

THE BUSINESS VALUE OF SEMANTIC TECHNOLOGY

From Vision to Mainstream Markets

2000 — 2010

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MILLS DAVIS

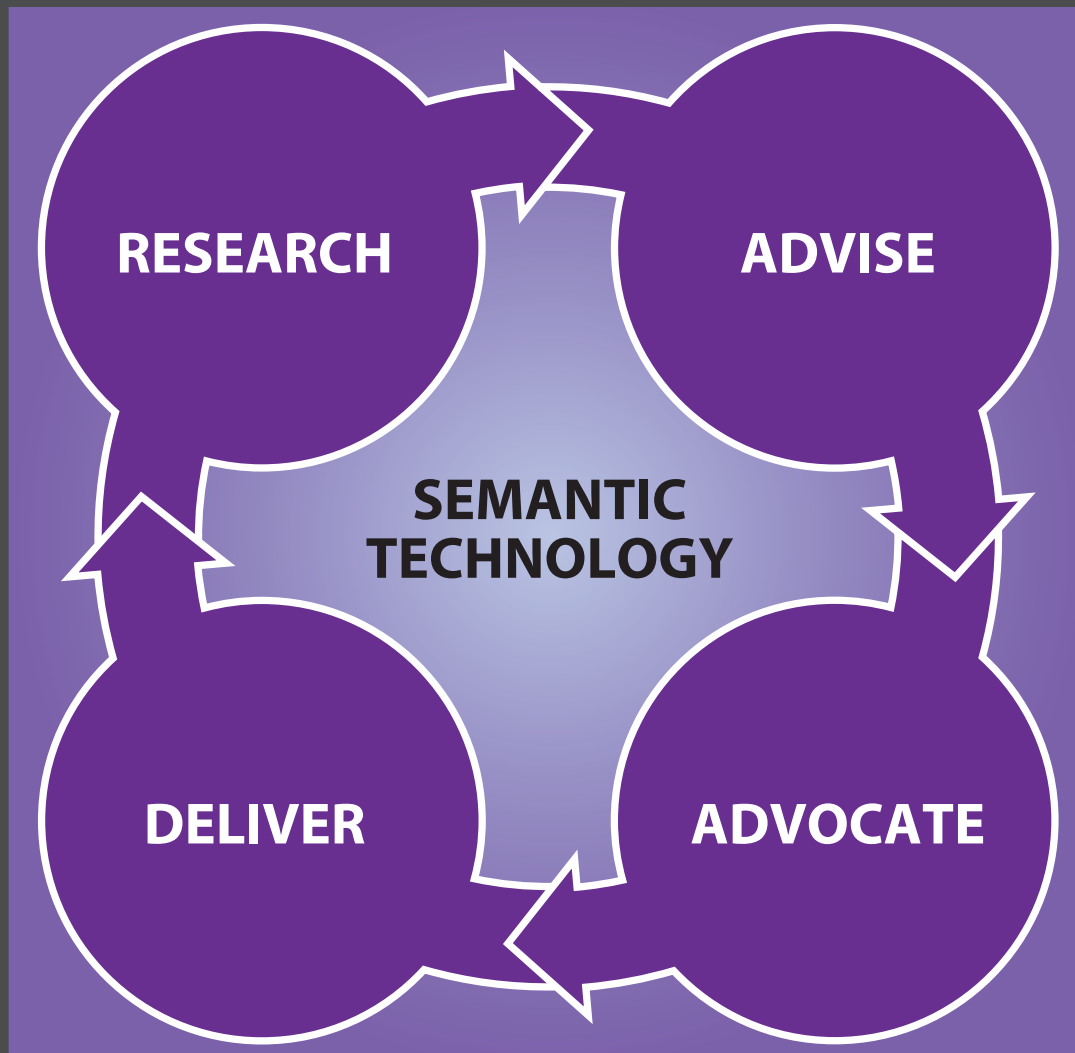


Mills Davis is TopQuadrant's managing director for industry research and strategic programs. He consults with technology manufacturers, global 2000 corporations, and government agencies on next-wave semantic technologies and solutions.

Mills directs TopConnexion, a multi-company initiative to build market awareness and accelerate adoption of semantic technologies.

A noted researcher and industry analyst, Mills has authored more than 100 reports, whitepapers, articles, and industry studies.

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Semantic technology consultants

RESEARCH

- Industry trends
- Markets
- Technologies
- Competition
- Best practices
- Business value

R&D

- Prototypes
- Demonstrators
- TRL 3-6

ADVISE

- Solution
Envisioning
- Strategy
- Business ROI

ADVOCATE

- TopConnexion:
build market
awareness
- Communities of
Practice: educate
collaborate, and
evangelize
- Campaign:
vertical market
development
(with partners)

DELIVER

- Pre-engagement
- Project mgmt.
- Semantic tech.
briefing/training
- Discovery
- Architecture
- Design
- Knowledge
engineering
- Development &
integration
- Deployment

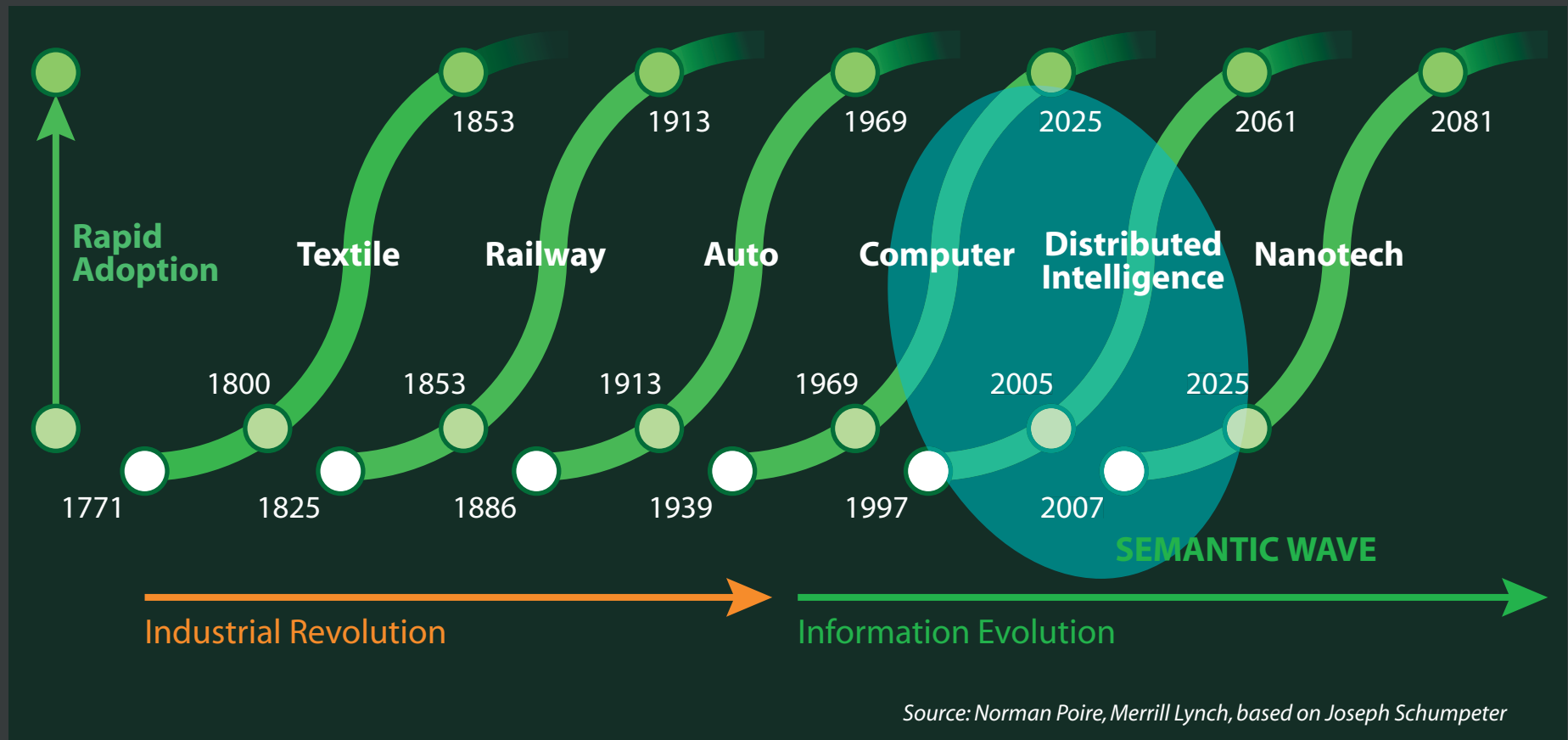
TOPICS

Business value of semantic technologies:

- Evolution of the semantic wave
- Early adopter experiences
- Growth of mainstream markets
- Conclusions

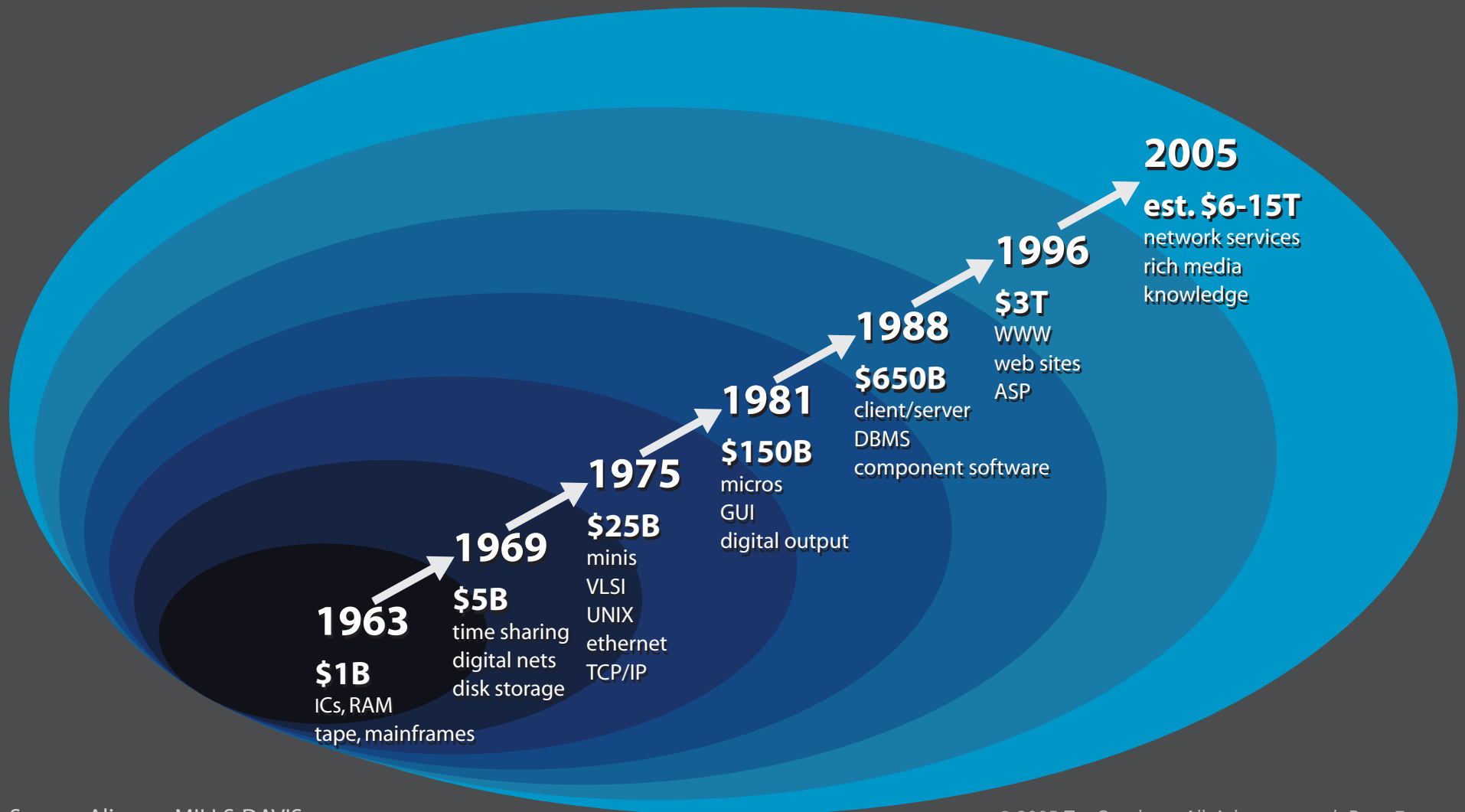
LONG WAVES OF INNOVATION...

What forces are driving the semantic wave?

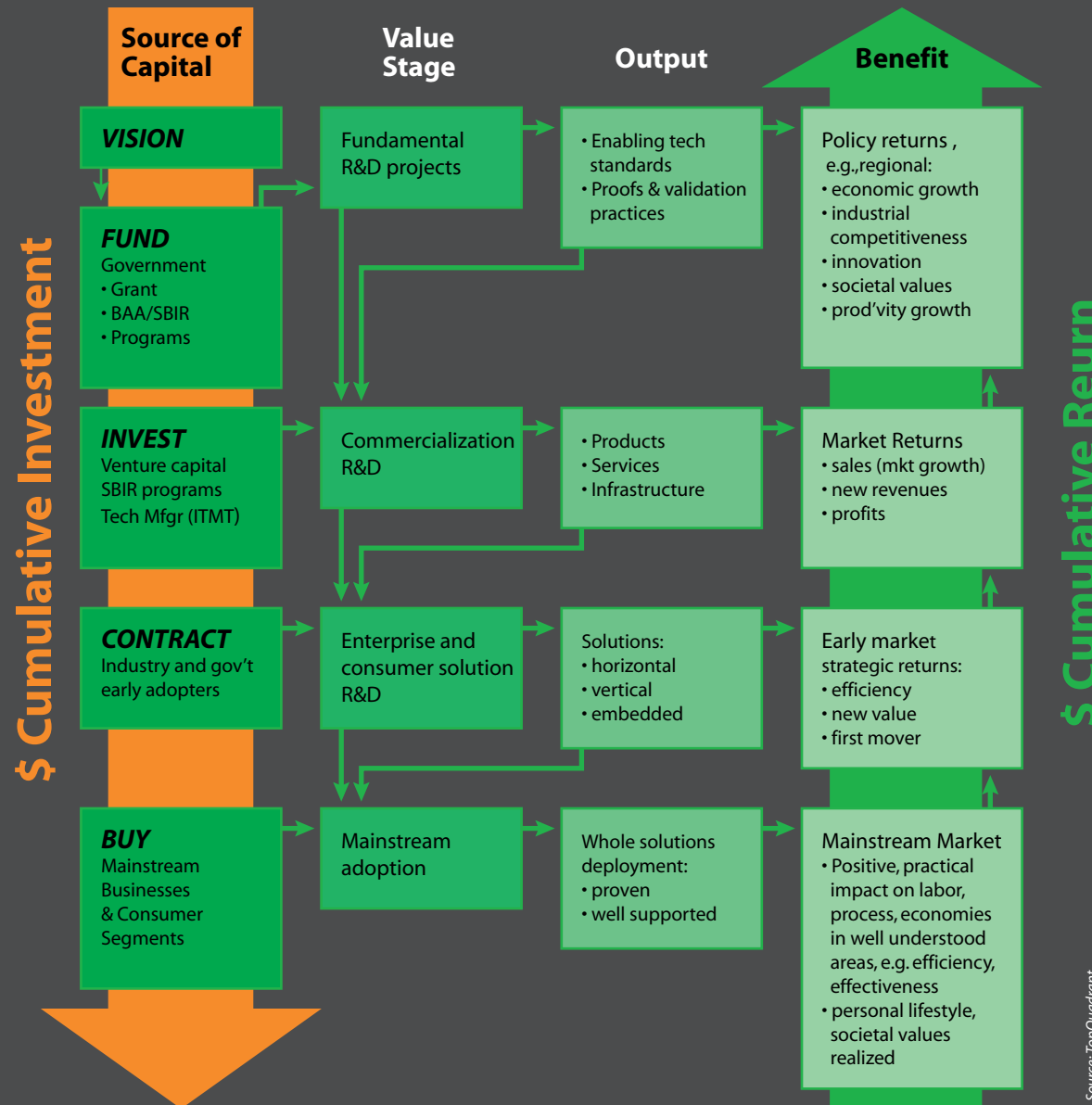


FUELED BY INVESTMENT CYCLES...

Next wave investment will dwarf previous cycles!

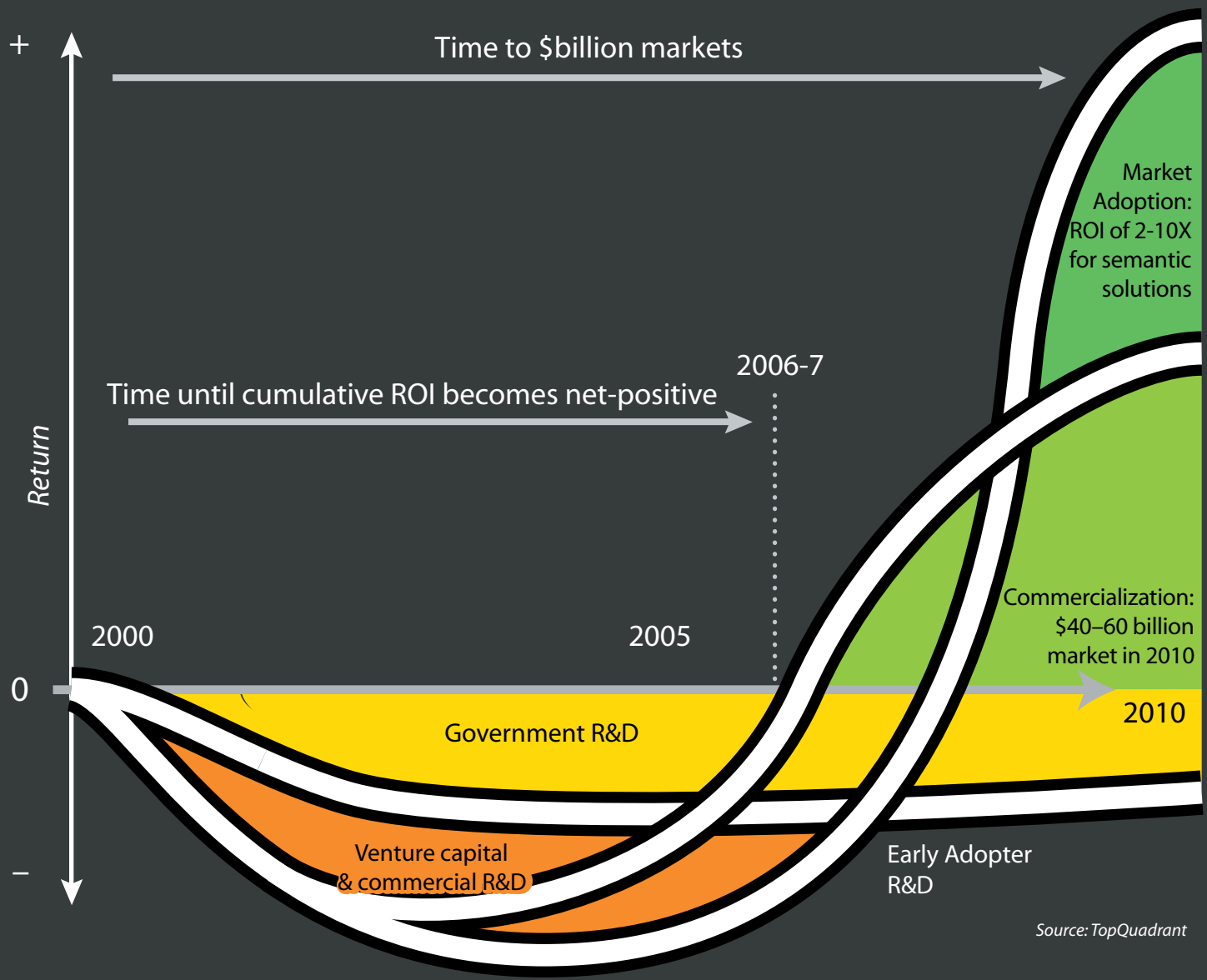


ANATOMY OF THE SEMANTIC WAVE



Source: TopQuadrant

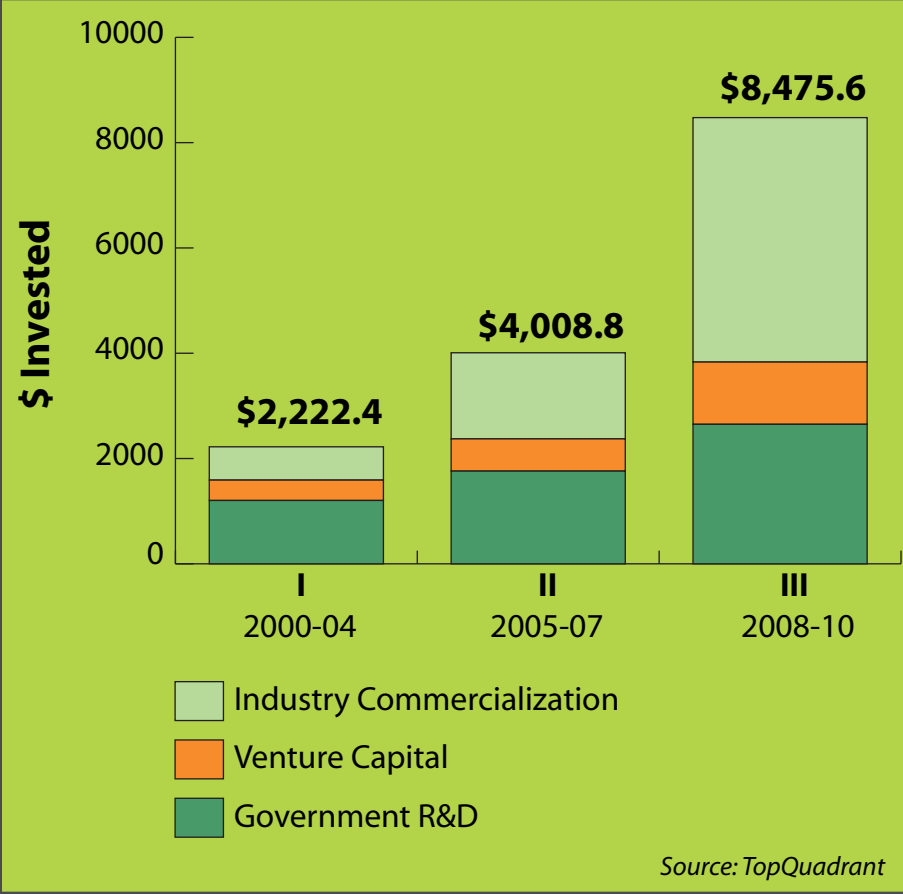
ECONOMICS OF THE SEMANTIC WAVE



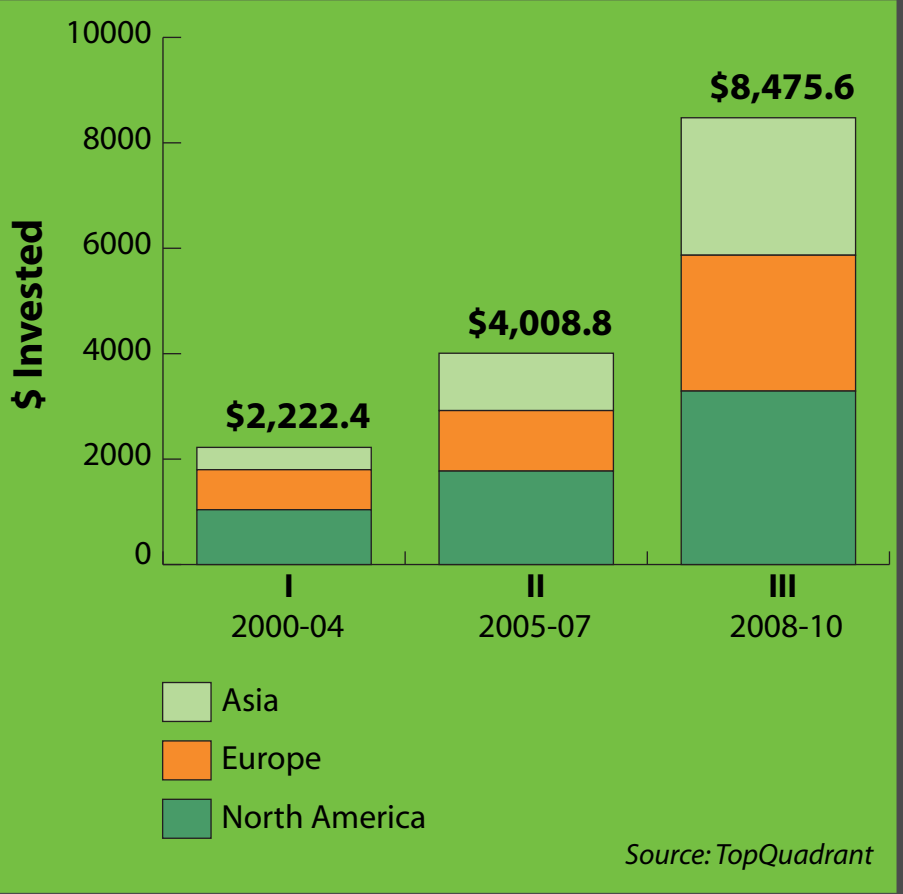
Source: TopQuadrant

INVESTMENT TO 2010 (\$M)

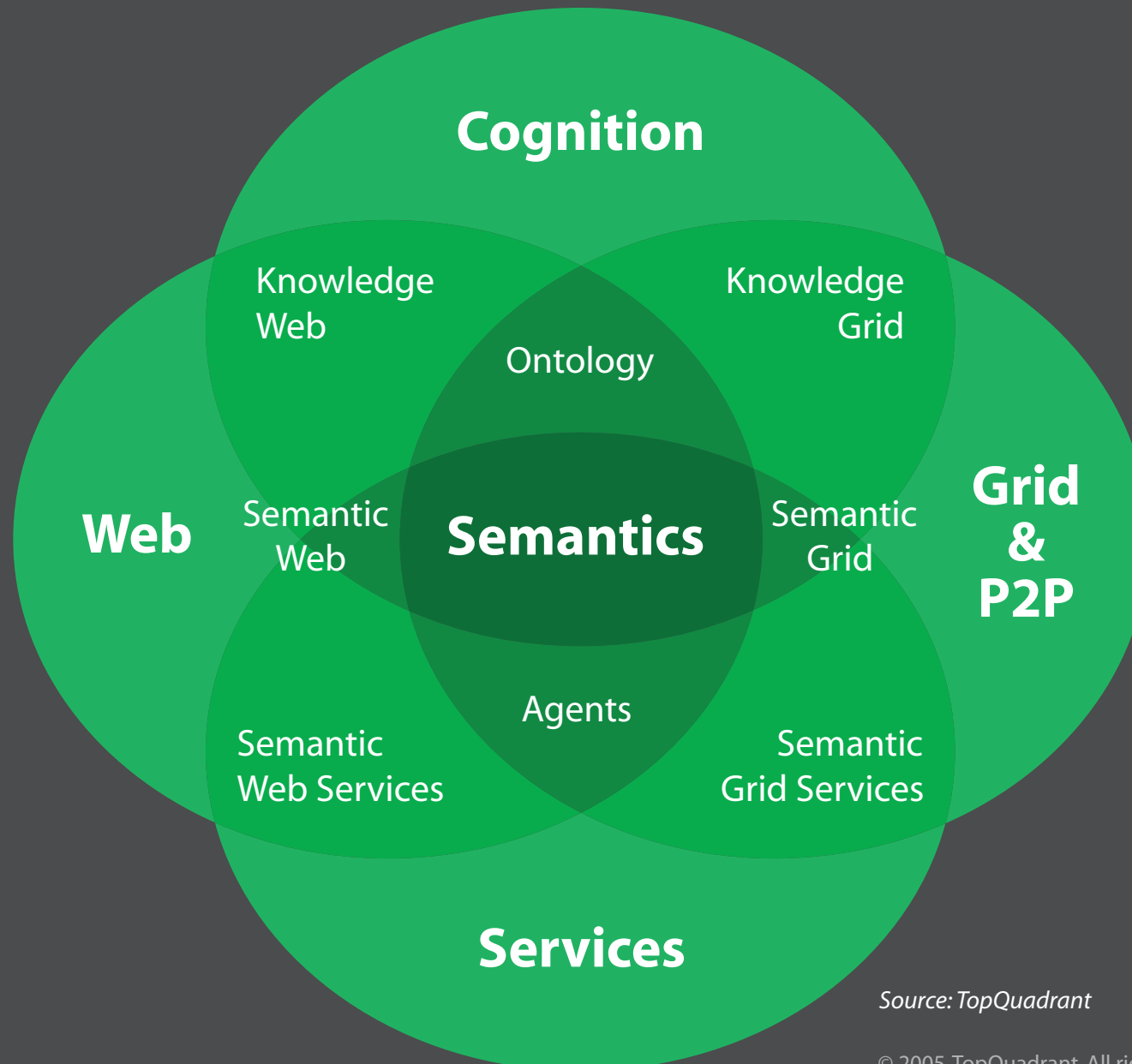
By type



By region



R&D THEMES IN THE SEMANTIC WAVE



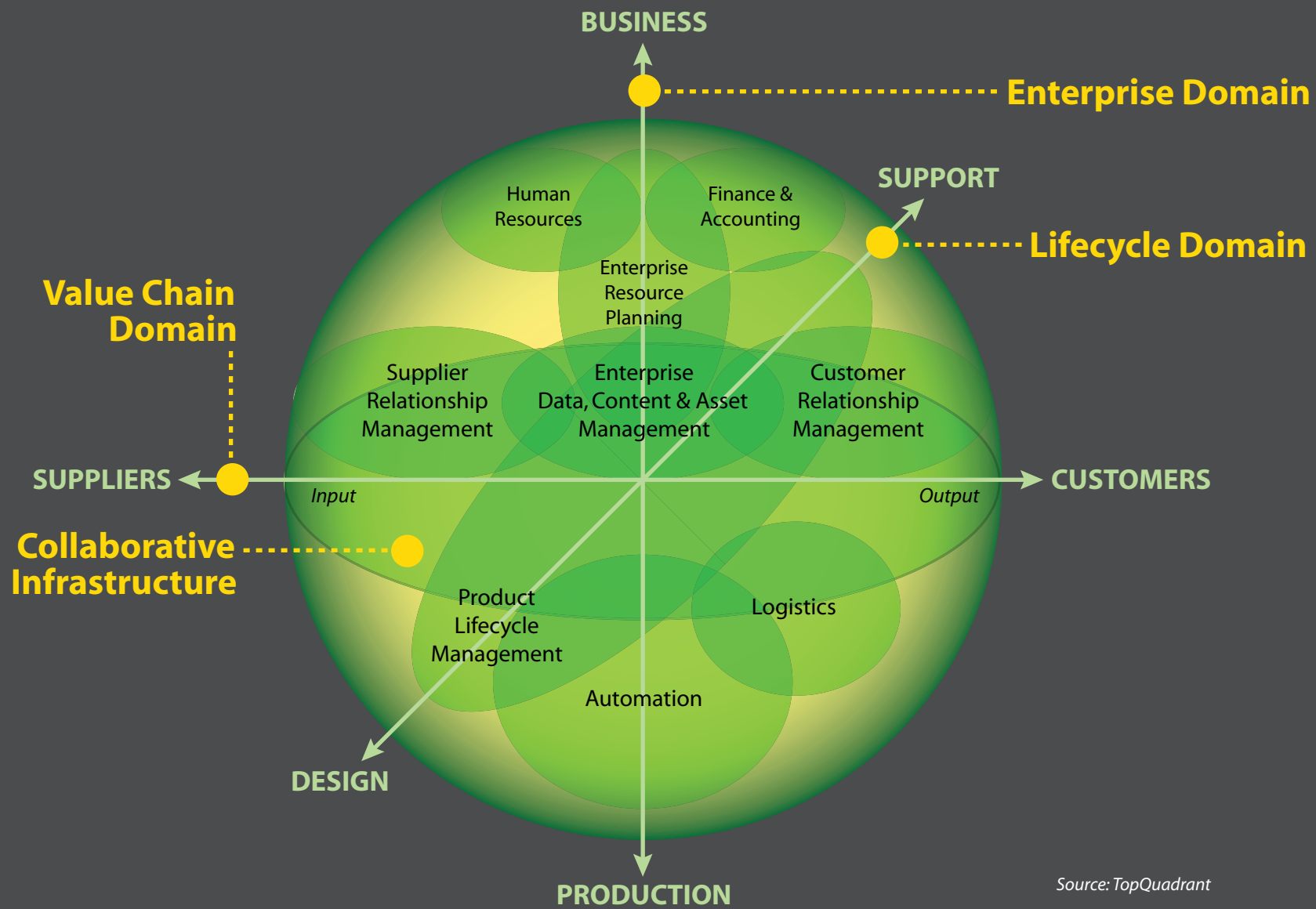
Source: TopQuadrant

COMMERCIALIZATION IN THE SEMANTIC WAVE

Function	Technology Providers Developing Semantic Solutions				
Discover, acquire, & create semantic meta-data for structured data and unstructured information	Active Navigation Adobe Aduna AKT Triple Store Amblit Technologies Anacubis Apelon	Clear Methods CoeTruman Technologies Cogito CognIT Cognos Compositee Compoze Software	Endeca Engenium Enigmatec EnLeague Systems Entopia Entrieva Epistemics Ltd.	Kofax L&C Merant Metallect Metamatrix Metatomix Miosoft	SeeBeyond Semagix Semanatic Sciences Semansys Technologies Semaview Semio Semtation GmbH
Represent, organize, integrate, & interoperate resources, content and knowledge using semantics	APR Smartlogik Arbortext Ask Jeeves AskMe Aspasia Astoria Software AT&T Attensity Autonomy Avaki BEA	Computas Computer Associates Conformative Systems Connecterra Connotate Context Media Contivo Convera Copernic Correlate Coveo Solutions	FAST FileNet GeoReference Online Global360 Google Grand Central Groxis H5 Technology Hewlett Packard Hummingbird	Modulant Mondeca Network Inference Neurok Noetix nStein NuTech Ontologent Ontology Works Ontoprise OpenText	ServiceWare Siderean SilkRoad Software AG Sony Stellent Stratify Sun Microsystems Sybase TEMIS The Brain Thoughtshare
Reason, interpret, infer, and answer using semantics	Black Pearl Blue Oxide BrandSoft Broadvision Btexact	Crystal Semantics Cycorp Dassault Systems DAY Digital Harbor	Hyperion IBM InfoData Systems Innodata (ISOGEN) Intellidimension	Oracle Pinnacor Primus Profium Radar Networks	Triple Hop Trous Unicorn Verity VerticalNet
Provision, present, communicate, and act using semantics	Business Objects C24 Solutions Captiva Celcorp ClearForest	Discovery Machine EasyAsk Ektron EMC/Documentum Empolis	Interwoven Inxight JARG Kalido KFI	RedDot Solutions Sandpiper Software SAP SAS SchemaLogic	Vignette Vitria XSB ZeroG

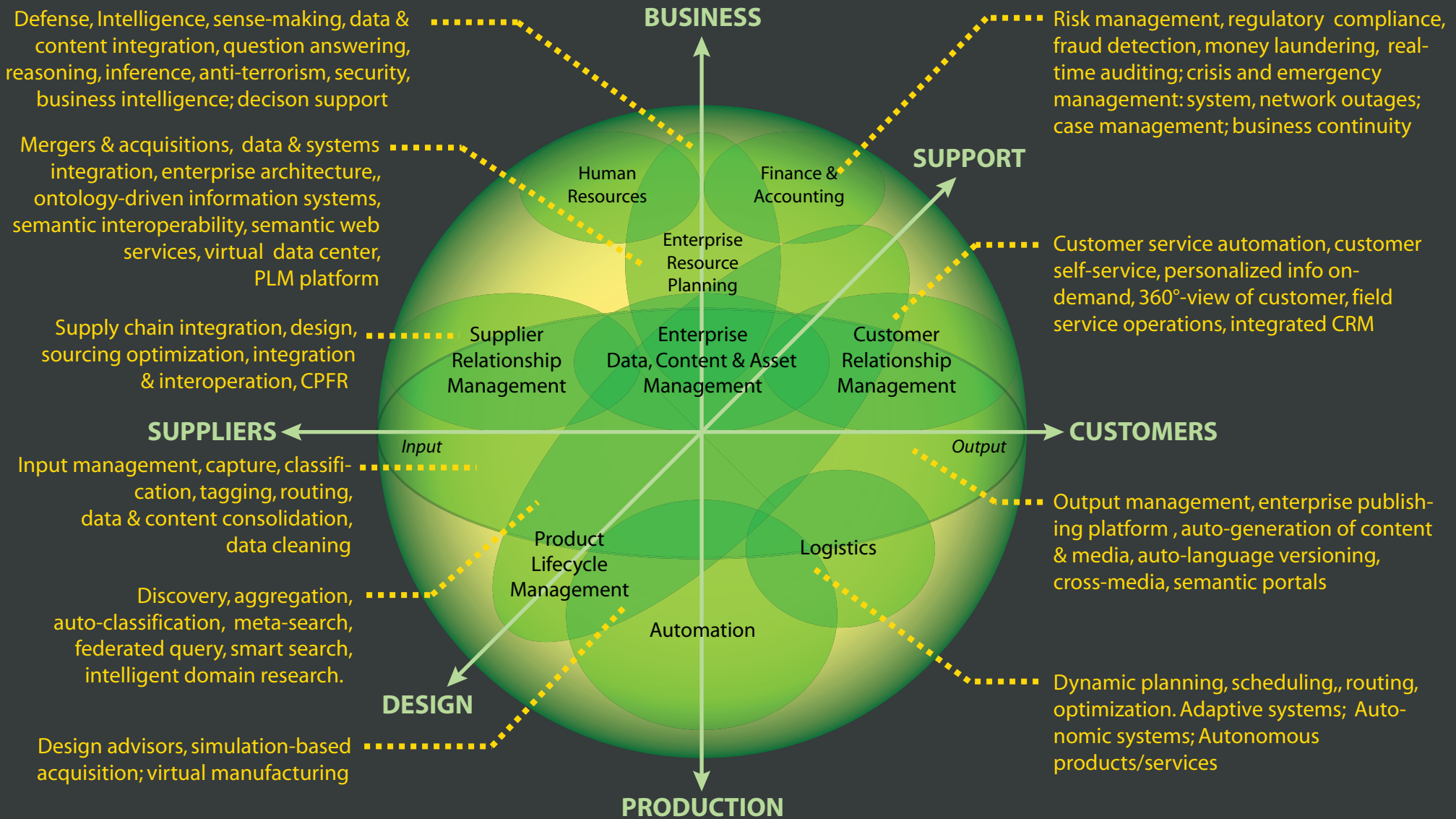
Source: TopQuadrant

EARLY ADOPTION OF SEMANTIC TECHNOLOGY



Source: TopQuadrant

EARLY ADOPTION OF SEMANTIC TECHNOLOGY



Source: TopQuadrant

BUSINESS VALUE OF SEMANTIC TECHNOLOGIES

EFFICIENCY	EFFECTIVENESS	EDGE
<p><i>Cost savings</i></p> <p>Doing the same job faster, cheaper, or with fewer resources than it was done before</p>	<p><i>Return on assets</i></p> <p>Doing a better job than the one you did before, making other resource more productive and increasing their return on assets and attainment of mission</p>	<p><i>Return on investment</i></p> <p>Changing some aspect of what the business does, resulting in growth, new value capture, mitigation of business risk, or other strategic advantage</p>
IMPACT OF SEMANTIC TECHNOLOGIES		
<p>20-80% less labor hours</p> <p>20-90% less cycle time</p> <p>30-60% less inventory levels</p> <p>20-75% less operating cost</p> <p>25-80% less set-up & development time</p> <p>20-85% less development cost</p>	<p>50-500% quality gain</p> <p>2-50X productivity gain</p> <p>2-10X greater number or complexity of concurrent projects, product releases & units of work handled</p> <p>2-25X increased return on assets.</p>	<p>2-30X revenue growth</p> <p>20-80% reduction in total cost of ownership</p> <p>3-12 month positive return on investment</p> <p>3-300X positive ROI over 3-years</p>

*Source: TopQuadrant

LIFECYCLE VALUE AND ROI

Development Stage



Lifecycle Activities

Diagnose problem
Envision solution
Map ontology
Make business case

Design semantic apps
Build business ontology
Connect resources
Integrate & test
Deploy

Use, operate solution
Monitor, measure performance
Maintain & support

Analyze new needs
Add capabilities
Upgrade solution
Optimize performance

Semantic Technology Benefits

Explicit business case
Knowledge needs modeled
Interrelated data, system sources
Value of legacy preserved
Make, buy, rent, share options
Flexible, federated architecture
Less time/cost to prototype

Business ontology speeds data, process integration
Composite applications give total picture, unified UI
Capital outlay reduced
Less time/cost to solution
Faster time-to-market
Faster return on investment
Reduced development risk

Faster, better decision-making
Cycle time, productivity improved
Higher service levels
Improved quality & reliability
Less training and support
Simplified maintenance
Reduced operating cost
Reduced total cost of ownership

Faster time to enhance
Greater agility, flexibility
Less capital re-investment
Real-time optimization
Faster time to deploy
Reduced development risk
Enhanced ROI

Source: TopQuadrant

SEMANTIC EAI

BUSINESS PROBLEM

- Global 2000 corporation needed to speed the process and reduce the cost and effort required to integrate enterprise business processes and applications across multiple locations.
- Maintaining point-to-point data transformation was becoming unsustainable. It was becoming cost-prohibitive to make changes in underlying data sources, message formats, and business rules since critical business logic and metadata was locked into proprietary applications and middleware.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based semantic information model providing leverage for integrating enterprise applications and data.
- *Efficiency gain* — High-level ontology-mapping reduces time and effort to integrate. 2-5X faster solution delivery. Reduced training and support and operating costs. Faster time to upgrade and enhance.
- *Effectiveness gain* — Enterprise processes and data sources map to each other through a common meta-model. Semantic development environment accelerates new & composite application deployment. Semantic portal puts information in context of total process, other applications, and all data sources.
- *Edge* — Reduce TCO by 20-65%. Financial exposure and developmental risk mitigated.

IT INFRASTRUCTURE RATIONALIZATION

BUSINESS PROBLEM

- A global financial services provider needed to overcome shackles of its client-server architecture.
- It needed only 6 databases to operate, but found it had more than 80 copies of some of these.
- New infrastructure solution and roadmap needed to decouple applications from data, eliminate redundancies, and provide higher quality data.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology meta-modeled information integration mapping data sources and inter-relationships.
- *Efficiency gain* — Operations, maintenance, and future development costs greatly reduced. Savings over 5 years in \$10s of millions.
- *Effectiveness gain* — Ontology decoupled applications from data. Eliminated 1/2 of redundant databases. Ontology permits creation of data transformations and “virtual databases” and “virtual data warehouses” providing real-time integrated queries across federated sources, with improved data control and quality.
- *Edge* — Faster time to deployment than conventional approaches. Substantially reduced TCO.

SCALABLE SEMANTIC SEARCH

BUSINESS PROBLEM

- Manufacturer needed a federated enterprise search capability that would scale to massive numbers of records, but whose performance (numbers of queries per second) would not degrade as with RDBMS or OODBMS indexing.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-driven graph database search.
- *Efficiency gain* — RDBMS and OODBMS search required indexing at each step; thus performance degraded as $L \log(N)$ where L is the path length and N is the number of records. Semantic graph database performed at scale because it required no indexing, eliminating the $\log(N)$ from the performance equation.
- *Effectiveness gain* — Graph-based search proved more than 10X faster than traditional query and delivered relatively constant performance regardless of number of records being searched.
- *Edge* — Scalable federated enterprise search.

VIRTUAL DATA CENTERS

BUSINESS PROBLEM

- A financial services firm needed scalable architecture for provisioning and managing IT across 1000s of databases, applications, and locations.
- Current fragmented situation was an operational cost time bomb.

SEMANTIC SOLUTION

- *Semantic solution — Ontology-based semantic service grid; policy-driven virtual data centers; autonomic components (self describing, self-provisioning)*
- *Efficiency gain — Development cost 25% of traditional. Operational savings > \$4M per year (fewer people).*
- *Effectiveness gain — Running 24 hours/day for several years.*
- *Edge — More sustainable IT infrastructure. Reduced TCO. Resources freed for new development.*

SEMANTIC SCM VIA SERVICE PLATFORM

BUSINESS PROBLEM

- Fortune 1000 company needed to integrate data and processes internally and with supply chain partners, while minimizing capital investment, time-to-solution, and total cost of ownership.

SEMANTIC SOLUTION

- *Semantic solution* — Semantic web service based shared resource platform for EAI, BPM, and B2B.
- *Efficiency gain* — No hardware, software, staffing. No maintenance or upgrade fees. TCO reduced up to 70%.
- *Effectiveness gain* — Fast partner on-boarding. Simple, self-service provisioning. Flexible change management.
- *Edge* — Service-oriented shared resource architecture enables faster ROI. No up-front investment. No fire-wall exposure. Readily scaleable, subscription based.

SIMULATION-BASED ACQUISITION

BUSINESS PROBLEM

- Government agency needs solution to better manage the lifecycle of complex systems-of-systems acquisitions.
- Solution must allow agency management to carefully align technologies to strategy, make better design decisions sooner, mature technologies well before deployment, build in partnership with an extended network of industry suppliers, accelerate time to deployment, and drive down lifecycle costs.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-driven simulation based acquisition (SBA) environment.
- *Efficiency gain* — External representation of concepts, relationships, logic and constraints speeds collaborative development and allows economical sharing, reuse, and evolution of capabilities across stages and organizations involved in a project.
- *Effectiveness gain* — Semantic models represent architecture, technology, and performance data for many purposes: proposal submission, engineering analysis, modeling, simulation, assessment, reporting and decision-making.
- *Edge* — Substantially reduce the time, resources and risk associated with the entire acquisition process. Increase the quality, worth and supportability of solution, while reducing their total ownership costs throughout the total life cycle.

EMERGENCY MANAGEMENT

BUSINESS PROBLEM

- Utility needed to manage emergencies (e.g. outages, breaches, service disruptions, etc.).
- Must make time-critical decisions that require total access to information in real-time, and in a context that supports its effective use.
- Solution must integrate disparate data, content and applications, and be deliverable within reasonable cost, time, effort, and risk.

SEMANTIC SOLUTION

- *Semantic solution* — Business ontology that connects data and processes providing real-time comprehensive integrated situation awareness. Semantic development environment for building composite applications and portal UIs.
- *Efficiency gain* — Semantic solution development is 2-5X faster and less costly. Having information in context eliminates searching for, and correlating sources. Faster response to query.
- *Effectiveness gain* — Ontology-based integration delivers real-time, 360 view from all relevant sources giving total picture for sense-making and decision support. Information in context enables faster, better decision-making. Productivity gain.
- *Edge* — Reduced TCO. Business risk mitigated.

REGULATORY COMPLIANCE

BUSINESS PROBLEM

- Public corporation needed to integrate policies, information, and processes into one view that provides legally defensible evidence of compliance with regulations such as Sarbanes-Oxley, HIPPA, Gram-Leech-Bliley.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based regulatory and standards models, semantic information and process models create “virtual databases” and metaview needed for compliance reporting and auditing.
- *Efficiency gain* — Reduced cost to establish compliance. Reduced cost to comply. Reduced cost to adapt as regulatory requirements, and internal systems change.
- *Effectiveness gain* — Ontologies map relationships between data sources and processes. Provide a unified view across all compliance-affected operations. Facilitates near real-time regulatory reporting and compliance audits. Provides foundation for cost-effective integration of process & data as well as process upgrades.
- *Edge* — Reduced TCO frees resources. Litigation risk mitigated.

CUSTOMER SELF-SERVICE CALL CENTER

BUSINESS PROBLEM

- A manufacturer needed to improve quality of customer service while reducing costs.
- Complex products and multiple product lines caused increased need for customer service, which is costly to provision, even with outsourcing.
- Cross-industries 40-80% of customers say they are dissatisfied with customer support.
- Also, 2/3 change provider after unsatisfactory service.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based self-service access to integrated content combined with case-based reasoning across similar problems to provide customer self-service.
- *Efficiency gain* — Electronic self-service reduces costs by more than 1/2. Cost savings through call avoidance was \$3M in first year. Maintenance of knowledgebase at 1/5 person-year.
- *Effectiveness gain* — 3/4 of the customers and 2/3 of the employees rate intelligent customer self-service as “good” or “very good.”
- *Edge* — Positive ROI in less than 12 months. Risk of customer defections mitigated.

SEMANTIC ENTERPRISE PUBLISHING

BUSINESS PROBLEM

- Global corporation needed to improve the effectiveness of lifecycle product communication while taking cost, time, and effort out of the process.
- Technical knowledge management spans content creation, content management, localization, cross-media publishing, and project and process management across geographic regions, business units, and supply-chain relationships.
- In support of PLM and global CRM, the strategy is to create once, localize once, store once, and deliver in multiple ways including web, CD, email, and print.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based platform for PLM and CRM technical knowledge creation, versioning, and cross-media delivery. Semantic metatagging. Semantic provisioning of multi-lingual text, graphics, documents, web pages, and interactive media.
- *Efficiency gain* — Save 1/4 to 1/2 of media communication spend. Semantic technology process improvements, sourcing and procurement standardization, integrated communications management . Save 1/4 to 1/2 of labor for authoring, graphics and illustration, production, and administration.
- *Effectiveness gain* — Time-to-market faster by 2-to-10 times. Concurrent support for multiple product launches in multiple geographic regions using multiple media channels.
- *Edge* — ROI of semantic technology-based solution is 2-5X faster.

KNOWLEDGE-CENTERED ENGINEERING

BUSINESS PROBLEM

- Large manufacturer needed a faster, more efficient engineering lifecycle that could scale to handle very large complex projects.
- Across the engineering lifecycle, a part design can translate into hundreds of drawings, schematics, and documents prepared for different disciplines, or usages at different stages.
- Currently, the workflow is document-centric, utilizing CAD and CAE tools as electronic pencils for creating and recreating documents.
- As project size and complexity grows, internal document maintenance and management consumes 80-90% of resources.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based engineering captures, represents, and maintains total product knowledge in a language-neutral, federated repository. Semantic applications generate all categories of engineering drawings, specifications, project documents, and technical literature as needed.
- *Efficiency gain* — Up to 5-10X faster design, build cycle. Up to 5-10X reduction in project costs. Up to 5-10X fewer engineering resources.
- *Effectiveness gain* — Knowledge-centered engineering enables control of larger and more complex projects than with conventional methods.
- *Edge* — ROI from taking huge amounts of labor, cost, and time out of the process. Lifecycle knowledge-base removes errors and inconsistencies; gives visibility to all parts and phases of the project; and stops knowledge erosion due to personnel changes.

VIRTUAL PRODUCT DEVELOPMENT

BUSINESS PROBLEM

- R&D unit of first-tier aerospace manufacturer needed to reduce product development cycle time and cost, while improving quality.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-integrated collaborative infrastructure, 3-D modeling, simulation and virtual reality tools
- *Efficiency gain* — Product cycle time and costs reduced by more than 50%.
- *Effectiveness gain* — Eliminate the need to build costly prototype hardware. Produce more efficient, supportable, higher performance systems with first-time quality.
- *Edge* — Customer and stakeholder access to virtual prototypes improves product quality and mitigates development and business risk.

DESIGN ADVISORS

BUSINESS PROBLEM

- Auto manufacturer needed to reduce the cycle time, cost, and labor required to develop new parts and product designs.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology, rule, and parametric based design advisors
- *Efficiency gain* — 20-40% gain in productivity. 25-95% savings in total cost of design.
- *Effectiveness gain* — Design advisors in use and proven effective for transmissions, crankshafts, powertrain components, drive line layouts, rack density, hood and decklid, stamping dies, direct field vision, tool design, injection molding, and many other applications.
- *Edge* — 50-75% gain in quality attaining 6-sigma certification.

LITIGATION DISCOVERY

BUSINESS PROBLEM

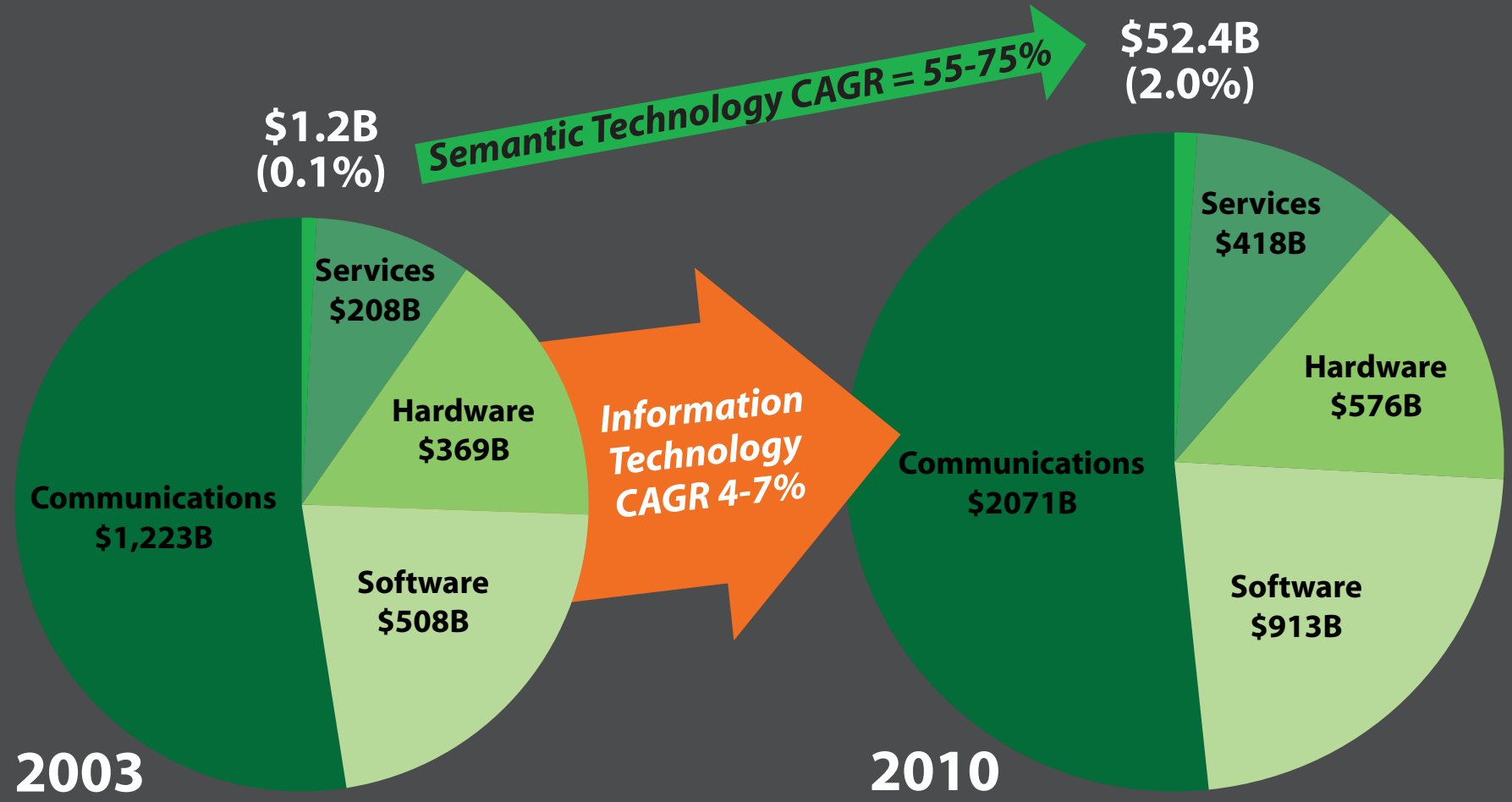
- Legal firm needed to improve the speed and comprehensiveness of their pre-trial discovery process.
- The discovery phase of the litigation process is critical for preparing a winning argument.
- Litigation teams must examine volumes of documents in a short period of time in order to identify all that are relevant to their case.
- Failure to identify and examine all relevant documents can incur significant risks to firm and its client.

SEMANTIC SOLUTION

- *Semantic solution* — Ontology-based directed discovery applies a knowledgebase of legal expertise together with case-specific criteria to automate scanning, evaluation, and identification of all documents relevant to the case out of the total collection. Benchmarking used to establish accuracy, follows set-up.
- *Efficiency gain* — Up to 2-3X faster document review. Up to 2-3X more accurate, comprehensive, and consistent review process across all stages of litigation.
- *Effectiveness gain* — Semantic/ AI-based system misses between 80% and 95% fewer actually relevant documents than humans typically do.
- *Edge* — ROI from acceleration of discovery process, reduced cost to litigate, and improved odds (competitive advantage.) Mitigates legal and financial risks.

MARKET GROWTH TO 2010

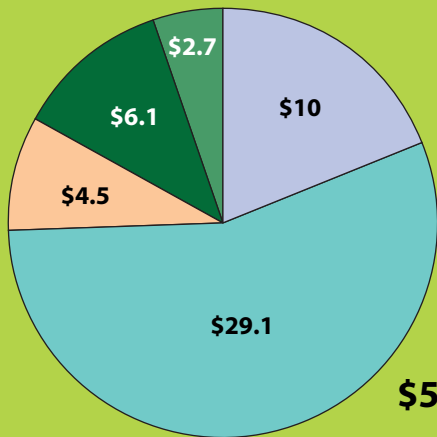
For semantic and information technologies



Sources: WITSA, IDC, Gartner, Meta Group, VSS, McKinsey, TopQuadrant

SEMANTIC TECHNOLOGY MARKET TO 2010 (\$B)

Horizontal

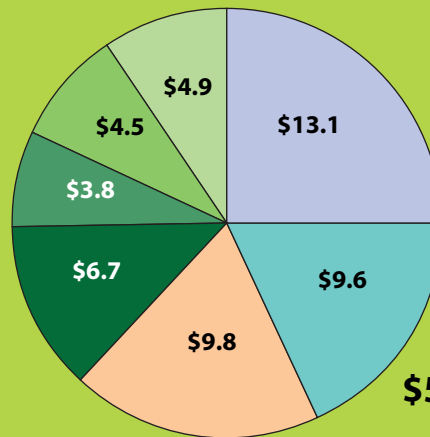


\$52.4 Total

- Discover & Access
- Integration & Interoperation
- Reasoning
- New Infrastructure
- Provision & Communication

Source: TopQuadrant

Vertical

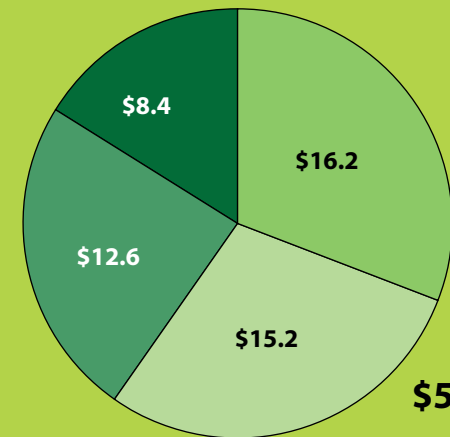


\$52.4 Total

- Services
- Government
- Transport, Com
- Finance
- Trade
- Consumer
- Manufacturing

Source: TopQuadrant

Regional



\$52.4 Total

- Europe
- Asia
- North America
- ROW

Source: TopQuadrant

SUMMARY

- Global investment in semantic technologies by governments, venture capital, and industry is accelerating and will approach \$15 billion this decade.
- More than 65 companies currently offer semantic technology products. Twice as many have product R&D underway.
- Early adoptor research documents 2–10 times improvements in key measures of performance across the solution lifecycle.
- Semantic technology is ready to “cross the chasm” from R&D and early adoptors to mainstream markets.
- Semantic solution, services & software markets will grow rapidly, topping \$50B by 2010.