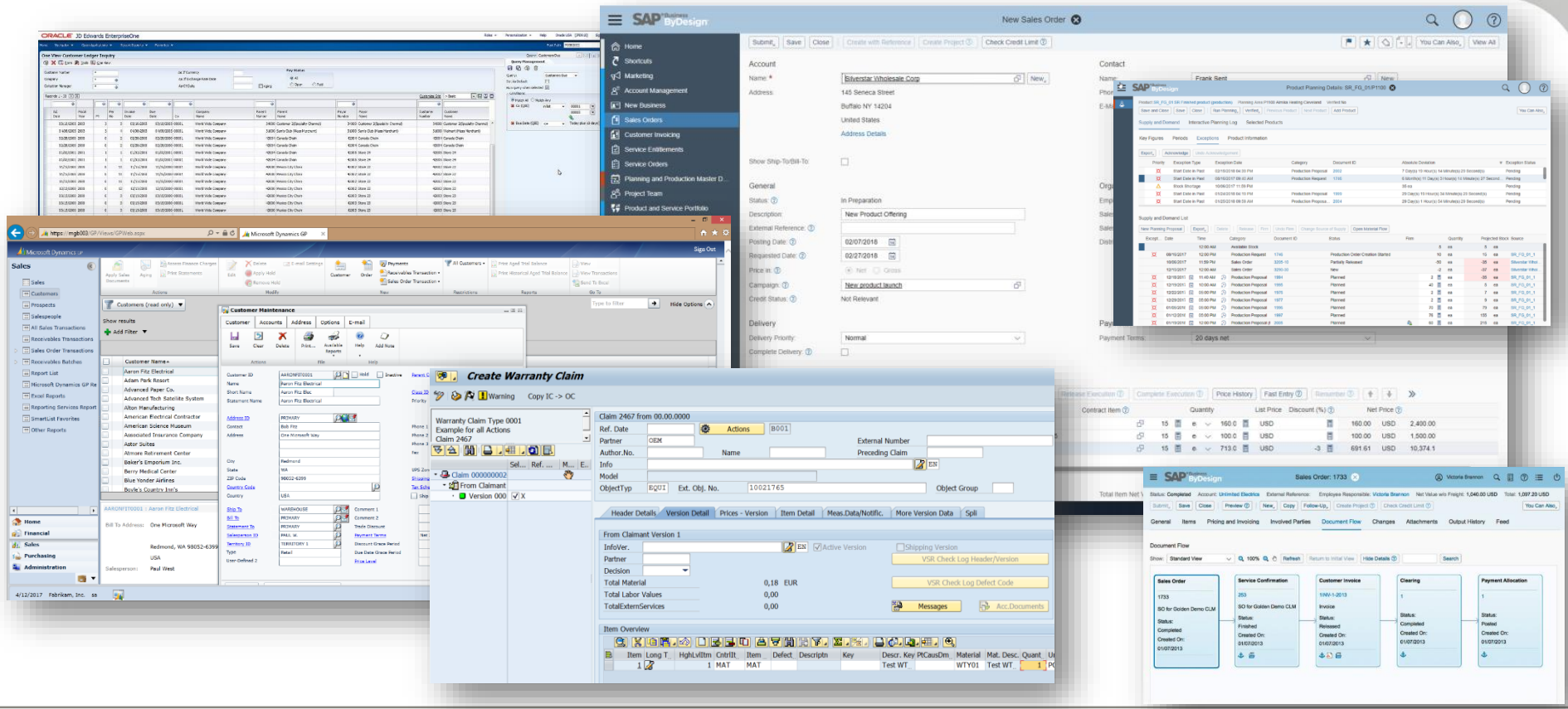
Production

- Bills of materials
- Production orders
- Forecasting and MRP

Purchasing

- Quotation and order processing
- Invoicing, payment, delivery
- Returns and crediting
- Purchasing forecasting

What do they really look like?



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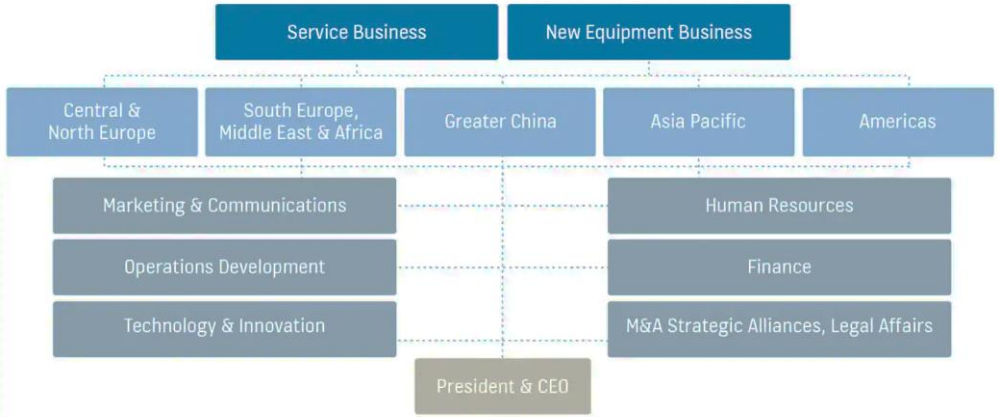
Business context and process reengineering

Organization charts and business processes



Analytics	Strategic Enterprise Management	Financial Analytics	Operations Analytics	Workforce Analytics
Financials	Financial Supply Chain Management	Financial Accounting	Management Accounting	Corporate Governance
Human Capital Management	Talent Management	Workforce Process Management	Workforce Deployment	
Procurement and Logistics Execution	Procurement	Supplier Collaboration	Inventory and Warehouse Management	Inbound and Outbound Logistics	Transportation Management
Product Development and Manufacturing	Production Planning	Manufacturing Execution	Enterprise Asset Management	Product Development	Life-Cycle Data Management
Sales and Services	Sales Order Management	Aftermarket Sales and Service	Professional Service Delivery	Global Trade Services	Incentive and Commission Management
Corporate Services	Real Estate Management	Project Portfolio Management	Travel Management	Environment, Health, and Safety	Quality Management

Organization (roles)

Top-down structure focused on operational and functional areas to configure & manage resources

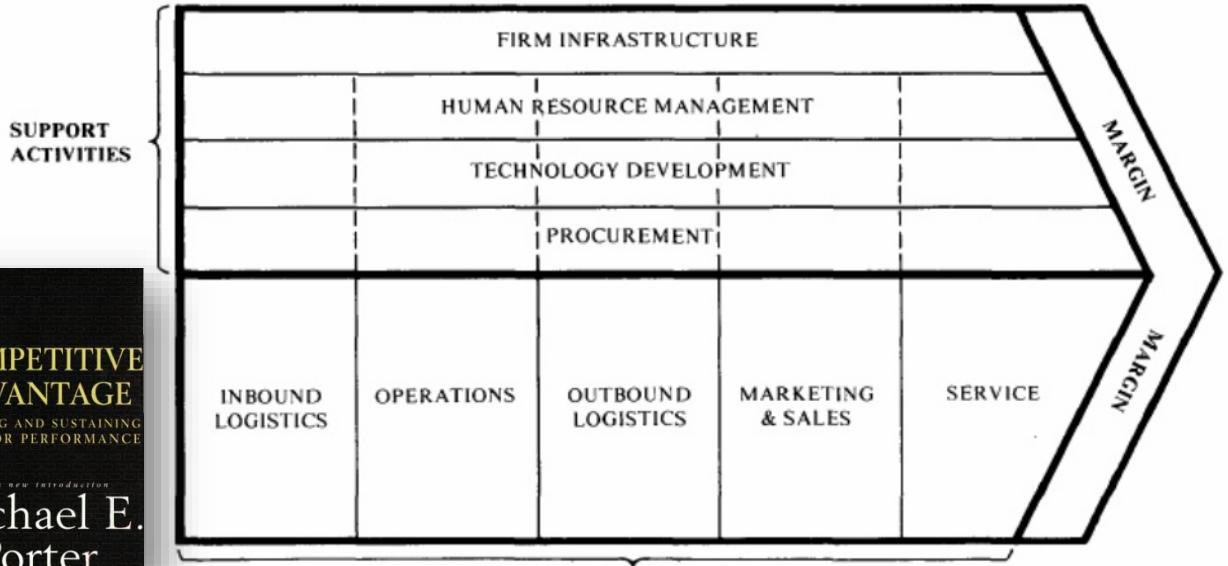
Responsibilities (processes)

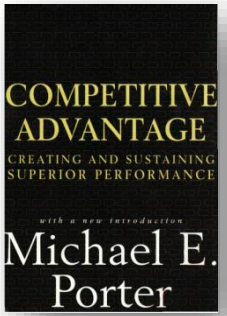
Workflows & activities focused on end-to-end accomplishments that cut org boundaries

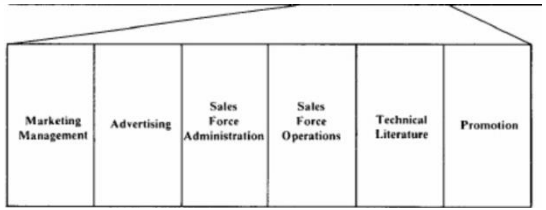
What type of information systems would meet the unique needs and objectives of the organizations and their processes?

manage performance, lower costs, reduce risks, improve predictability, create transparency, enhance consistency, optimize tasks, provide insight, support decisions,...

Porter's value chain





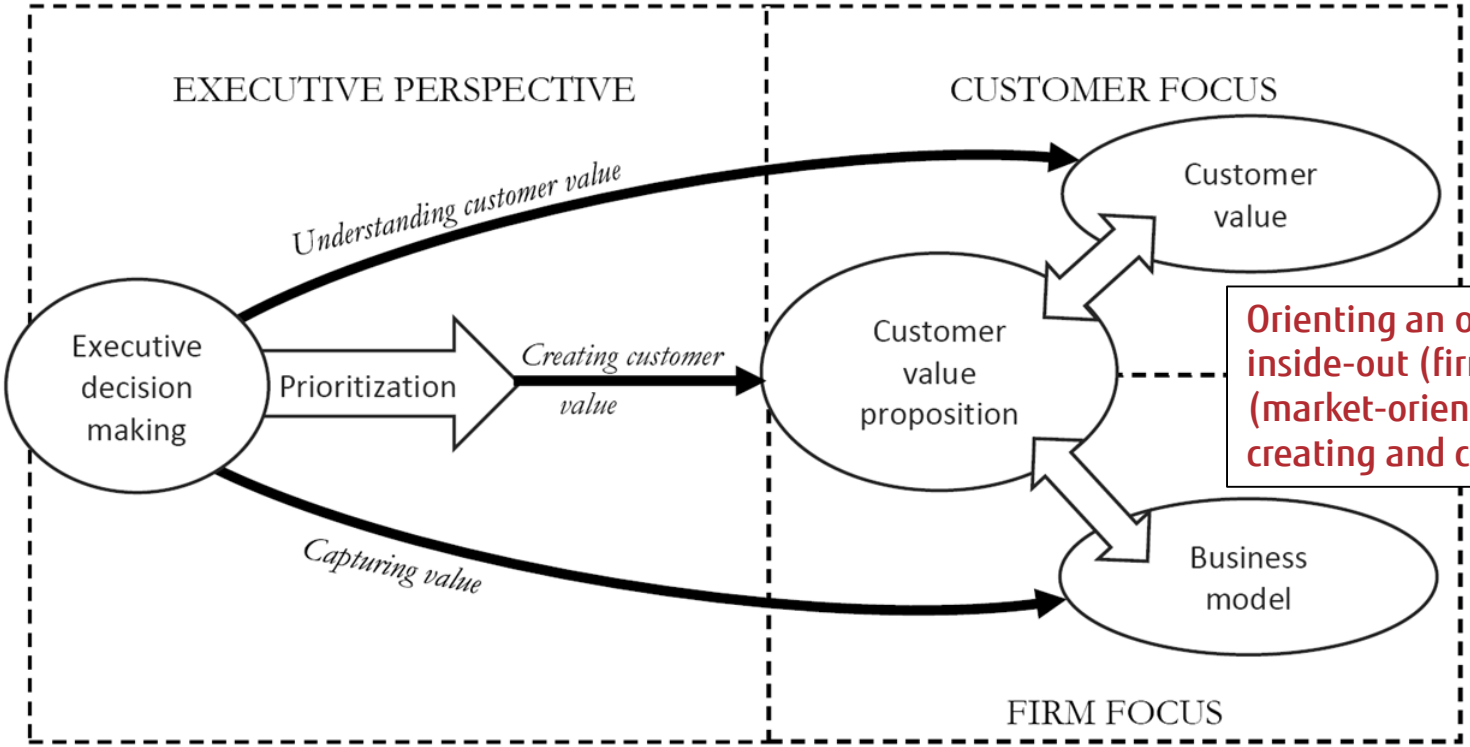


Porter, Michael E., "Competitive Advantage", 1985, Ch. 2, pp 37-46.

Core business processes – such as sales and operations – are linked directly to **external customers** and their values

They control and provide resources to the "core", and structure interactions among organization units and partners, to meet marketplace demands on day to day basis.

Customer value framework



Orienting an organization from inside-out (firm-oriented) to outside-in (market-oriented) by understanding, creating and capturing value.

Picture from Mika Yrjölä's Acedemic Dissertation 2015: Departures to Executive Decision Making in Omni-Channel Retailing (School of Management of the University of Tampere)

Example: bike sharing company (a simple service)

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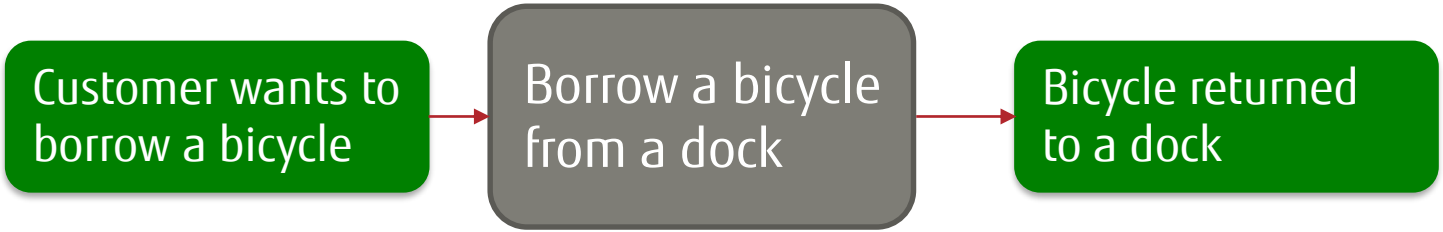

Simple & easy value chain to understand, create and capture value.

Simple & easy? Bike-sharing firms in China

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Case exercise: car rental company

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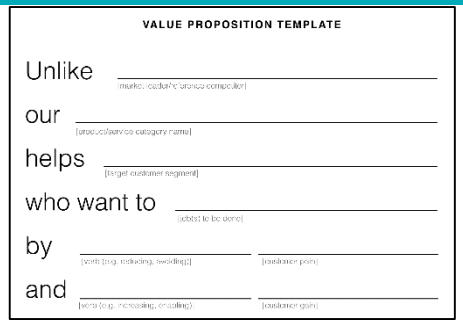
Customer requests to rent a car → Rent a car from shop → Car returned and paid for

Think about it yourself….

What would you do to make it work?

Not just work but provide customers with a quality service, efficiently, with several market differentiating elements that beat
Avis, Sixt, Budget, Hertz, National,…

Focus on understanding the experience that the customer wants delivered.



From value stream to processes & interactions

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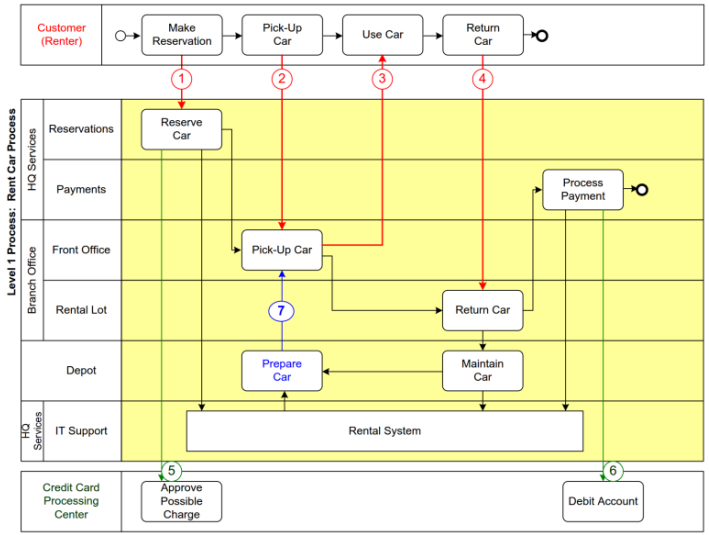
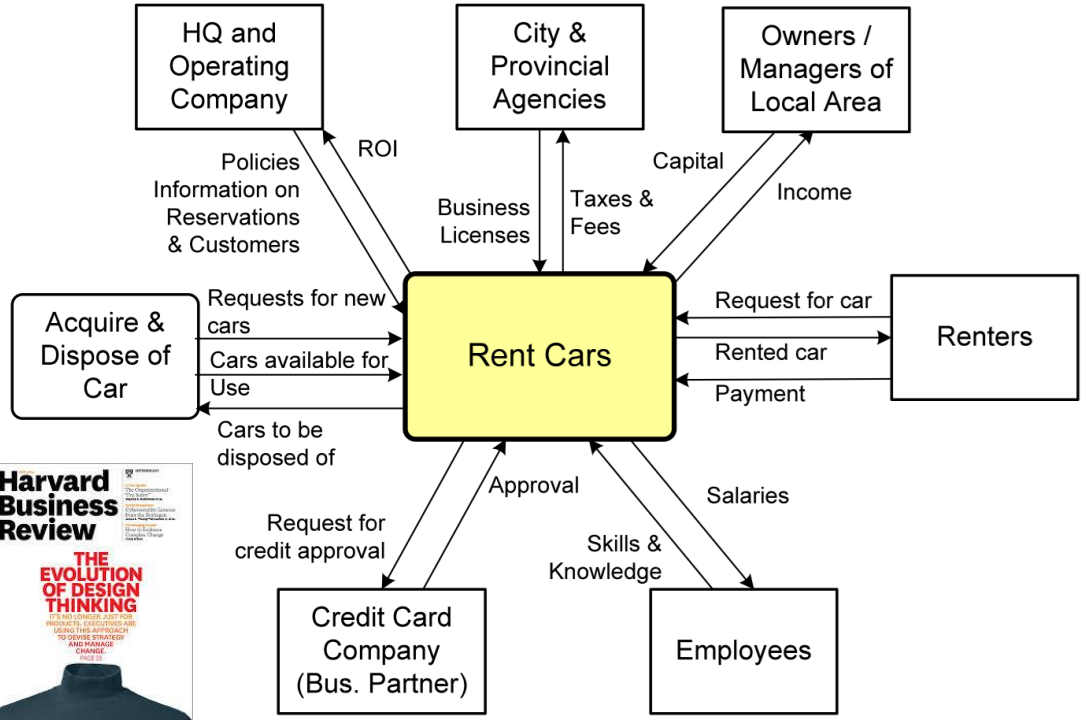
Core process



Several support processes



Every part of the business has its own viewpoint

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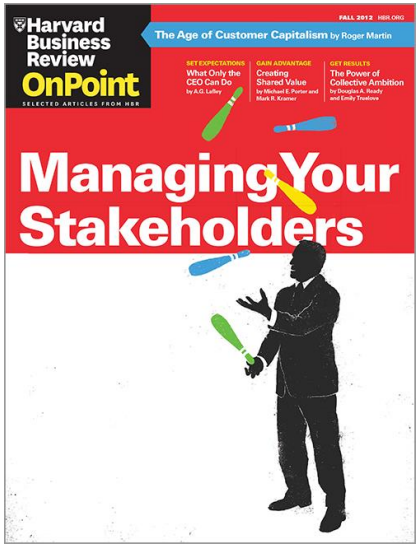
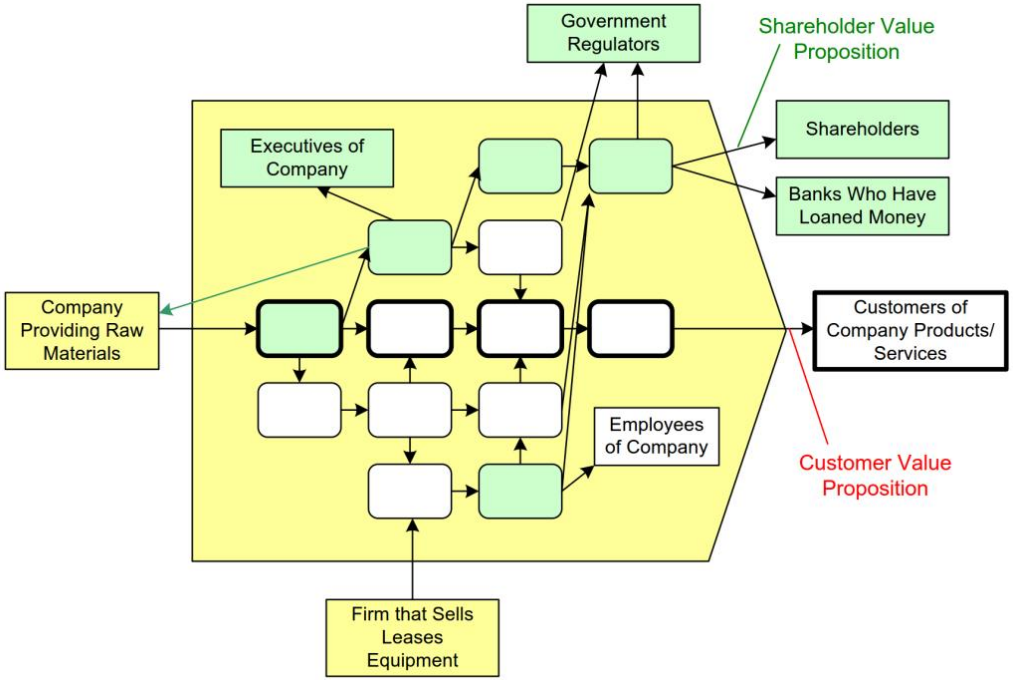
Level 1 Process: Rent Car	Possible Level 1 Process Measures
Financial Perspective	**Customer Perspective**
• Cash flow • Quarterly sales growth & operating income by division • Increased market share and ROI • Share price • Credit rating	• Customer satisfaction • Percent of sales from new products • On-time delivery (defined by customer) • Share of key accounts' purchases • Ranking by key accounts • Number of partnership efforts • Quality ratings of products /service • Price of product
Internal Business Process Perspective	**Innovation & Learning Perspective**
• Manufacturing cost, Unit cost • Cycle time, Wait time, Yield • Wastage, Scrap, Spoilage, Returns • Ratios of resources / time • Actual introduction schedule vs. plan • Consistency /Quality of product /service	• Time to develop next generation • Process time to maturity • Percent of products that equal 80% sales • New product introduction vs. competition • Time /cost to change to new line or model • Ability to handle non-standard orders • Workforce capability



Processes are more complex than value chains



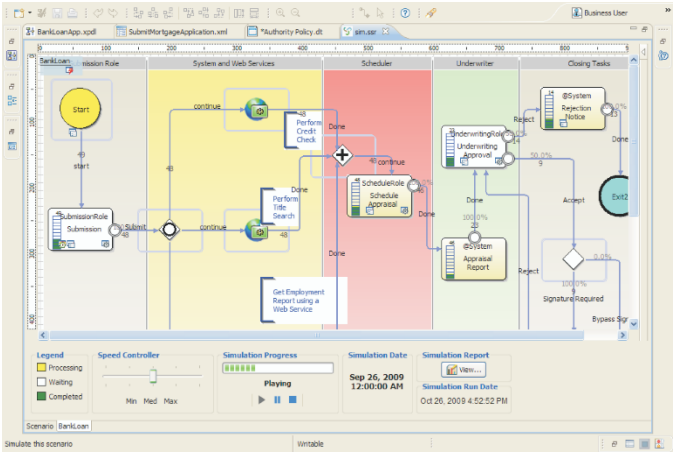
- How processes create value isn't as easy as early practitioners thought it might be – especially as most firms have shifted from producing products to providing services
- The ultimate customer, as important as he or she is, is only one stakeholder and that **several different stakeholders need to receive value if a process is to succeed**

Processes are (can be) important

- Business differentiation (competitive advantage)
- Financial pressures (reduced costs, increased output, consistent quality)

The context of business processes

- **How we do what we do**
  - Delivers a product or service to an external stakeholder or internal process
- Triggered by an **external business event**
  - Comprised of all the activities necessary to provide the appropriate business outcomes in response to the triggering business events
  - Contains activities which usually cross functions and often organizational units (processes connect to other processes)
- Transforms **inputs of all types into outputs**
  - According to guidance (policies, standards, procedures, rules etc.)
  - Employing reusable resources of all types
- Has performance indicators for which measurable objectives can be set and actual performance evaluated



Business Process Management (BPM) software helps firms manage business change through continuous process visualization and optimization.

Think about processes as value streams

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Core:

- Insight to Strategy — Vision to Plan — Financial Close to Reporting
- Market to Business — Initiative to Results — Relationship to Partnership
- Concept to Development — Idea to Product — Acquisition to Obsolescence
- Manufacturing to Distribution — Demand to Stock
- Request to Service — Order to Delivery — Order to Cash
- Prospect to Customer — Lead to Cash, Quote to Cash

Support:

- Finance & Accounting
- Human Resources
- Purchasing
- Infrastructure Management

- Automate and integrate processes
- Share common data and practices
- Produce and access real-time information
- Enter, process, monitor and report on all business transactions
- Re-engineer business processes

End-to-end collection of activities that creates a result for a customer

Distinguish between core and support processes

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Core processes

= direct value impact on business model

- Strategy and planning
- Marketing
- Product development
- Production
- Order processing
- Supply

"Functional business systems", when integrated then "enterprise systems"

Support processes

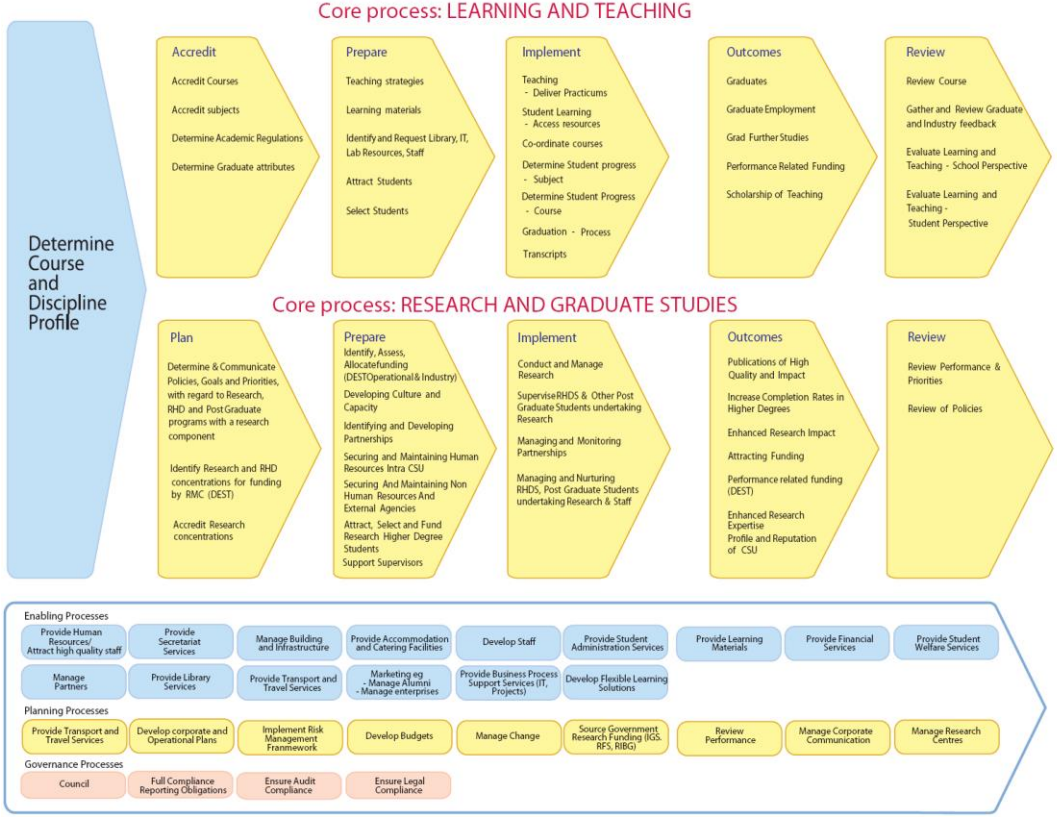
= activities critical to overall performance

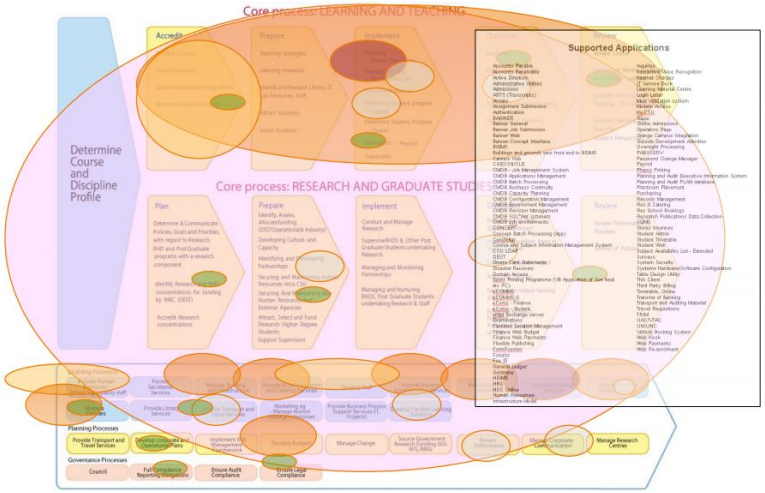
- Invoicing and accounting
- Personnel development
- Industrial process control
- Purchasing
- Relations management
- Workgroup collaboration
- Infrastructure management

What's support for one can be core for another

In traditional firms these activities tend to be isolated from one another, and information does not flow seamlessly from one end of the organization to the other. Efficiency and business value tend to suffer greatly.

Studying is the same thing

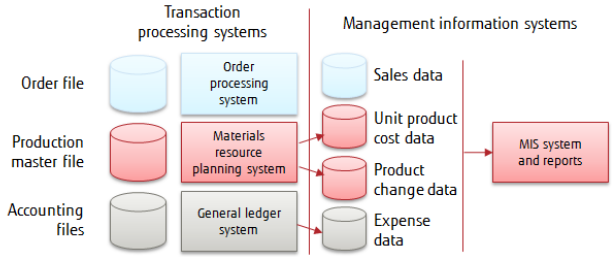




Transactional & analytical needs

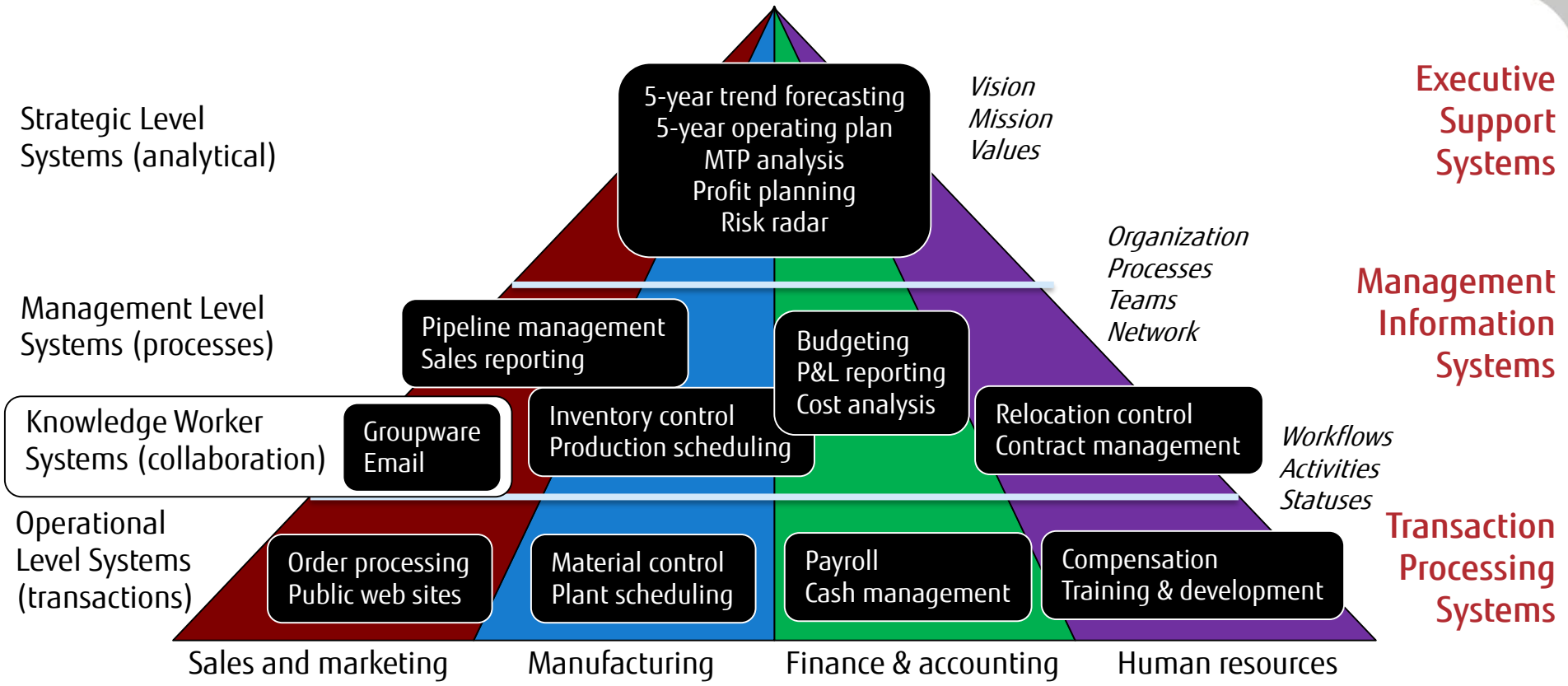
- **Transactional**: all of the information contained **within a single business process or unit of work**, and its primary purpose is to support performing of **daily operational tasks**
  - Facilitates daily routine transactions necessary to the conduct of the business and captures and stores data associated with the transaction
    - Purchasing stocks, making an airline reservation, or withdrawing cash from an ATM
  - Organizations use transactional information when performing operational tasks and repetitive decisions
    - Analyzing daily sales reports to determine how much inventory to carry

- **Analytical**: all organizational information, to **support managerial analysis**
  - Includes transactional information along with other information such as market and industry information
    - Trends, sales, product statistics, growth projections
  - Managers use analytical information when making important ad hoc decisions
    - Whether the organization should build a new manufacturing plant or hire additional sales personnel



Hierarchy of process systems

[and how strongly organization charts have influenced them]



That is the role of business applications

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Organizations utilize various types of information systems to **help run their daily operations**.

Business model
Operating model
Value chain model
Marketing model
Sales model
Distribution model
Revenue/profit logic

- These systems are primarily **transactional systems** that concentrate on the management and **flow of low-level data items** pertaining to basic business processes such as manufacturing and order delivery
- This data is often rolled-up and **summarized** into higher-level **decision support systems** to help firms understand what is happening in their organizations and how best to respond

To manage a business, to run a business, to support a business

There are business apps for all areas of a business

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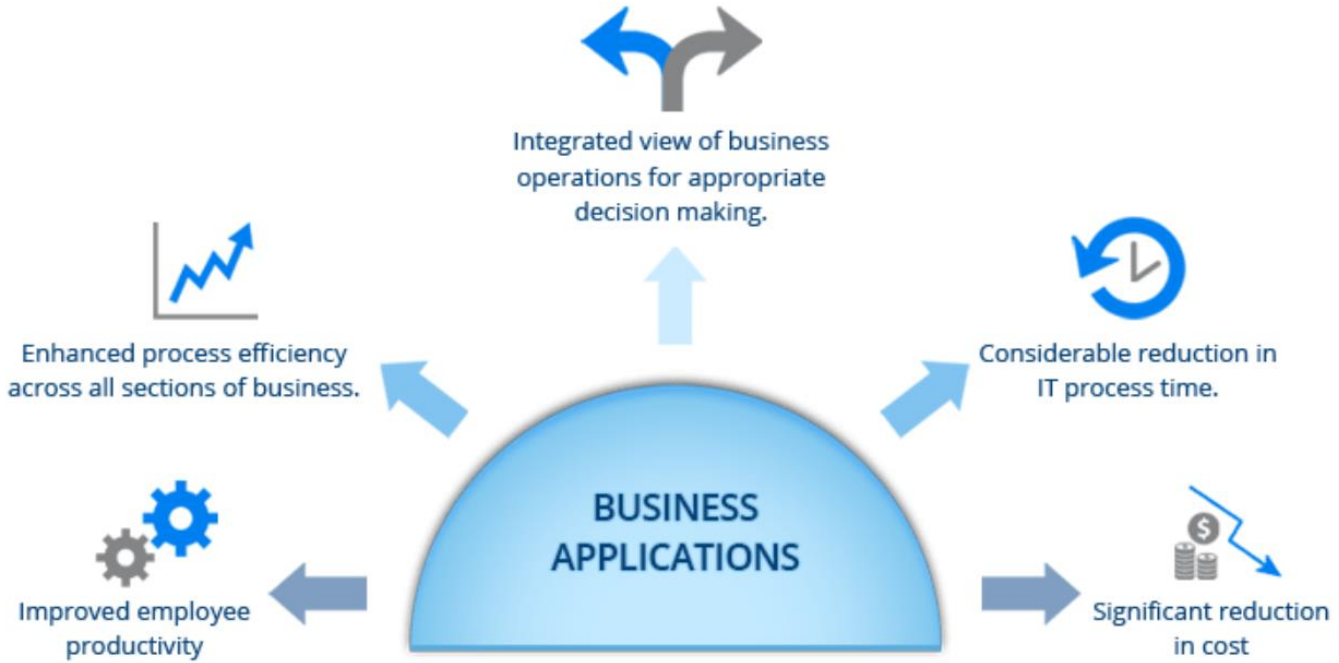
Customer relationship mgmt
Product data mgmt
Supply chain mgmt
Financial accounting and mgmt
Human resource/capital mgmt
Business intelligence
Material resources planning
Enterprise resource planning
Supplier relationship mgmt
Production planning
Decision support systems
Executive information systems
Data mining systems
Artificial intelligence
Product lifecycle mgmt
Knowledge mgmt
Enterprise content mgmt
Case mgmt
Collaboration and communication

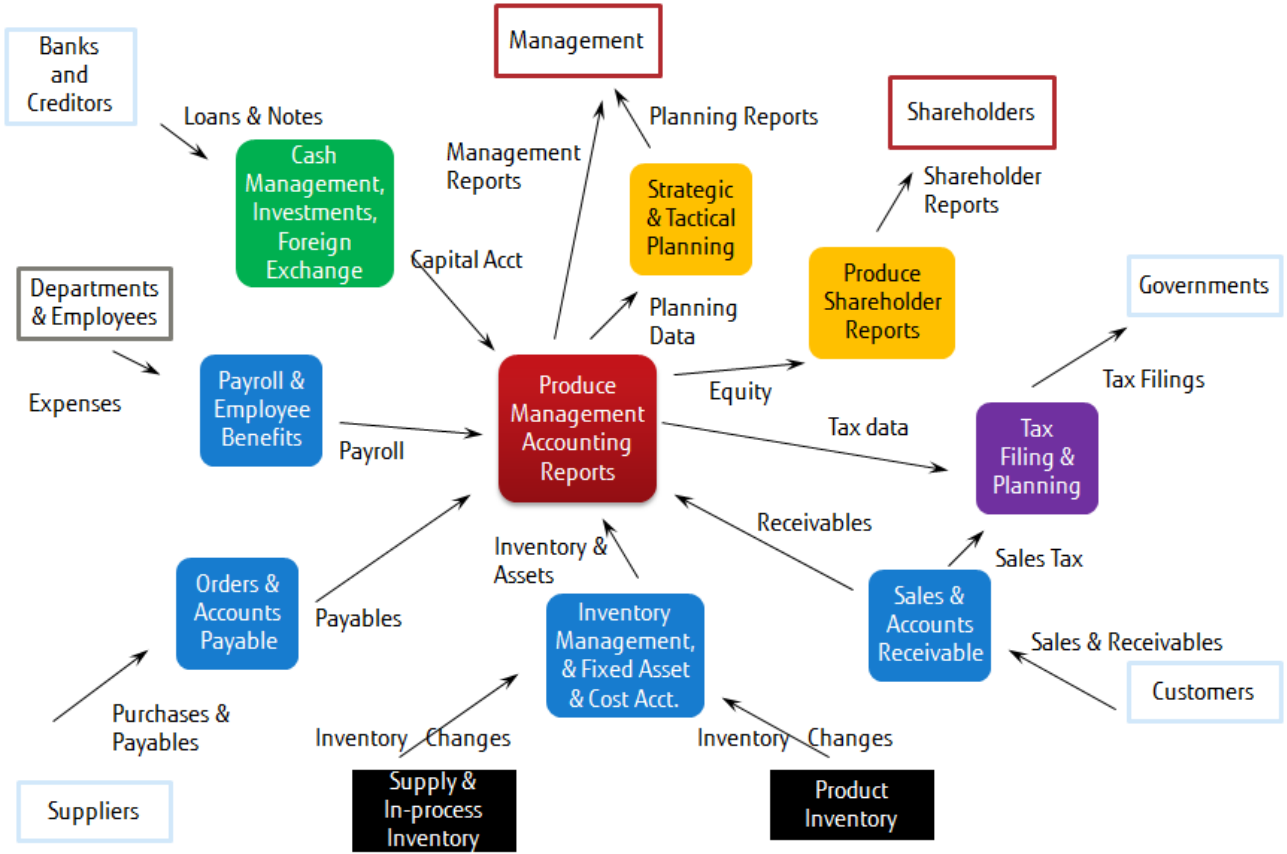


Material flows + Work flows + Money flows + Information flows

Financial Accounting & Management software

"Wow! Guess what a great sales forecast headquarters has set for you!"

Think about accounting...



What here is transactional and what is analytical?

Financial management functional areas (1/2)

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- **Financial Accounting**
  - General ledger
  - Accounts receivable/payable
  - Special ledgers
  - Fixed assets
  - Legal consolidation
- **Investment Management**
  - Investment planning/budgeting/control
  - Depreciation forecast/simulation/calculate
- **Treasury**
  - Cash management
  - Treasury management
  - Market risk management
  - Funds management
- **Enterprise Control**
  - Executive information system
  - Business planning and budgeting
  - Profit center accounting
  - Consolidation
- **Controls**
  - Overhead cost
  - Activity based costing
  - Product cost
  - Profitability analysis

Financial accounting functional areas (2/2)

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- **General Ledger**
  - Sample chart of accounts
  - Automatic posting
  - Automatic entry of vendors
  - Fiscal years
  - Keep past data books open
  - Post to prior years
  - Allocate department expenses
- **Accounts Receivable**
  - Automatic early discounts
  - Interest on late payments
  - Multiple shipping addresses
  - Sales tax
  - Automatic reminder notices
  - Automatic monthly fees
  - Keep monthly details
- **Accounts payable**
  - Check reconciliation
  - Automatic recurring entries
  - Monitor payment discounts
  - Select bills from screen
  - Pay by item, not just total bill
- **General Features**
  - Printer support
  - Use of preprinted forms
  - Custom reports
  - Custom queries
  - Security controls
  - Technical support costs

Human resource management functional areas

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- **Personnel management**
  - HR master data
  - Personnel administration
  - Information systems
  - Recruitment
  - Travel management
  - Benefits administration
  - Salary administration
- **Organizational management**
  - Organization structure
  - Staffing schedules
  - Job descriptions
  - Planning scenarios
  - Personnel cost planning
- **Payroll accounting**
  - Gross/net accounting
  - History function
  - Dialog capability
  - Multi-currency capability
  - International solutions
- **Time management**
  - Shift planning
  - Work schedules
  - Time recording
  - Absence determination
  - Error handling
- **Personnel development**
  - Career and succession planning
  - Profile comparisons
  - Qualifications assessments
  - Additional training determination
  - Training and event management
- **Other features**
  - Business workflow
  - Internet scenarios
  - Employee self-service

State-of-art... changing industry

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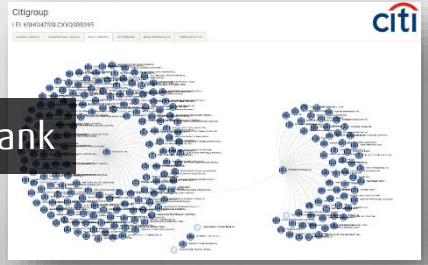
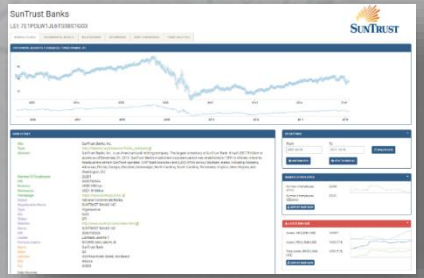
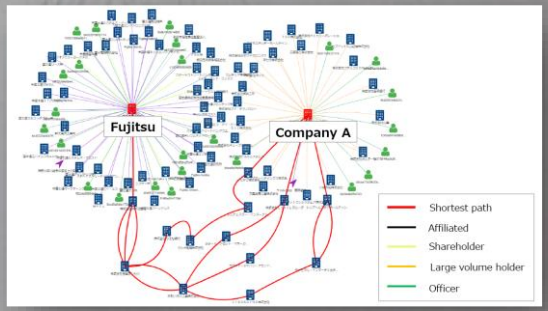
Bank



Semantically shortest paths
Hidden relationships
KYC support
Credibility evaluation
Merger prediction

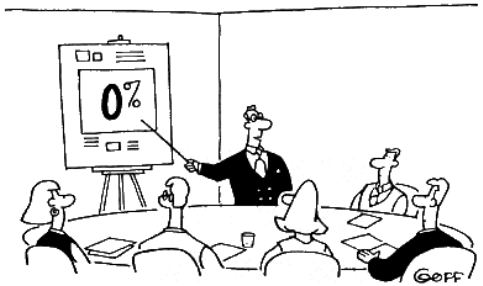
Metadata management
Linked Open Data
Financial reports
Stock prices
Customers' private data
Newspapers
Social networking services
Wikipedia/DBpedia





Obtaining superior data resources that puts other market players at disadvantage

Customer Relationship Management software



"Our study concludes that this is the percentage of our customers who will buy from us without any effort whatsoever on our part."

Customer relationship management (CRM)

- A **cross-functional** enterprise system that **integrates and automates many of the customer-serving processes** in sales, marketing, and customer services
  - Organizations that understand the needs of the individual customers are best positioned to achieve sustainable competitive advantage in the future

Operational CRM supports traditional transactional processing for day-to-day front-office operations or systems that deal directly with the customers

Analytical CRM supports back-office operations and strategic analysis and includes all systems that do not deal directly with the customers

CRM – 360 degree viewpoint

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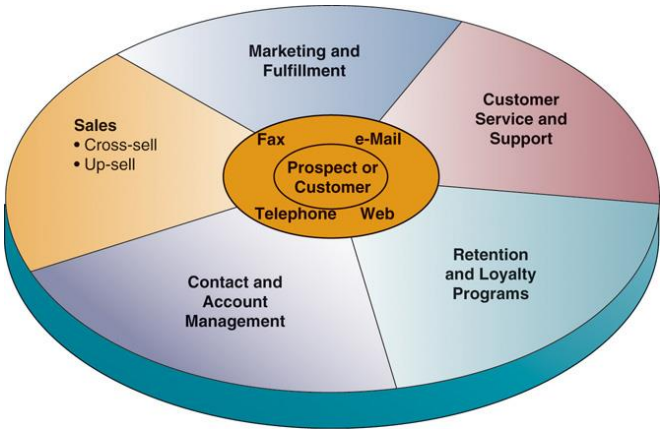
- Involves **managing all aspects of a customers relationship** with an organization to increase customer **loyalty, retention**, and an organization's **profitability**
  - Marketing automation (lead generation)
  - Sales force automation (pre-sales)
  - Call center management and customer service (post-sales)
- Acknowledges industries that they are migrating from the traditional product-focused organization toward customer-driven organizations
  - **360 degree viewpoint of all and every customer, from all personal and digital channels**
  - Capture as much information about a customer as possible: organizational structures, roles, all transactions, contacts, service history, incidents, account plans, initiatives
  - **Manage sales leads, opportunity pipeline, case management, activities, marketing**

CRM functional areas

- **Contact and Account Management** – helps sales, marketing, and service professionals capture and track relevant data about every past and planned contact with prospects and customers, as well as other business and life cycle events of customers
- **Retention and Loyalty Programs** – help a company identify, reward, and market to their most loyal and profitable customers
- **Sales Automation**– provides sales reps with tools and company data sources needed to support and manage leads, pipeline activities, sales forecasting, and optimize cross- and up-selling
- **Marketing Fulfillment** – help marketing professionals accomplish direct marketing campaigns by automating such tasks as qualifying leads for targeted marketing, targeted online content, and scheduling and tracking direct marketing activities
- **Customer Service and Support** – provides service reps with software tools and real-time access to the common customer database shared by sales and marketing professionals



“Other” relation management apps

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- Partner Relationship Management (PRM)
  - Applications that apply many of the same tools used in CRM systems to enhance collaboration between a company and its business partners, such as distributors and dealers, to better coordinate and optimize sales and service to customers across all marketing channels
  - Keeping vendors satisfied by managing alliance partner and reseller relationship that provide customers with the optimal sales channel
- Supplier relationship management (SRM)
  - Focuses on keeping suppliers satisfied by evaluating and categorizing suppliers for different projects, which optimizes supplier selection
- Same principles have been deployed also to patient management, student management, etc.

State-of-art... use every advantage available

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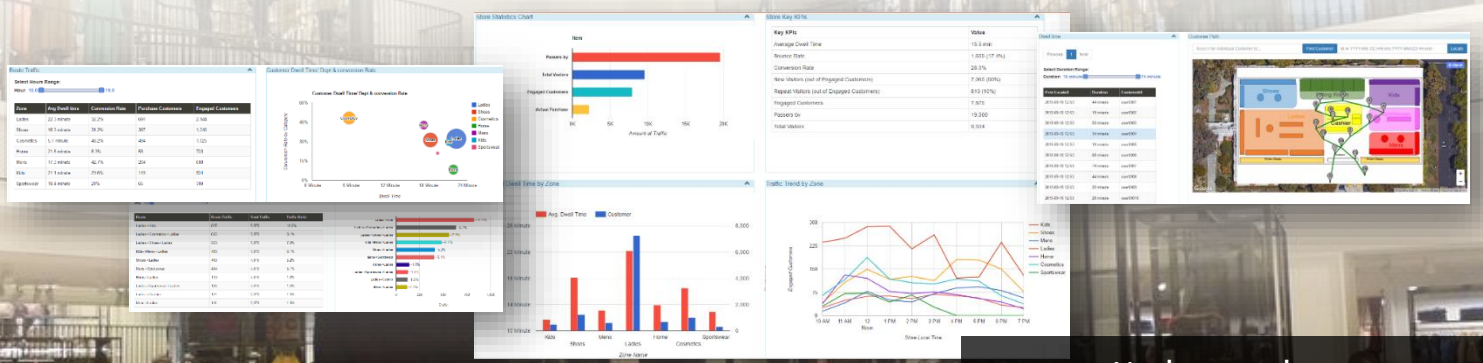
Fashion retailer



Understand customer paths
Measure conversion rates
Measure dwell & conversation time
Measure promotion effectiveness
Optimize store layout
Understand valuable real estate
Align staff location with traffic

Improve customer experience and sharpen store operations, zone plan, and conversion rates

Supply Chain Management software

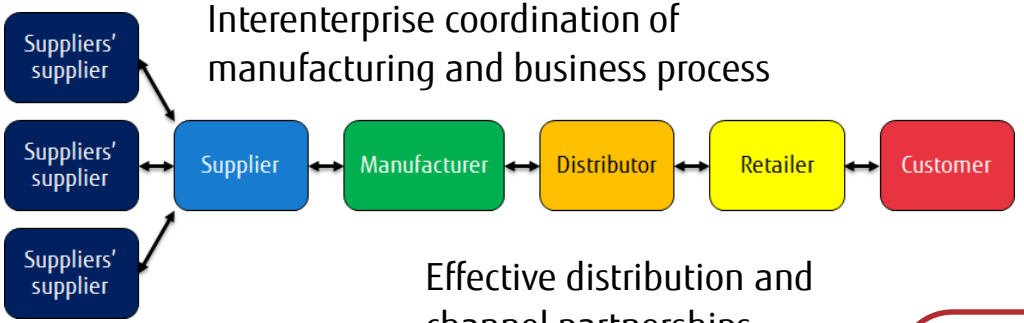
"Well, when can I buy your
'always in stock' products?"

Supply chain management (SCM)

- Support and manage the links between some of a firm's key business processes and those of its **suppliers, customers, and business partners**

Business value goals

- Rapid demand fulfillment
- Collaborative supply chain planning and execution



Interenterprise coordination of manufacturing and business process

Effective distribution and channel partnerships

Customer value goals

- Give them what they want, when and how they want it, at the lowest cost

Supply chain planning (SCP) software:
uses advanced mathematical algorithms to improve the flow and efficiency of the supply chain

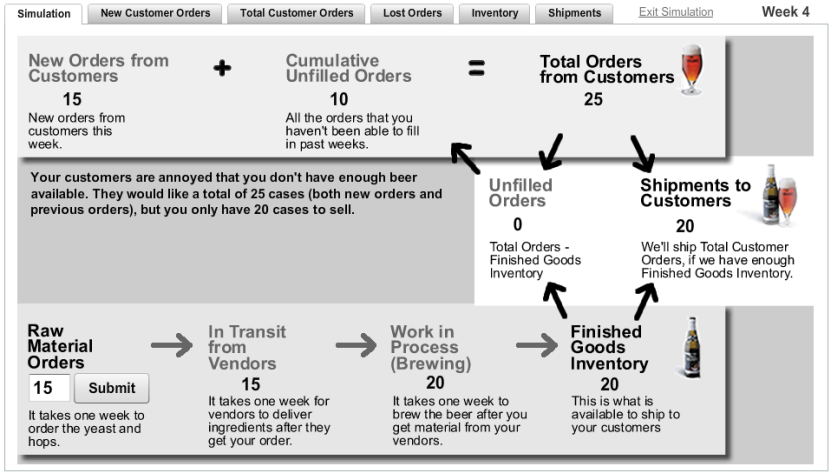
Supply chain execution (SCE) software:
automates the different steps and stages of the supply chain

Think of a business that you recently had a problem with, placing an order, or receiving an order. Identify 1 or 2 areas where the business could improve its supply chain management with technology / information systems.

Supply chain management is difficult

- SCM helps all **different entities in the supply chain work together** more effectively
  - Materials flow from suppliers and their "upstream" suppliers at all levels
  - Transformation of materials into semi-finished and finished products through the firm's own production process
  - Distribution of products to customers and their "downstream" customers at all levels
- It does this by collecting, analyzing, and distributing transactional information to all relevant parties
  - Use metrics to meet demand
  - Find suppliers, deal with pricing, delivery, and payments
  - Manufacture product or service (metric intensive!)
  - Processes & controls for efficient and effective transport and storage of supplies from supplier to customer
  - Process for allowing customers to return defective/excess products

Try the "beer game": https://forio.com/simulate/mbean/near-beer-game/run/



Supply chains can be very complex

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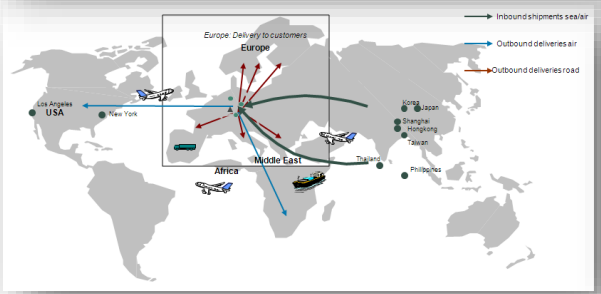
Wholesalers' origin of components is frequently unknown to the OEM
Exemplary journey of a single active component:

Processes	location	following transport [km]
Si-wafer production	Oregon	1000
wafer-processing	California	11000
IC-packaging	Taiwan	11000
test	California	13000
distribution	Germany	+ X (to customer)

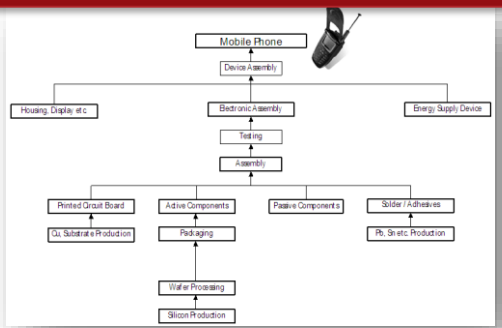
following processes:
electronic assembly, device assembly, packaging, distribution to customer



Microelectronics = process chemicals

AsH_3
BCl_3
$NH(Si(CH_3)_3)_2$ (HMDS)
N_2O
C_2H_5OH (Ethanol)
$(CH_3)_2CHOH$ (Isopropanol)
$CH_3O(CH_2)_3OOCCH_3$ (PGMEA)
$C_2H_5OOCC(OH)CH_3$ (Ethyl lactate)
$C_4H_8ON(CH_3)$ (NMP)
$C_4H_8SO_2$ (Sulfolane)
$CH_3(CO)C_6H_{11}$ (2-Heptanone)
Cl_2
HBr
SF_6
$Si(OC_2H_5)_4$ (TEOS)
$PO(C_2H_5O)_3$ (TEPO)
$TiCl_4$
WF_6
HCl
HF
NF_3
NH_3

Process chain of a mobile phone
(500-1000 components in all)



SCM functional areas

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- **Materials Management** – share accurate inventory and procurement order information, ensure materials required for production are available in the right place at the right time, and reduce raw material spending, inventory targets, procurement costs, safety stocks, and raw material and finished goods inventory Collaborative Manufacturing – optimize plans and schedules while considering resource, material, and dependency constraints
- **Supply Chain Performance Management** – report key measurements in the supply chain, such as filling rates, order cycle times, and capacity utilization (service levels)
- **Collaborative Fulfillment** – commit to delivery dates in real time, fulfill orders from all channels on time with order management, transportation planning, and vehicle scheduling, and support the entire logistics process, including picking, packing, shipping, delivery and tracking in foreign countries (material movement)
- **Supply Chain Event Management** – monitor every stage of the supply chain process, from price quotation to the moment the customer receives the product, and receive alerts when problems arise (order cycle)

SCM benefits

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Benefits

- Reduces production & distribution costs
- Improves timeliness of shipments
- Reduces manufacturer inventory levels
- Faster, more accurate order processing
- Reductions in inventory levels
- Quicker times to market
- Lower transaction and material costs
- Strategic relationship with suppliers

Planning functions

- Supply Chain Design:
  optimize network of suppliers, plants, and distribution centers
- Collaborative Demand and Supply Planning:
  develop an accurate forecast of customer demand by sharing demand and supply forecasts instantaneously across tiers

State-of-art... digital twin of global operations

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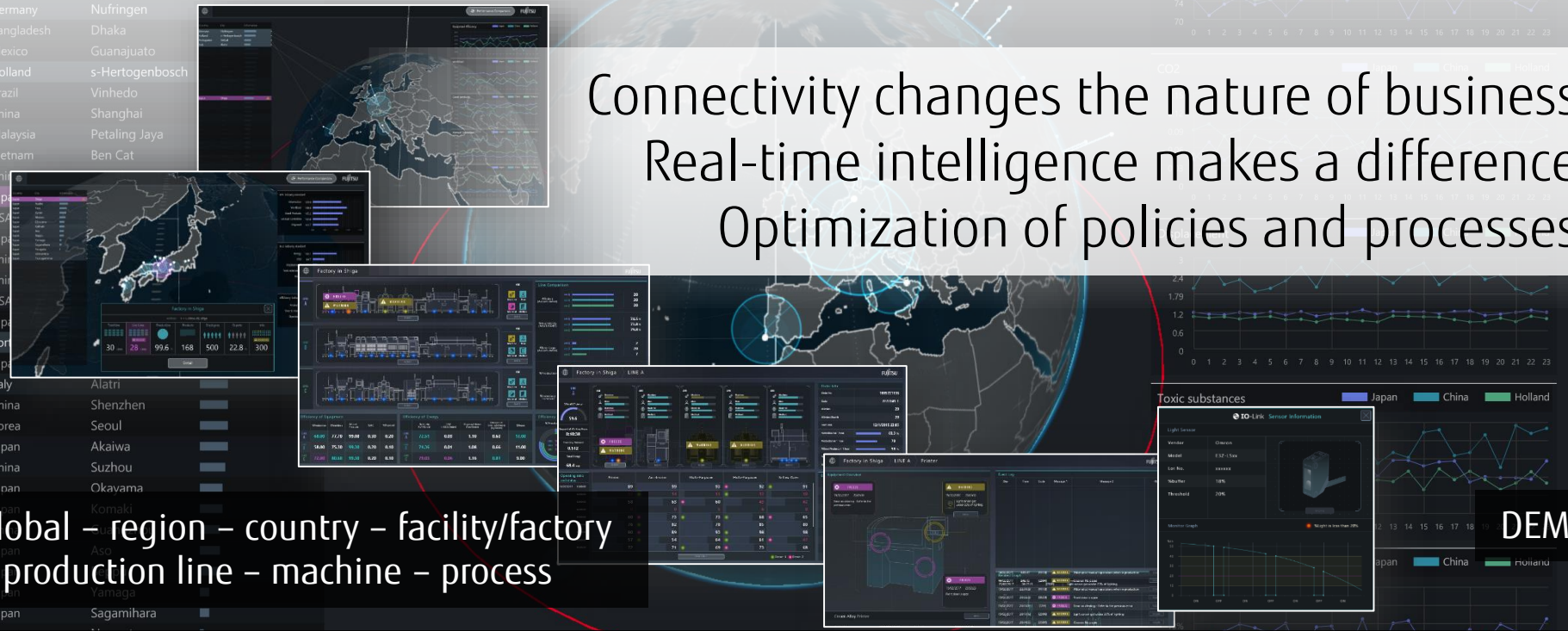
Connectivity changes the nature of business
Real-time intelligence makes a difference
Optimization of policies and processes

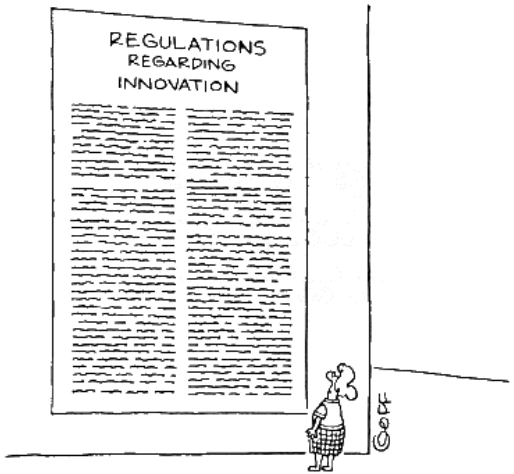


Global – region – country – facility/factory – production line – machine – process

DEMO

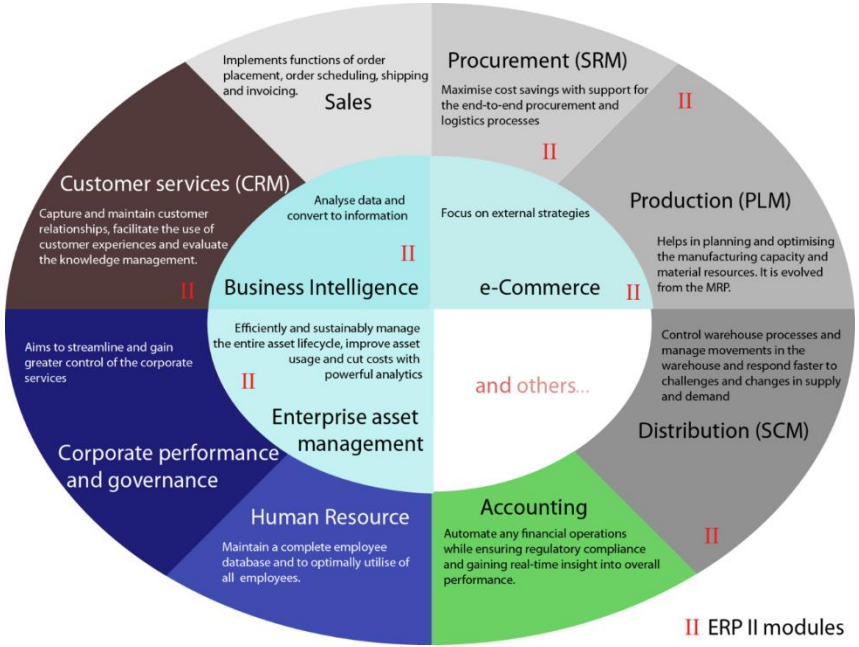
Unprecedented global real-time visibility of the manufacturing operations

Enterprise Resource Planning software



Enterprise resource planning (ERP)

- **Cross-functional** enterprise system driven by an integrated suite of software modules that support the basic internal business processes of a company
- **Integrates all departments and functions** throughout an organization into a single IT system (or integrated set of IT systems so that employees can make decisions by viewing **enterprise wide information** on all business operations)
  - Not all functions, many non-functional system components like access control, authentication,... are not part of ERP systems
- Implementations are fundamental **transformations** of a firm's business processes
  - People, processes, policies, and company's culture are all factors that should be taken into consideration



ERP functional areas (1/2)

- Purchasing
- Materials management
- Manufacturing
- Warehousing
- Quality management
- Plant maintenance
- Service management
- Sales
- Distribution

- Product data management
  - Master data management
  - Design and change process
  - Product structure
  - Development projects
- Sales and distribution
  - Sales activities
  - Sales order management
  - Shipping and transportation
  - Billing
  - Sales information system

- Transport operations
  - Route planning and scheduling
  - Fleet management
  - Parcel shipping, load building
  - Track & trace
  - Freight rating, payment
- Production planning and control
  - Production planning
  - Material requirements planning
  - Production control and capacity planning
  - Costing
  - Order information system
  - Shop floor information system

ERP functional areas (2/2)

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Project system

- Work breakdown structures
- Network planning techniques, milestones
- Cost, revenue, financial, schedule, and resource management
- Earned value calculation
- Project information system

Materials management

- Purchasing
- Inventory management
- Warehouse management
- Invoice verification
- Inventory controlling
- Purchasing information system

Quality management

- Quality planning
- Quality inspections
- Quality control
- Quality notifications and certificates
- Quality management information system

Plant maintenance

- Structuring technical systems
- Maintenance resource planning
- Maintenance planning
- System for technical and cost accounting data
- Maintenance information system

Service management

- Customer installed base administration
- Service contract management
- Call management
- Billing
- Service information system

Integration

- When the clerk enters a sale, bills are generated automatically (mail, fax, or EDI)
- Sales and revenue are instantly updated in financial and control modules

Surplus, Equilibrium, Shortage [again and again]

Case: 1 GB MLC NAND (flash memory)

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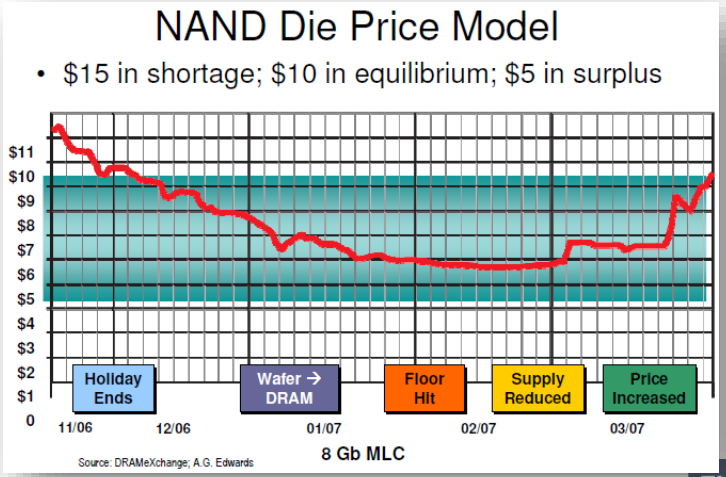
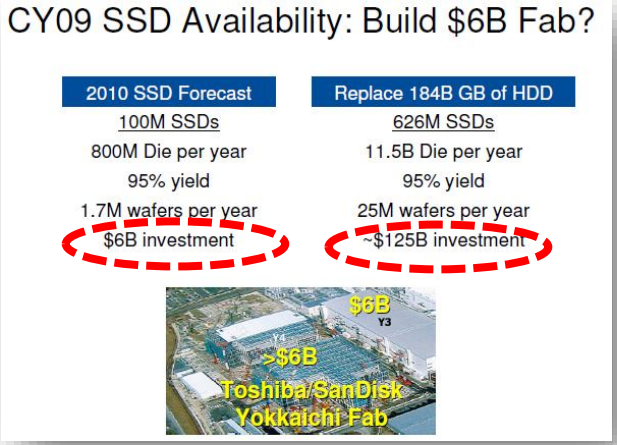


Economically viable point for NAND appears to be in 4-8 die range (NAND dies are physically large at 145 mm2). Number of wafers/month that would be need to ship 100M NAND SSDs in CY09 (100% yield/utilization to be conservative) needs $6B capex. What is the ROI?



All components are dominated by maintaining a supply/demand dynamic.

Price X when in equilibrium, up to Y during shortage, and down to Z in surplus.

Flash Spot Price MORE — Last Update: Mar.18 2019 18:10 (GMT+8) <Price Notice>

Early notice was announced at 17:50. (20 minutes in advance)

Item	Daily High	Daily Low	Session High	Session Low	Session Average	Session Change	History
SLC 2Gb 256MBx8	1.25	0.80	1.25	0.80	0.982	-0.41 %	
SLC 1Gb 128MBx8	1.65	0.59	1.65	0.59	0.893	-0.34 %	
MLC 64Gb 8GBx8	2.60	1.95	2.60	1.95	2.372	-0.59 %	

ERP benefits

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- **Quality and Efficiency** – creates a framework for integrating and improving a company's internal business processes that results in significant improvements in the quality and efficiency of customer service, production, and distribution
  - Cycle time reduction
  - Faster information transactions
  - Encourages to manage processes more explicitly
- **Decreased Costs** – Significant reductions in transaction processing costs and hardware, software, and IT support staff
  - Better financial management
- **Decision Support** – Provides vital cross-functional information on business performance quickly to managers to significantly improve their ability to make better decisions in a timely manner
  - Integrate many software applications and business functions using a common database
- **Enterprise Agility** – ERP breaks down many former departmental and functional walls of business processes, information systems, and information resources
  - Laying the groundwork for electronic commerce

Form of ERP varies from vertical to vertical

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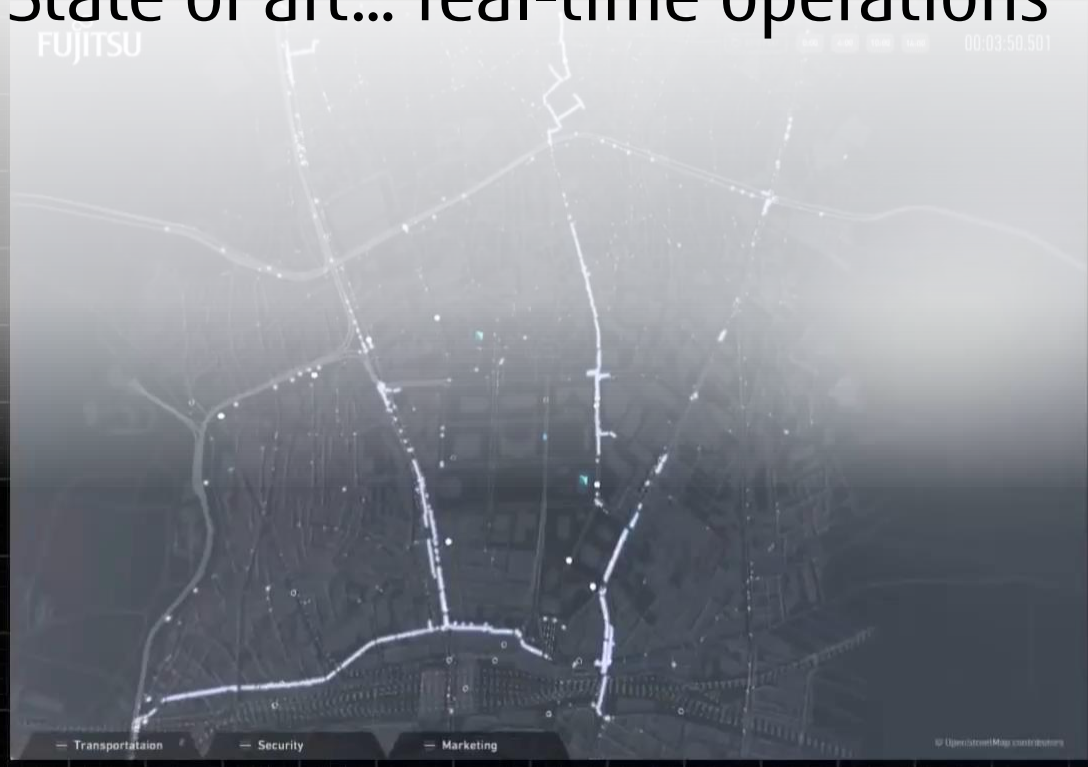
- Retail: procurement, warehousing/distribution, store/online sales
- Manufacturing: supply, production, logistics
- Construction: planning, workforce, project management
- Healthcare: staffing, asset management, patient management
- Airline: scheduling, booking, flight operations, crew management

- Many companies purchase modules from an ERP vendor, an SCM vendor, and a CRM vendor and must integrate the different modules together
  - What are the key application components? What is the business purpose of each of them?
  - Enterprise application integration (EAI) middleware – packages together commonly used functionality which reduced the time necessary to develop solutions that integrate applications from multiple vendors

State of art... real-time operations

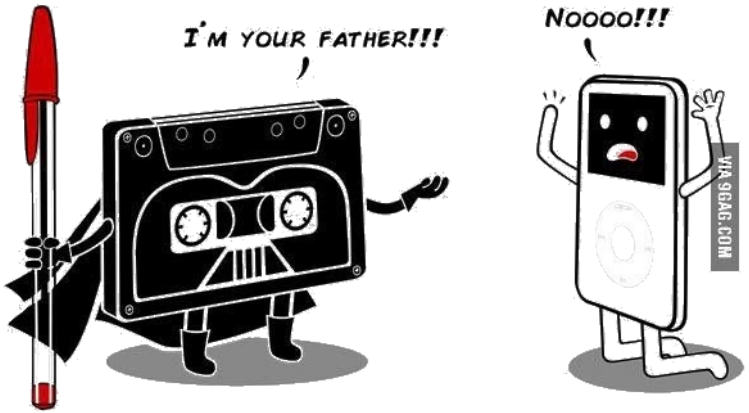


Real-time traffic conditions
Prediction of delays and overcrowding
Unexpected incident influence prediction
Visualization of service and passenger flows

Congestion detection and mitigation
Line and composition recommendations
Multi-modal journey planner & ticketing
Car/bicycle-sharing utilization

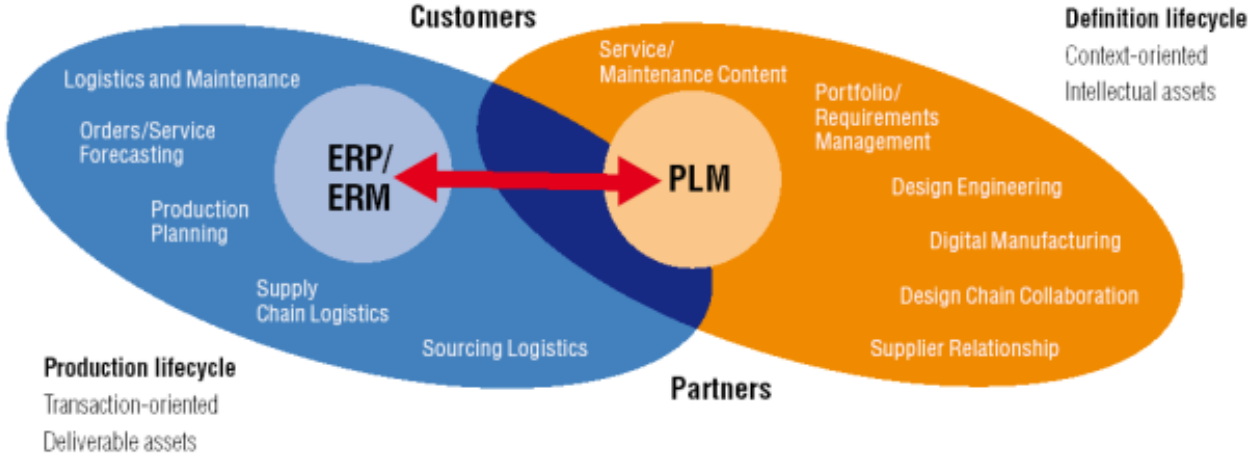
Venue traffic management
Delivery service management
Crowd & security management
Commercial promotions

Product Lifecycle Management software

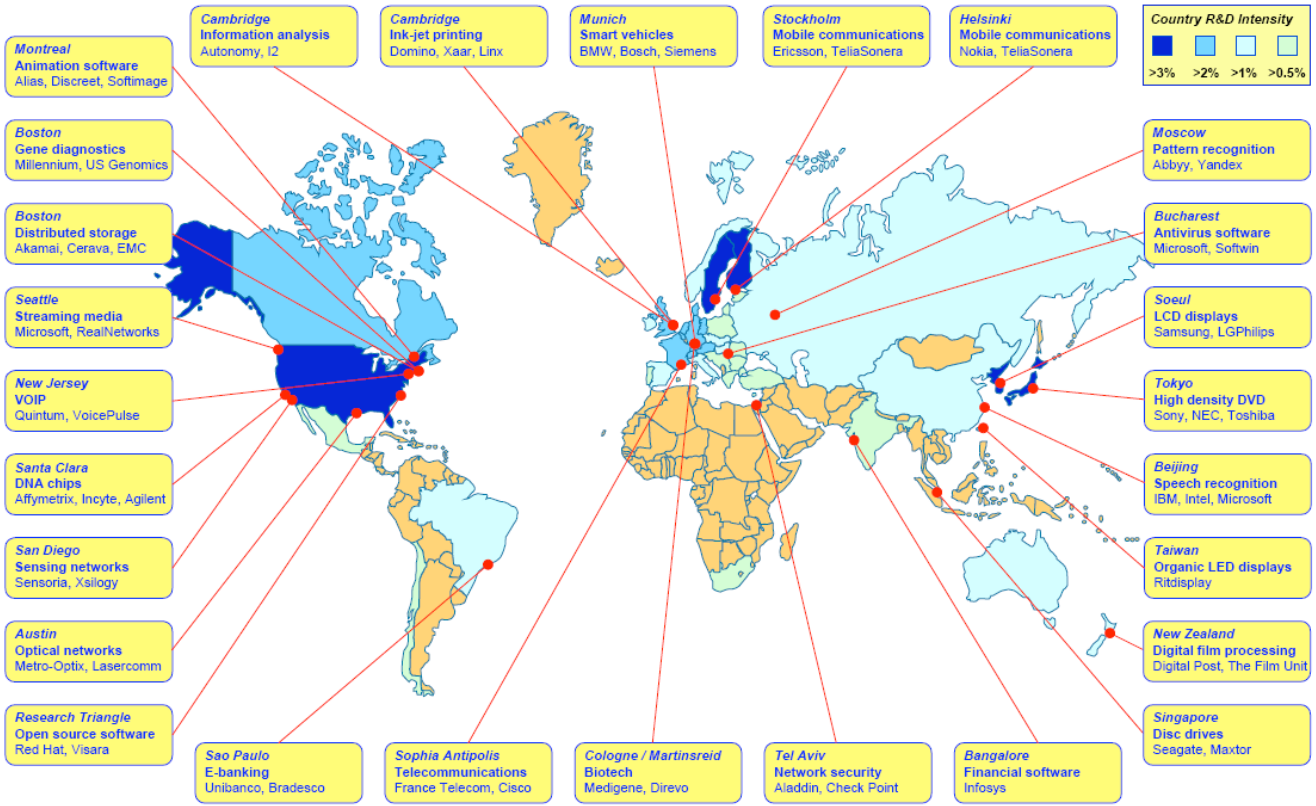


Product lifecycle management (PLM)

- Designed to manage all the product's information **from initial concept to end of life**
  - Enables engineers to access more accurate part, supplier and product info during the product's design and development phase so that engineers can make better design decisions – that determine the quality and cost of the product over it's lifetime
  - This in turn enables the firm to produce better products that are less costly to produce
  - Product development process itself becomes more efficient through automation and collaboration



Networks, Ecosystems, Alliances,...



Key innovation networks and clusters around the globe

Transformation into service-based models

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Providing a product in a way that customers value more than the competitions'.

Real-time expert support
Supervisor authorization
Sensor data presentation
Context driven task instructions
Voice control
Activity recording
Audit of quality assurance
Data and image capture
Service bulletins
Exemption programmes
Head mounted displays
Augmented reality
Biometric access control

Remote supervision of on-site inspection, maintenance and repair for complex processes

Business intelligence software

"I was just passing by when I noticed
that your company needs more profit.
That's why you should buy our product."

Business Intelligence

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- BI software goes beyond simply gathering and storing company data, it **allows executives to make informed business decisions – operational and strategic** – about ever-changing market demands, sales strategy development, earnings and forecasting, materials management etc.
  - Functionality to analyze business data to identify trends and relationships to make better business decisions
- Acquisition and transformation of **raw data into meaningful & useful information**
  - Many traditional BI software systems start with a dedicated data warehouse, but as BI tools get better at using data from various source systems, there's less need to deploy a data warehouse
  - A business must have one logical place where all pieces of data can be stored and related to one another
- Business data must be clean
  - Focused on data quality processes and technologies to ensure that BI systems display accurate data, using e.g. master data management (MDM) or product information management (PIM) to ensure consistent data across applications and departments

Various (traditional) decision support systems

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Management information systems (MIS)

- Provides with reports and online access to the organization's current performance and historical records
- Summary reports, past & present data,
- Report control oriented

Decision support systems (DSS)

- Serve decision that are unique, rapidly changing, and not easily specified in advance
- Use of mathematical models by modeling information
- What if, goal-seeking

Executive information/ support systems (EIS/ESS)

- Help make decisions that are non-routine requiring judgment, evaluation, and insight
- Contain data from external sources as well as data from internal sources
- Aggregate data, projections

State of art... ship performance in actual conditions

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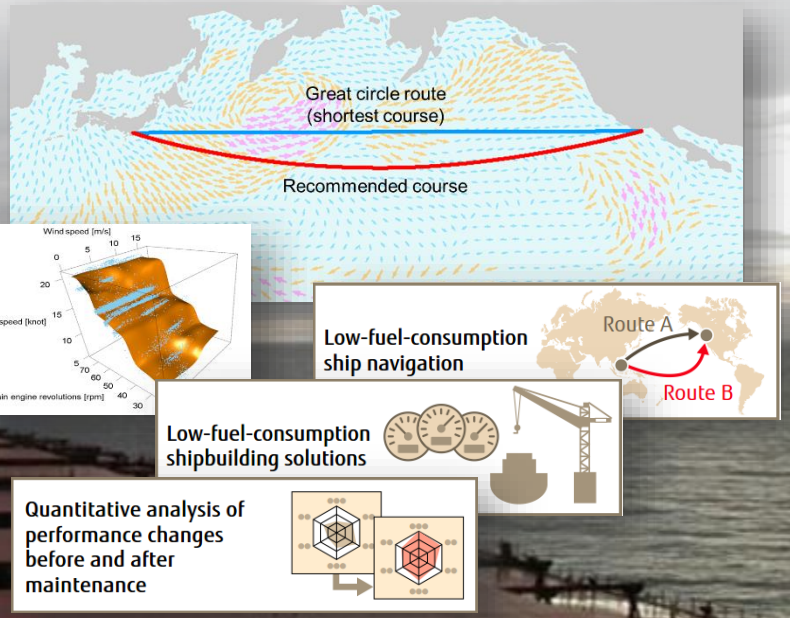
Analysis of ship-related big data to estimate fuel efficiency, speed and other performance in actual sea conditions.



Utilizing massive volume of measurement data, including meteorological and hydrographic conditions such as wind, waves, tides and currents, ship engine log data, and data about the speed and position of the ship.

Facilitates the selection of vessel routes in order to reduce fuel consumption

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Compexity of integration and transformation

Business application projects

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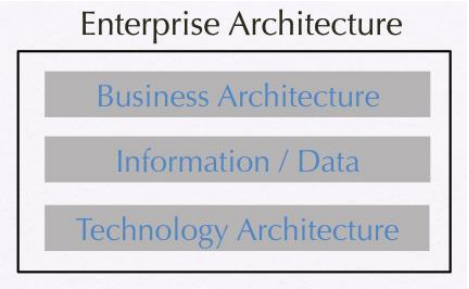
- Enterprise software projects are **business process renewal projects**
  - The measurable improvement of business performance through **synchronized changes to:**
    - **a process**
    - **its guiding factors**
    - **its enablers**

- Requires management of
  - Political commitment — awareness, understanding, willingness, opportunity cost
  - Quality/Risk — risk/reward, gating checkpoints, resource commitment
  - Project — communication, perceptions, commitments
  - Technology enablers — infrastructure, IT appliances, communications, apps
  - Human enablers — skills, capabilities, attitudes, incentives



Net present value of an ERP project

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Software	2,420,000					
Software Licenses		220,000	220,000	220,000	220,000	220,000
Hardware	1,850,000	Servers + Networking capability in a client server environment				
Consulting	3,000,400	Installing + Configuring the software				
Training	1,280,000	Initial training time			Project management time + Internal team time + Project steering committee time	
Implementation Team	400,000	400,000	400,000	400,000		
Total Costs	8,950,400	620,000	620,000	620,000	220,000	220,000
Savings	0					
Reduced Inventory Costs		2,750,000	2,750,000	2,750,000	2,750,000	2,750,000
Reduced Administrative Costs		1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Intangible Benefits	Improved employee morale, improved customer satisfaction, less duplication of effort in maintaining multiple databases					
Total Savings	0	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000
Net Balance	-8,950,400	3,380,000	3,380,000	3,380,000	3,780,000	3,780,000
DCF Factor (Discounted Cash Flow)	1.000	0.909	0.826	0.751	0.683	0.621
Discounted Bal.	-8,950,400	3,072,420	2,791,880	2,538,380	2,581,740	2,347,380
Cumulative Discounted Bal.	-8,950,400	-5,877,980	-3,086,100	-547,720	2,034,020	4,381,400

Start-up costs | Non-recurring costs | Recurring costs

License is 10% of total costs, implementation 50%

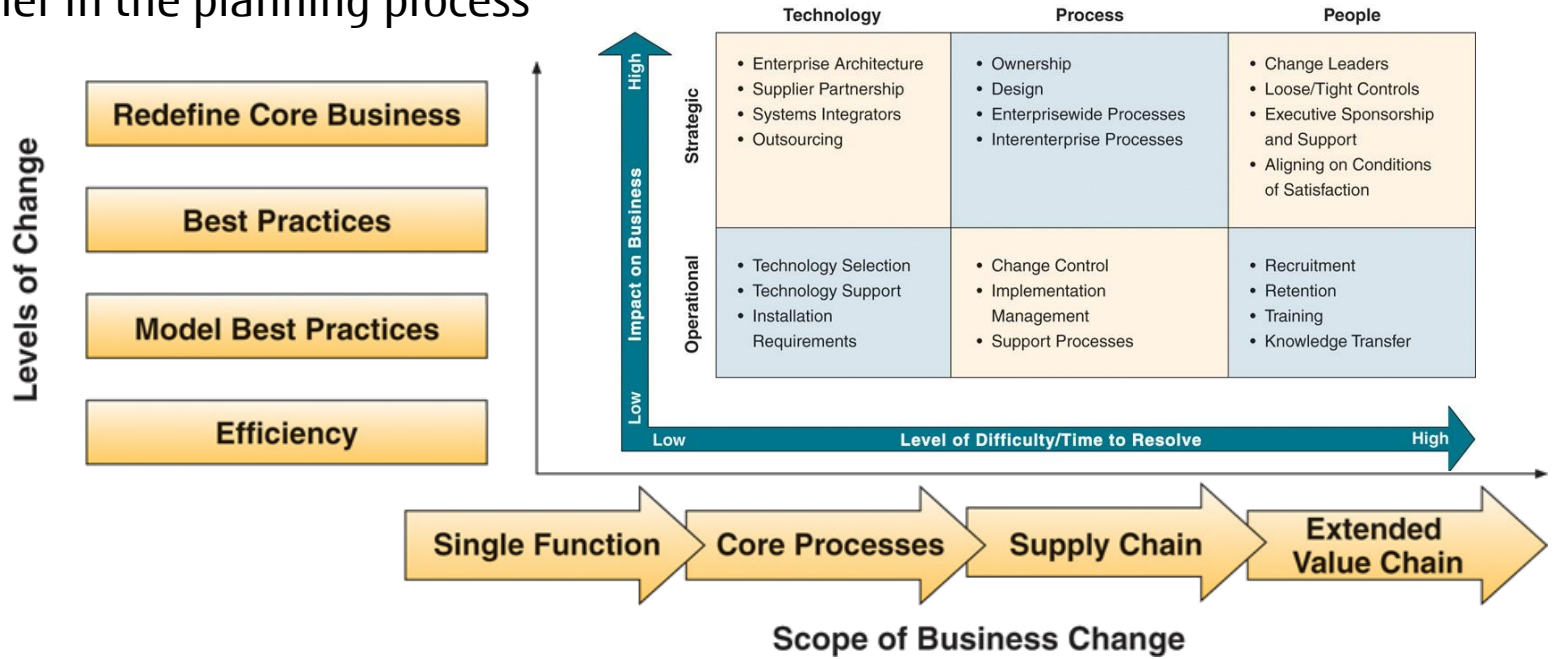
Best-of-breed software components or an integrated application package/suite?

Most systems are not ready-to-run. They are business process platforms with **numerous ways to configure rules, policies, interfaces, process steps, workflows, conflict management...**

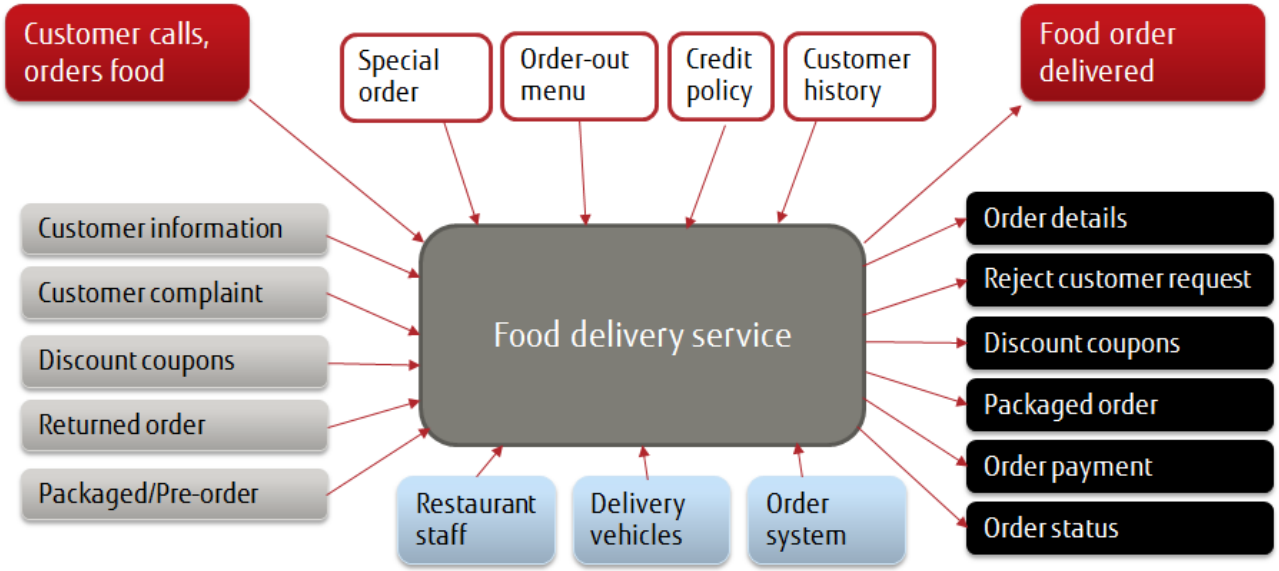
Example SAP ERP:
Up to 10000 configuration decisions, data structuring, custom code modifications, custom logic scripting, 3rd party add-on component integration,...

Business application planning

- Includes the **evaluation of proposals** made by the IT management of a company for using information technology to accomplish the strategic business priorities developed earlier in the planning process



Example



Mission:
Provide customers with a quality product delivered in 30 minutes of less.

Think about it yourself....
What would you do?

Example (cont.) – So, what would you do?

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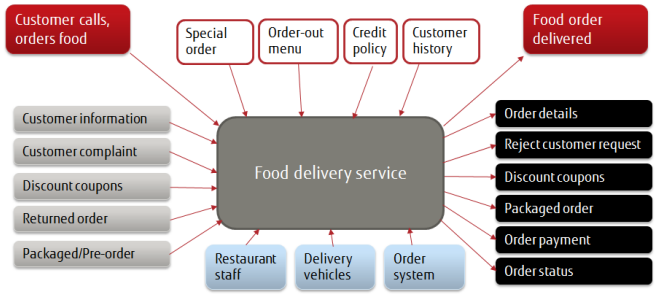
KPI's: Customer Satisfaction

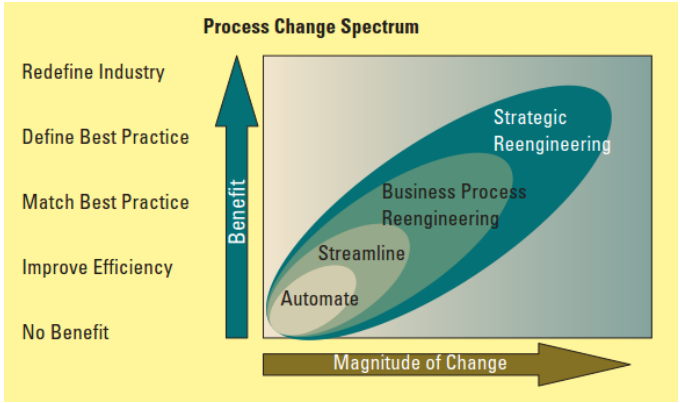
Objectives: Eliminate non-value-added activities
Reduce # of exceptions
Improve the reliability of delivery
Increase customer satisfaction

CSF's: Food Delivery within 30 minutes or less of order
Satisfied Customers

Constraints: Delivery service vehicles are unreliable
Delivery by taxi is not within our complete control

Identify improvement targets, gather process information, decompose scoped process into 3-7 sub-processes (activities), develop modeling methods, model the process, determine process roles and responsibilities,...





How firms have transformed over the decades?

Leveraging the transferability of best practices

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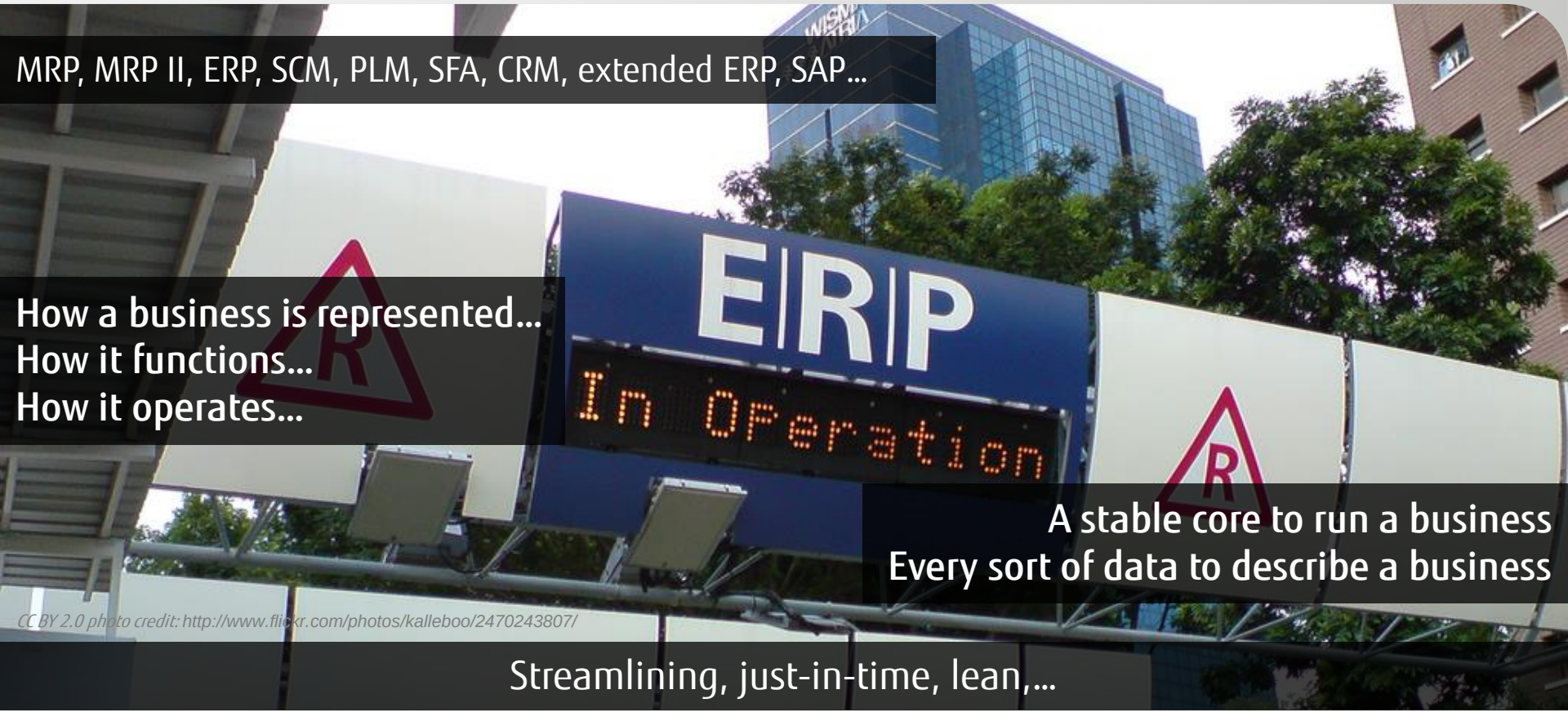

MRP, MRP II, ERP, SCM, PLM, SFA, CRM, extended ERP, SAP...

How a business is represented...
How it functions...
How it operates...

A stable core to run a business
Every sort of data to describe a business

Streamlining, just-in-time, lean,...

Operational excellence is insufficient

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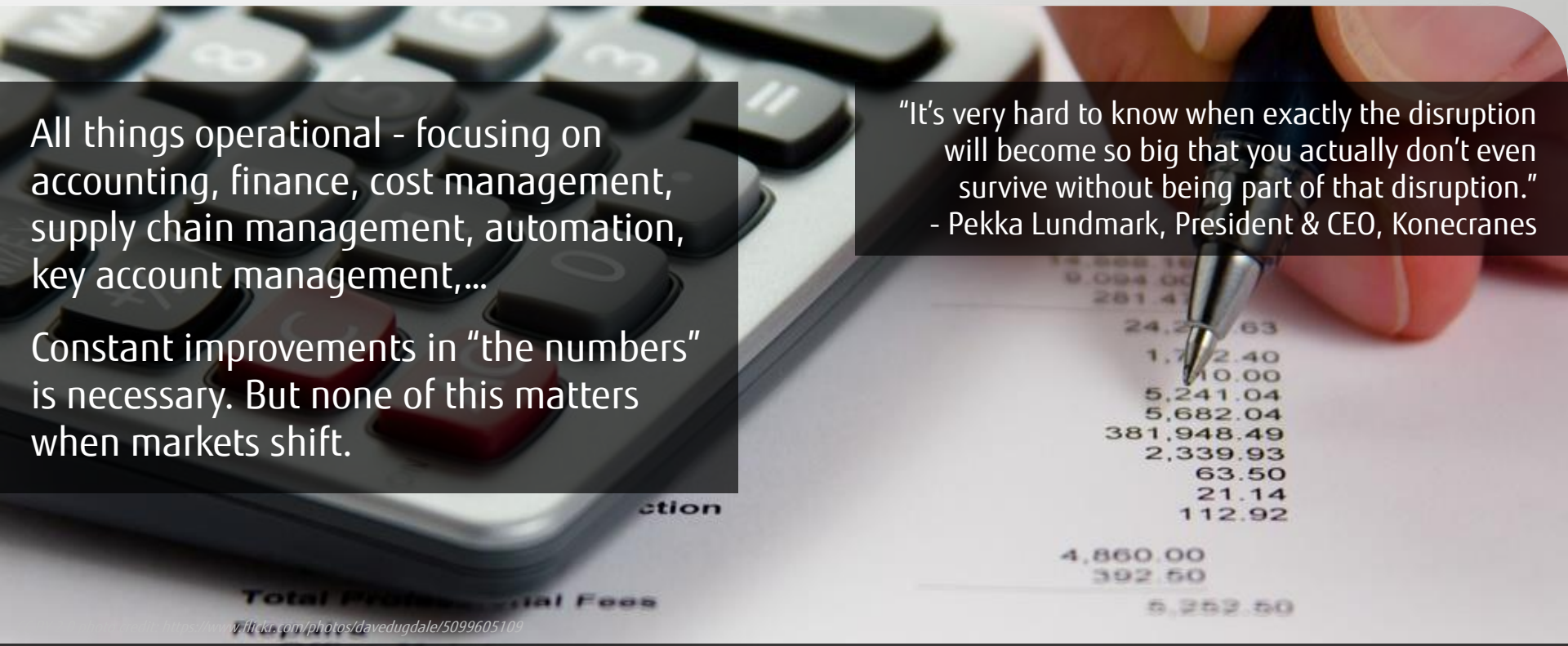

All things operational - focusing on accounting, finance, cost management, supply chain management, automation, key account management,...

Constant improvements in "the numbers" is necessary. But none of this matters when markets shift.

"It's very hard to know when exactly the disruption will become so big that you actually don't even survive without being part of that disruption."
- Pekka Lundmark, President & CEO, Konecranes

Digital economy shifts the entire market rather than merely optimizes existing

The technology trend story

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Online consumer business

Hyperconnected World
A huge impact to every industry

Transaction cost of leveraging external capabilities

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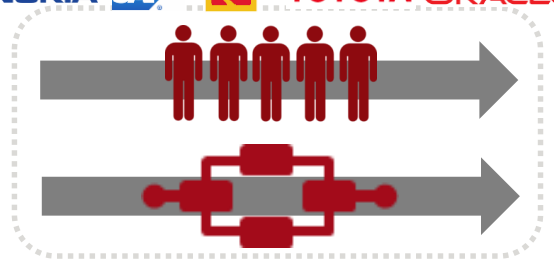
NOKIA SAP Kodak TOYOTA ORACLE



MRP, MRPII, SCM, PLM, ERP,...

amazon YAHOO! ebay Microsoft Google

Email, Internet, Extranet, eCommerce, UC, EDI, Web1.0, process automation, SOA,...

LinkedIn facebook

Blogs, social networks, tweets, cloud, communities, media, crowdsourcing, SaaS, gamification,...

Specialization across physical value chain

Transaction processing
Management information systems
Components & products

Specialization across information value chain

Information & processes, Online information systems
Global functional organization and BPOs
Decision support and BI systems

Specialization across human value chain

Collaborative learning and problem solving
Knowledge work agents, Analytical systems
Community collaboration tools

Evolve or transform or get disrupted: firms, organizations and industries

Where business applications are heading?

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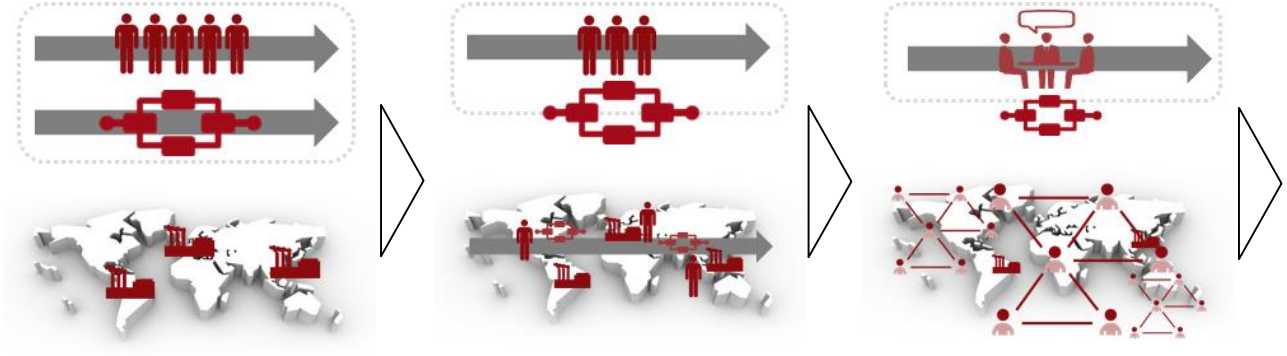
Purpose of the firm will no longer be to minimize the transaction costs of doing business by executing efficient in-house processes:
Staff on demand, social engagement, algorithms, community & crowd, leveraged assets,...



amazon services UBER NETFLIX

AI/ML/DL, Internet of Things, APIs, AR/VR, 5G, Blockchain, Robotics , Fog computing,...

Specialization across dynamic digital value chain
Cyber-physical systems, marriage of digital and physical
Advanced automation, control, and/or brokering
Digital transformation, service enablement
Un-linear business models, Platform economy

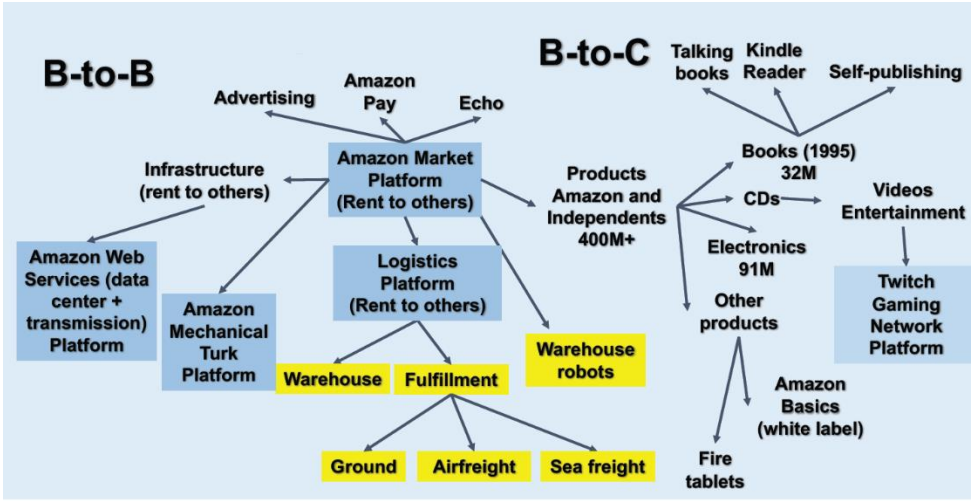
"Growing from 0.02 to 0.04 in a quarter is beyond attention but following the doubling path for 5 years you end up at 209715"

The only constant: digital disruptions continue

Platform economy… reorganization of “production”

[API economy for geeks]

Digital platform owners are developing power that will be as formidable as that of the factory owners in the early industrial revolution



Picture source: Matrin Kenney, Distinguished professor, University of California & Berkeley Roundtable on the International Economy, 2017

Amazon Web Services (IaaS/PaaS), Fulfillment by Amazon (warehouse, order fulfillment, customer service), Amazon Prime (loyalty membership), Amazon Prime Video (video-only offering), AmazonFresh (online grocery order and delivery), Amazon Advertising (digital advertising), Amazon Pay (check out), Amazon Kindle Store (e-book), Amazon Music and Amazon Video (digital media stores) Amazon Music Unlimited (subscription music), Amazon Prime Air (experimental delivery),…

Amazon isn't a retail company. It's a services business. Key to Amazon's services is that Amazon is its biggest customer.

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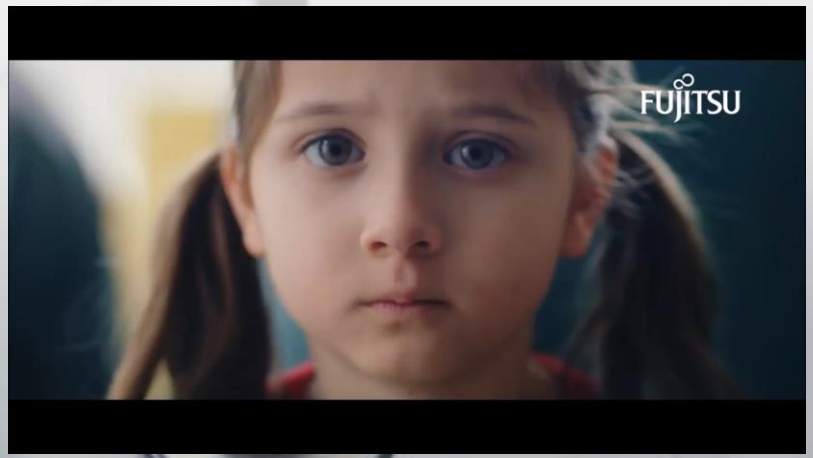
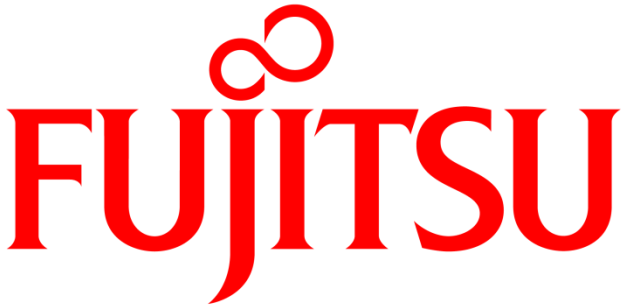
Q&A

Human Centric Intelligent Society





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