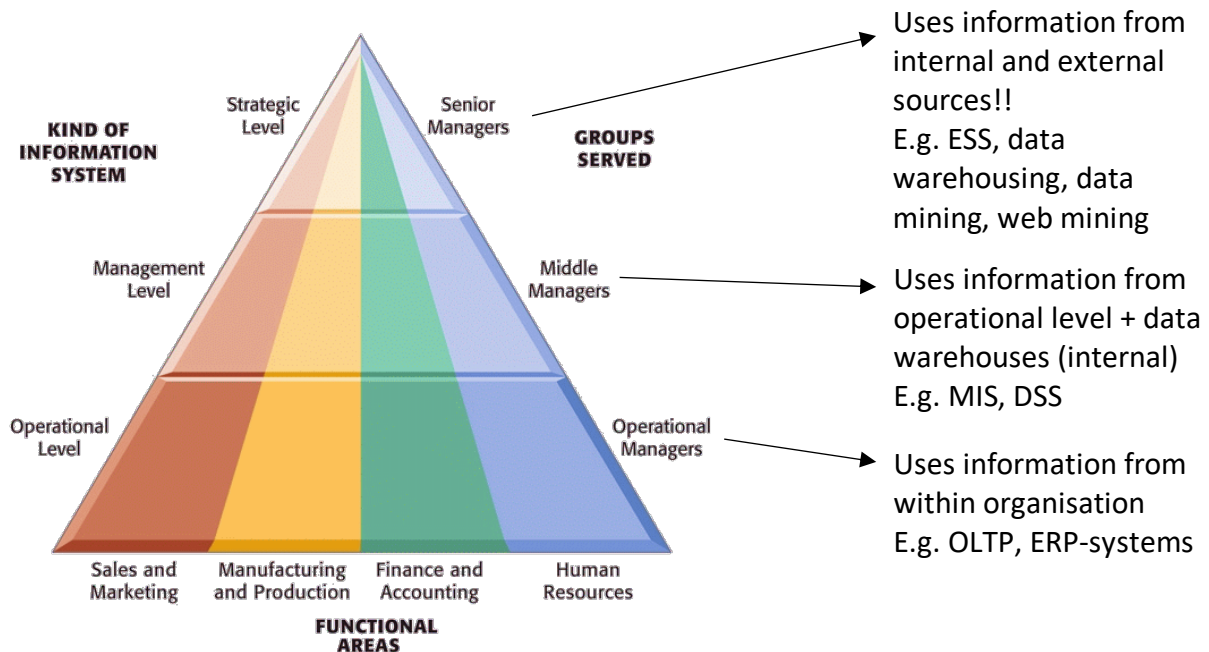


Business Information Systems

1. Information systems, strategy and governance

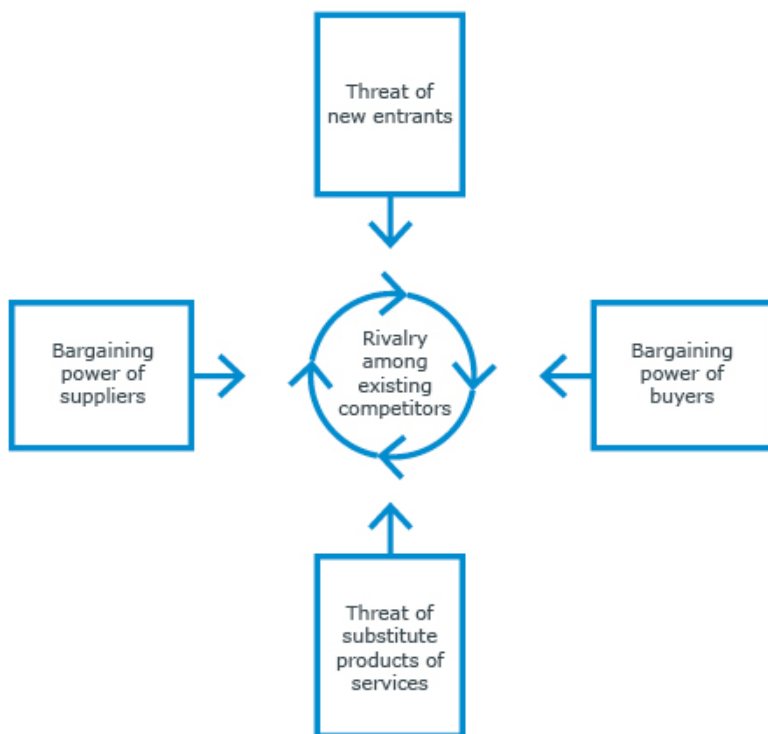
What is an IS?



IS Strategy

Business strategy

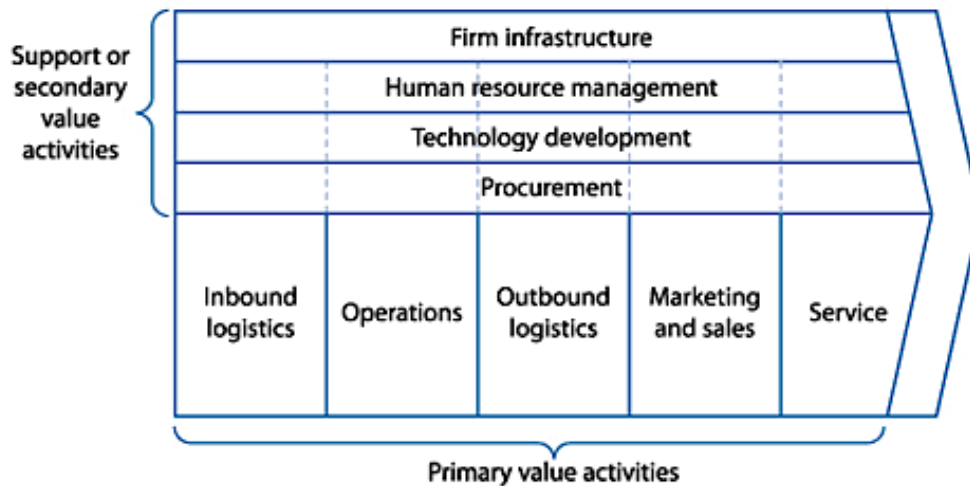
Porter's five forces theory:



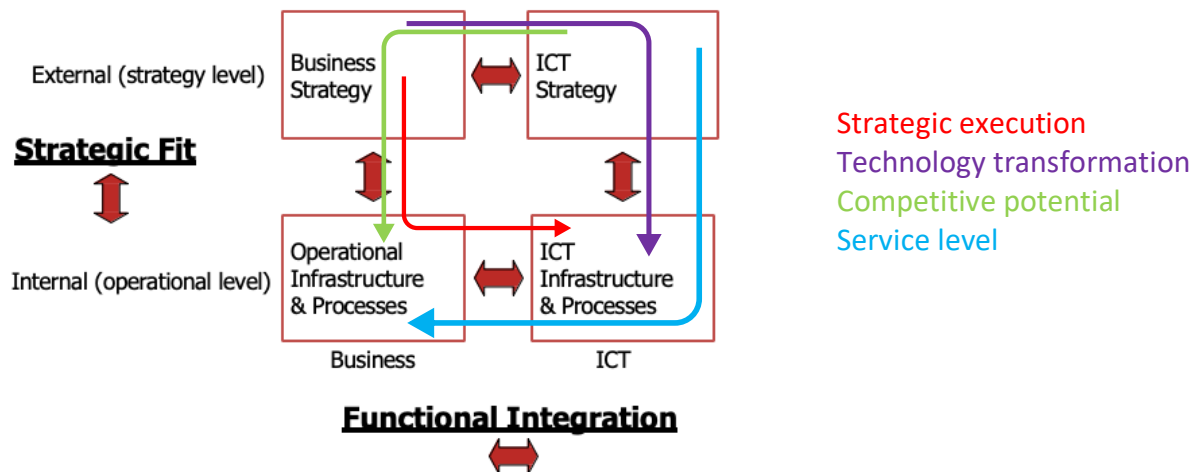
→ Describes the structure of a market

→ Limited use for determining future strategy

Value chain & IS → competitive advantages



Strategic Alignment Model - Henderson & Venkatraman



IT Governance

Corporate governance: **SOX Act** → meeting stakeholder needs (responsibility of directors)

Includes assessment of internal control (responsibility of management)

- **COSO Internal Control** – Integrated Framework: proves SOX compliance
 - **COBIT 5**: proves SOX compliance for IT-centred organisations
 - End-to-end approach
 - Integrated framework
 - Enablers: practical guidelines
- ← complementary

2. Creating value with IT

Business value of IT

IT business value model

- Resource-based view: a resource will confer to sustainable competitive advantage if it is valuable, rare, inimitable and non-substitutable

Evaluating projects

Technology acceptance models

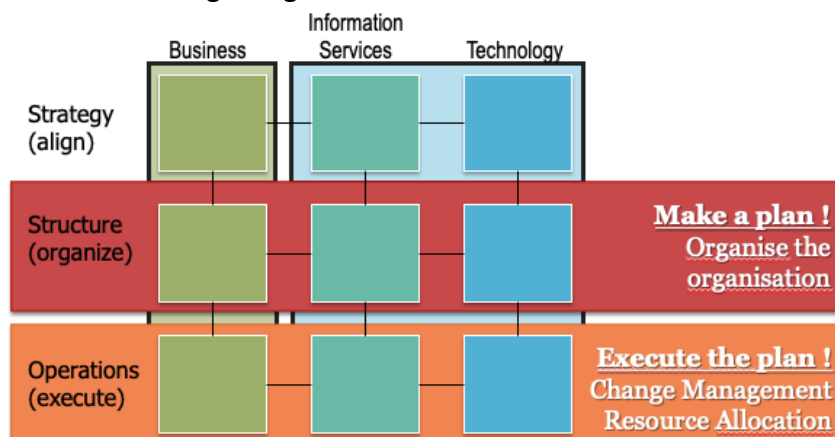
- TAM:** based on Expectancy Value Theory and Theory of Reasoned Action
- UTAUT:** summarisation of TAM models
- UTAUT 2:** consumer use

Information system success

- DeLone & McLean**

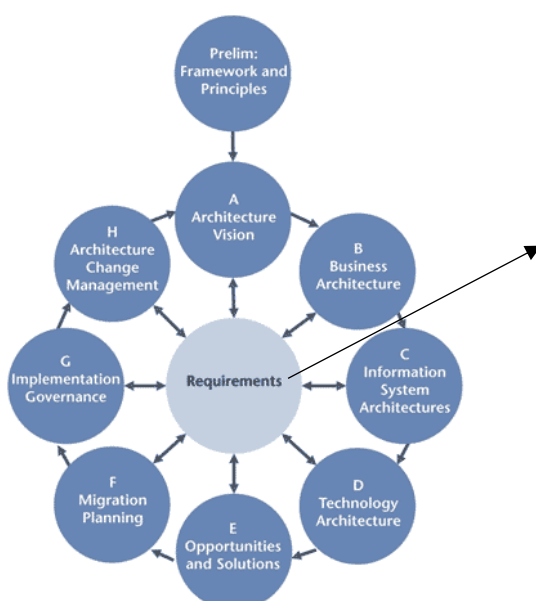
Enterprise architecture

Extended Strategic Alignment Model:



Frameworks

TOGAF

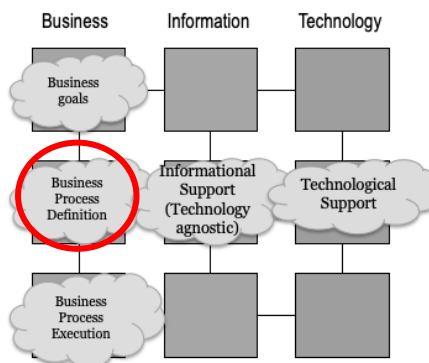


ZACHMAN

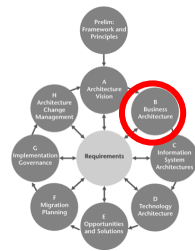
		What	How	Where	Who	When	Why
1	Scope (Contextual)						
2	Business Model (Conceptual)						
3	IS Model (Logical)						
4	Technology Model (Physical)						
5	Detailed Representations						
6	Functioning/ Code						
		Entity Relationship Entity	Input Process Output	Node Line Node	Organization Reporting Organization	Event Cycle Event	Objective Precedent Objective

3. Fundamentals of Business Process Management

Extended Strategic Alignment model



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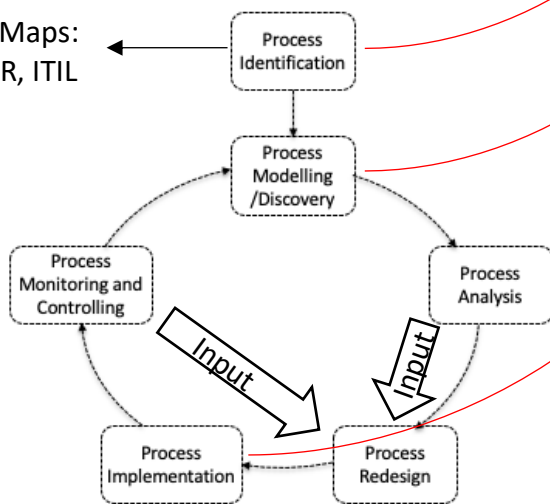


ZACHMAN "How"

	What	How	Where	Who	When	Why
1	Scope (Contextual)					
2	Business Model (Conceptual)					
3	IS Model (Logical)					
4	Technology Model (Physical)					
5	Detailed Representations					
6	Functioning/ Code					
	Entity Relationship Entity	Input Process Output	Node Line Node	Organization Reporting Organization	Event Cycle Event	Objective Precedent Objective

The BPM cycle

Process Maps:
e.g. SCOR, ITIL



Root-cause analysis, PICK-chart, issue register, process simulation

Process modelling

Modelling techniques:

- Prescriptive: e.g. tasks (BPMN), states (FSMs), tasks & states (Petri Nets), pi-calculus
- Descriptive: e.g. organisational (RASCI, SIPOC), business rules, case management

Process implementation

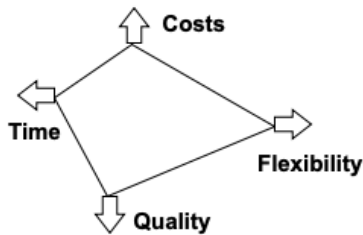
Enactment architectures:

Process/data coordination	No Integration	Hard-coded Feed-forward of data	Data Coordination via BPMS	Integrated Enterprise Database
No BPMS				
Basic WF support				
Advanced WF Support				

Evolution requires flexibility: **simple versioning** VS **evolutionary change**

Process redesign

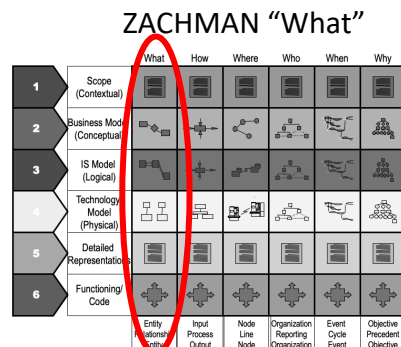
Improving KPI's: **devil's quadrangle**



Improvement

- Process re-engineering = clean slate approach
- Implementing reference frameworks (e.g. SCOR, ITIL)
- Process Optimization
 - Redesign heuristics: task elimination, task composition, triage, resequencing, parallelism, process specialisation/standardisation, resource optimisation, communication optimisation, automation
 - **LEAN process management** principles:
 1. Which processes create value?
 2. How is value created?
 3. Remove “waste”
 4. Only start working when there is a request
 5. Repeat continuously

4. Information Management



Conceptual data modelling
e.g. EER, crow's foot notation, **UML class diagrams**

Logical data modelling
e.g. **Relational Model**

Relational Model

Normalisation via candidate keys (= minimal determinant)

- Primary key (\neq NULL)
- Alternate key
- Foreign key (can be NULL)

→ Querying a relational database via **SQL**

5. Business Intelligence and Data Analytics

Verification-based BI

Enterprise reporting

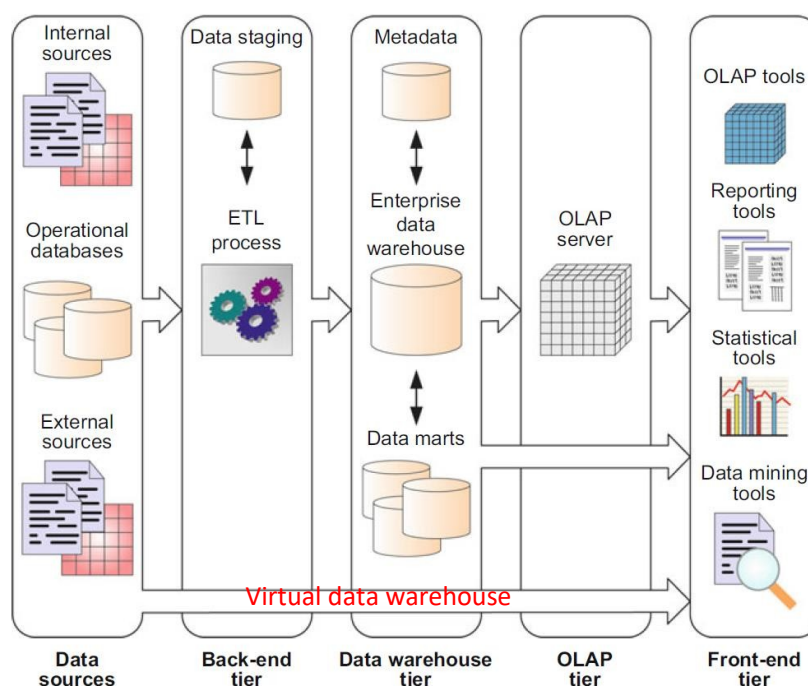
- Balanced scorecard
- Digital dashboards
- Customized reports

Corporate performance management

- Business Activity Monitoring (real-time)

Online Analytical Processing

- **OLAP** database = **data warehouse** >< **OLTP** database: normalised
 Support of tactical and strategic decisions Support of operational processes
 Integrated Not integrated
 Subject-oriented Transaction-oriented
 Time-variant Time independent
 Non-volatile Volatile
 Aggregated Detailed
- Conceptual data warehouse design
 Multidimensional model (theoretical) ≠ language!
- Logical data warehouse design
Relational OLAP (query via SQL): e.g. star schema, snowflake schema
Multidimensional OLAP (query via MDX: e.g. roll-up, drill-down, slice, dice)
Hybrid OLAP
- Data warehouse architecture



Discovery-based BI = data analytics

Predictive methods (Supervised)

- Regression
- Classification
 - **K Nearest Neighbor classification**
 - **Decision trees**

Impurity of a node: $Error(t) = 1 - \max [p(i|t)]$

Impurity of a split: $Impurity(split) = \sum_l \frac{n_l}{n} \times Impurity(leaf\ node_l)$

→ Lowest impurity = best split

Evaluation

- via confusion matrix:

ACTUAL CLASS	PREDICTED CLASS	
	Class=True	Class=False
Class=True	TP	FN
Class=False	FP	TN

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN}$$

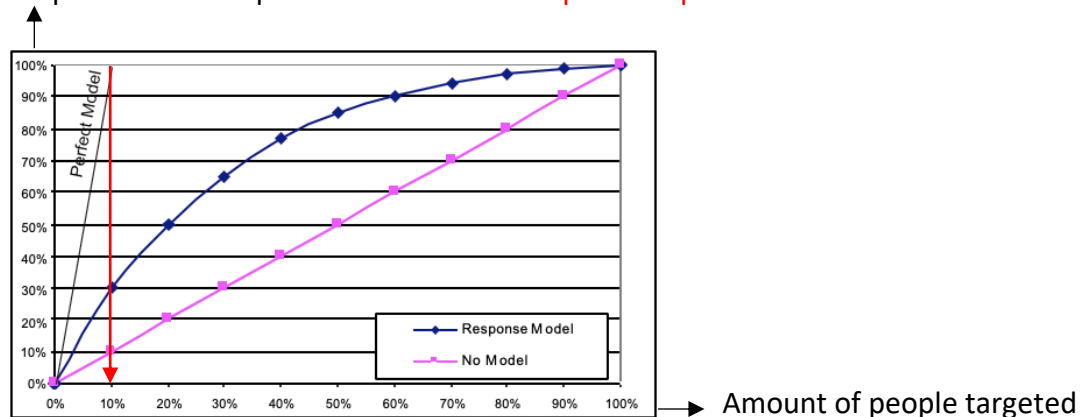
$$Error\ rate = 1 - Accuracy = \frac{FP + FN}{TP + FP + FN + TN}$$

If accuracy of test set can increase → underfitting

If accuracy of test set has decreased → overfitting

- via gains chart

Responses with respect to the **maximal respondent possible**



Descriptive methods (Unsupervised)

- **Association rule learning**

Support ($X \rightarrow Y$) = $\frac{\text{how many times is (X,Y) a subset of a transaction}}{\text{number of transactions}}$

Confidence ($X \rightarrow Y$) = $\frac{\text{how many times is (X,Y) a subset of a transaction}}{\text{how many times is X a subset of a transaction}}$

→ Apriori algorithm

Interestingness ($X \rightarrow Y$) = $\frac{\text{support}(X \cup Y)}{\text{support}(X) \cdot \text{support}(Y)}$

> 1: complements
< 1: substitutes

- **Clustering**
 - Partitional clustering: e.g. k-means, DBSCAN
 - Hierarchical clustering: agglomerative or divisive
- Pattern mining

6. E-business

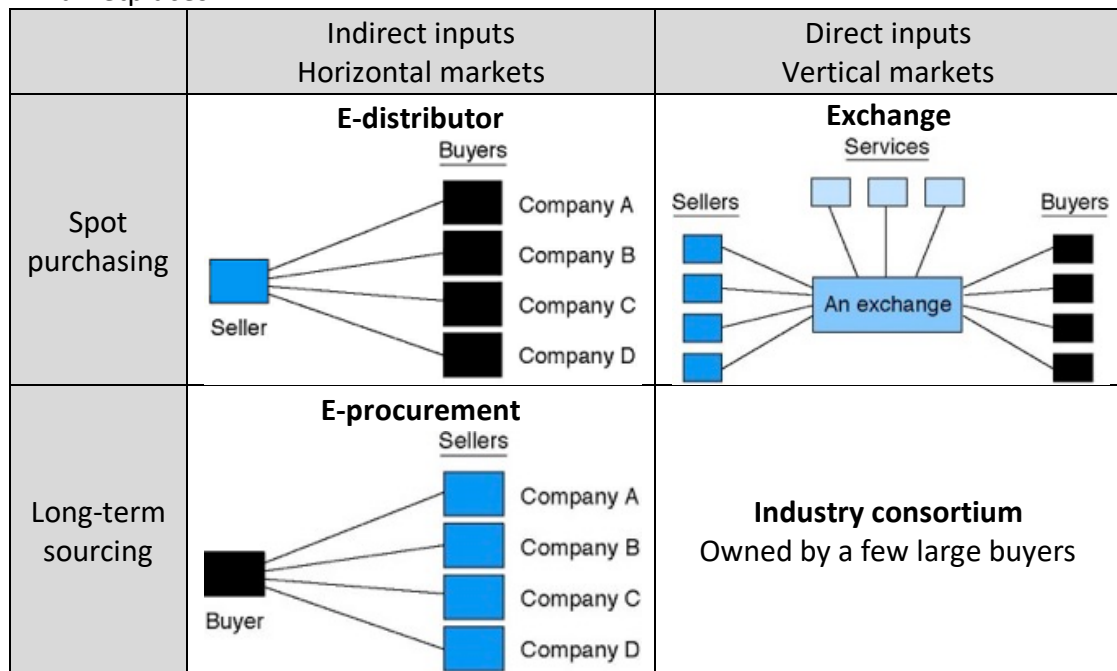
Business models

Revenue models

- Sales model
- Advertisement model
- Subscription model (e.g. **freemium strategy**)
- Transaction fee model
- Affiliate model

B2B business models

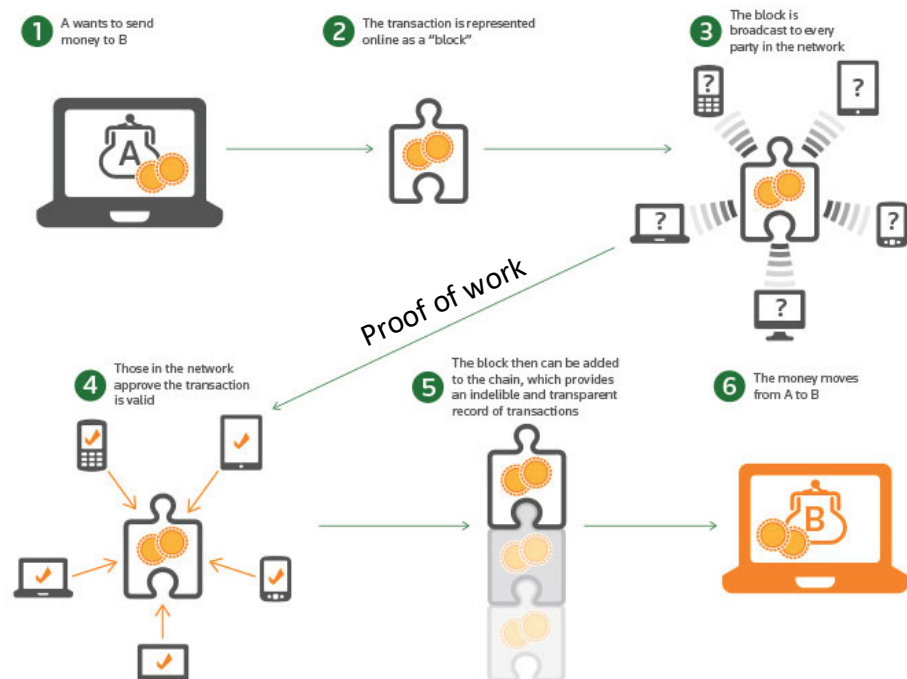
- E-marketplaces



- **Private Industrial Network (PIN)**
= few strategic business partner firms coordinate the entire business process
 - VMI counters bullwhip effect

B2C business models

- **E-tailer**
 - Virtual merchants
 - Clicks-and-mortar
 - Catalogue merchants
 - Manufacturer-direct→ Typical revenue model: sales model
- **Service provider** (e.g. cloud services)
→ Typical revenue model: subscription model
- **Community provider**
 - Potential crowdsourcing: e.g. crowdfunding (donation/rewards-based/equity/debt)→ Typical revenue model: advertisement, affiliate (and subscription) model
- **Content provider**
→ Typical revenue model: advertisement, subscription and sales model
- **Portal**
→ Typical revenue model: advertisement, affiliate, subscription and transaction fee model
- **Transaction broker**
 - Mobile payments: e.g. Bitcoin



→ Typical revenue model: transaction fee model

- **Market maker**
 - E.g. E-auctions: forward VS reverse; liquidation VS market efficiency
Automation → dynamic pricing, proxy bidding, sniping
! Unfair practices: puffing/shilling, bid shielding, auction rings→ Typical revenue model: transaction fee model

Online advertising

Types

Email advertising

Display advertising = bannering

- Classical banners: e.g. **text ad**, **banner**, **skyscraper**
- Pop-ups (e.g. **interstitial**, **layer/floating ad**) VS pop-under ads
- YouTube **true view ads**: in-stream ad or video discovery ad

Search engine advertising

- **Search Engine Optimisation (SEO)**
 - On-page optimisation: content (! e.g. keyword stuffing, doorway pages), robots.txt (! e.g. cloaking, adding invisible content)
 - Off-page optimisation: influence hyperlink structure → PageRank (! e.g. blog-ping/ping spam/sping, link farms)
- **Search Engine Marketing (SEM)**
 - Sponsored links, local ads and paid listing (via CPC bidding campaigns)

Social media advertising

- Social ads: uses the social graph of a platform (e.g. Facebook OpenGraph)
- Marketing on social media: include your ad in the interface of a platform

Pricing models

- Cost per click (CPC)
- Cost per action (CPA)
- Cost per mille (CPM) = $CPC * CTR (\text{click through rate}) * 1.000$
- Hybrid models possible

Real-time bidding: demand side ↔ **ad exchange/ad network** ↔ publisher

Personalised advertising = below-the-line

Contextual targeting VS behavioural targeting

- Personalize name
- Geo-targeting (via IP, GPS, cookies)
- Demographic or psychographic
- Dayparting, day of week, etc.
- Bandwidth
- **Pixel targeting** or **retargeting**

! Spam or unsolicited commercial email (UCE)

! Click fraud: publisher or competitor

! Adware

- ! Privacy:
- **Cookies**: first-party (regular HTTP) VS third-party (tracking)
→ flash cookies, evercookies, zombiecookies, device/browser fingerprinting, canvas fingerprinting
 - Search engines
 - Social networks
 - Internet Service Providers
 - Malware, spyware: e.g. keystroke logging
 - Phishing

→ Regulation: **GDPR** (in EU)

"Personal data shall be processed for specified and legitimate purposes, and shall not be used in a way incompatible with those purposes."

Web analytics

On-site VS off-site

Web usage mining VS web content mining VS web structure mining

Metrics

- Page views
- Visits and sessions
- Visitors
 - Unique visitors
 - Repeat visitors = visitors who return during period
 - New visitors = first-ever visit during period
 - Return visitors = visitors during period who have visited before that period
- Visit length (time on site/page) and depth
- Bounce rate of page X = $\frac{\text{only page X visited}}{\text{visits that start with page X}}$
- Bounce rate of site = $\frac{\text{single page is visited}}{\text{total number of visits}}$
- Page exit rate of page X = $\frac{\text{page X is last page of visit}}{\text{visits that include page X}}$
- Conversion metrics
 - Conversion (chain)
 - Conversion rate
 - Average visits/days to purchase (= pan-session metric)

Methods

- Segmentation
- Navigation analysis → funnel plot/Sankey diagram
- Experiment and test
 - A/B testing
 - Multivariate testing