Smarter Planet Meets Manufacturing: Big Data and Analytics

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As we look at the electronics industry landscape today, there are at least five key mega-trends driving change.

Drivers of Change (Mega-Trends)

Technology  Growth Markets  Globalization  Sustainability  Customers
These mega-trends present both challenges and opportunities.

**Mega-Trends**

- **Technology**
- **Growth Markets**
- **Globalization**
- **Sustainability**
- **Consumers**

**Key Industry Challenges & Opportunities**

- **Managing Complexity**
  Managing complexity & advances in technology while enabling dynamic value chains

- **Ecosystem-Wide Operations**
  Enhancing ecosystem-wide operations & performance; optimizing asset utilization

- **The Demanding Consumer**
  Satisfying rising consumer expectations and executing in globally dispersed markets

- **From Products to Services**
  Expansion beyond products to new business models and service delivery platforms
The growing velocity of the volume, variety, and granularity of information is driving new, unprecedented complexity.

Image provided by Go-Globe.com at http://www.go-gulf.com/blog/60-seconds
Volume of Digital Data

Every day, 15 petabytes of new information are being generated. This is 8x more than the information in all U.S. libraries.

By 2010, the codified information base of the world is expected to double every 11 hours.
Variety of Information

Today, 80% of new data growth is unstructured content, generated largely by email, with increasing contribution by documents, images, and video and audio.

38% of email archiving decisions receive input from a C-level executive and 23% from legal/compliance professional.
Velocity of Decision Making

70% of executives believe that poor decision making has had a degrading impact on their companies’ performance.

Only 9% of CFOs believe they excel at interpreting data for senior management.
With this explosion in information …

…organizations are operating with blind spots

1 in 3
Business leaders frequently make decisions based on information they don’t trust, or don’t have

1 in 2
Business leaders say they don’t have access to the information they need to do their jobs

83%
of CIOs cited “Business intelligence and analytics” as part of their visionary plans to enhance competitiveness

60%
of CEOs need to do a better job capturing and understanding information rapidly in order to make swift business decisions
We can sense and see the exact condition of everything in Smarter Manufacturing.

87 trillion
There are 87 trillion measurements performed world wide in semiconductor plants annually.

2 million
There are 2 million RFID’s embedded tags world wide in semiconductor plants use to track product.

130 billion
There are 130 billion Chips produced in the world wide in semiconductor plants annually.
Smarter Manufacturing can communicate and interact with in entirely new ways.

1.4 quadrillion
1.4 quadrillion pieces of data transfer annually in semiconductor plants

119,000
There are 119 thousand servers worldwide in semiconductor plants

5.73X
There are 143 thousand miles of cable to support the communication network… 5.73 times the Earth’s circumference
Our world is becoming smarter

Instrumented

Interconnected

Intelligent

creating a need for a new kind of intelligence
Smarter Manufacturing Characteristics and Benefits

**Characteristics**

- Instrument
- Interconnect
- Intelligence

**Benefits**

- Manage
- Drive
- Create Meaningful

- Manage variability
- Drive velocity
- Create Meaningful visibility
Imagine what can change when manufacturing is Instrumented.

Bridge and Fill the GAPS at every level and manage variation.

Realize lower cost structure through Instrumentation.
  - Collecting the correct data and measuring against expected performance
  - Immediately breaks down the wall between Planned and Actual performance

Measure and monitor Everything because Everything Matters!
Imagine what can change when manufacturing is Interconnected

Immediately drive **Velocity** by reducing unnecessary buffers

Eliminate buffers when you:
- Know what to do next
- Sustain priority
- Manage constraints
- Leverage capability

Connect and Synchronize Everything because **Everything Matters**!
Imagine what can change when manufacturing is Intelligent

You can only fix problems you can see with meaningful Visibility

More than dashboards:
- Predictive Alerts
- Anticipate performance
- Accurate System Prediction
- Collaborate across the Mfg. network
- Intelligence at the point of decisioning

Apply Analytics to Everything because Everything Matters!

Would your company pass the test?
Smarter Manufacturing delivers V³ thru instrumentation, interconnection & intelligence because everything matters.

Visibility and control is the key factors for virtual single factory

- Global Integrated View provides collaborative visibility in the ecosystem.

Issue 1: Production control in the virtual factory

Issue 2: Quality assurance and traceability

Issue 3: Cost reduction initiative in the ecosystem

Integrated View
Something Profound has Happened … Manufacturing tools have evolved and converged; enabling us to meet the challenge of manufacturing volatility head on!

Use resources effectively by managing:

- **V**ariability

Turn cash quickly by driving manufacturing:

- **V**elocit

Be predictive and adaptable with meaningful:

- **V**isibility
Business Analytics is more than just Business Intelligence…its increasing the level of analytics sophistication allows an organization to improve results and adopt new ways of working

Use **structured** and **unstructured** Data

- Numeric
- Text
- Image
- Audio
- Video

Made consumable and accessible to **everyone**, **optimized** for their specific purpose, at the point of impact, to deliver **better decisions and actions** through:

- **Descriptive Analytics**
  - What happened?
  - How many, how often, where?
  - What exactly is the problem?
  - What actions are needed?

- **Predictive Analytics**
  - What could happen?
    - Simulation
  - What if these trends continue?
    - Forecasting
  - What will happen next if?
    - Predictive Modelling

- **Prescriptive Analytics**
  - How can we achieve the best outcome?
    - Optimization
  - How can we achieve the best outcome and address variability?
    - Stochastic Optimization
Can we design a computing system that rivals a human’s ability to answer questions posed in natural language, interpreting meaning and context and retrieving, analyzing and understanding vast amounts of information in real-time?
Watson video here
Watson’s analytics is more than search

- Web search returns a ranked list of ‘possible’ web pages containing the requested data
  - Search engines results are based on popularity and page ranking
  - User must still analyze results – sift through a web page -- to find the best answer

- Watson’s analytics understand the structure and wording of the question asked
  - Finds a specific answer
  - Ranks its answer and provides a level of ‘confidence’ that it is correct based on experience

- Watson answers ‘natural language’ questions
  - Can contain puns, slang, jargon and acronyms that must all be evaluated
Automatic Learning From “Reading”

Volumes of Text → Syntactic Frames → Semantic Frames

- Sentences are parsed into syntactic frames.
- Syntactic frames are then converted into semantic frames.

Examples:
- Inventors patent inventions (.8)
- Officials Submit Resignations (.7)
- People earn degrees at schools (0.9)
- Fluid is a liquid (.6)
- Liquid is a fluid (.5)
- Vessels Sink (0.7)
- People sink 8-balls (0.5) (in pool/0.8)
Find the answer to a question

- **Question**
- **Clue/ Category Analysis**
- **Primary Search & Candidate Generation**
  - 1000s of Candidates
- **Distributed Search Engine**
  - 100s of Hits
- **Shallow Scoring & Filtering**
  - 10s of Candidates
- **Supporting Evidence Retrieval**
  - 10ks Pieces of Evidence
- **Deep Evidence Scorers**
  - 100ks of Scores
- **Final Merging / Ranking**
- **Statistical Models**

- **1000s of Candidates**
- **10ks of Pieces of Evidence**
- **100ks of Scores**

**DeepQA System**

- Reads huge volumes of text to acquire wide range of knowledge
- 100s of Millions of facts inform and refine text interpretation
In May 1898, Portugal celebrated the 400th anniversary of this explorer’s arrival in India. In May, Gary arrived in India after he celebrated his anniversary in Portugal.

This evidence suggests “Gary” is the answer, but the system must learn that keyword matching may be weak relative to other types of evidence.
In May 1898 Portugal celebrated the 400th anniversary of this explorer’s arrival in India.

On the 27th of May 1498, Vasco da Gama landed in Kappad Beach.

The evidence is still not 100% certain.

Stronger evidence can be much harder to find and score.

Temporal Reasoning

Statistical Paraphrasing

Geospatial Reasoning

- Search Far and Wide
- Explore many hypotheses
- Find Judge Evidence
- Many inference algorithms

May 1898

400th anniversary

celebrated

Portugal

arrival in

India

explorer

27th May 1498

landed in

Kappad Beach

Vasco da Gama

Date Math

Para-
phrase

Geo-
KB

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DeepQA: The Technology Behind Watson

Generates and scores many hypotheses using Natural Language Processing, Information Retrieval, Machine Learning and Reasoning Algorithms. These gather, evaluate, weigh and balance different types of evidence to deliver the answer with the best support it can find.

Learned Models help combine and weigh the Evidence

Answer & Confidence
From battling humans at Jeopardy! to transforming business
Watson’s capabilities for business applications

Watson’s technology is a powerful tool for information gathering and decision support
- Responds to questions in natural language
- Returns a ranked list answers based on confidence
- Provides summaries of justifying or supporting evidence

Business applications could include:
- Customer Relationship Management
- Regulatory Compliance
- Contact Centers
- Help Desks
- Web Self-Service
- Business Intelligence