Disruptive Technologies in Construction
The impact - disaster or opportunity
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Content

- Is there an issue with construction performance?
- **Innovation** in South Africa
- Key questions relating to **Disruption** in the SA context
- Challenges around **Disruption** and its impact
- How **Disruption** plays out in the SA context
- **Disruptive impact** of globalisation on our industry
- What can our schools of Engineering and Construction Management contribute?
Poor performance contributors*

- Low Productivity
- Poor Predictability
- Structural Fragmentation
- Leadership Fragmentation
- Low Margins, Adversarial Pricing Modules, and Financial Fragility
- Inappropriate Training Funding and Delivery Model
- Workforce Size and Demographics
- Lack of Collaboration and Improvement Culture
- Lack of R&D and Investment in Innovation
- Poor Industry Image

* Recent UK Construction Industry Study

Innovation in South Africa

Innovation spawning sites

- Academic institutions
- Corporations with a clear R&D drive and focus
- State research institutes
- Amongst us / the population / entrepreneurs

- Globalisation leads to influx of innovations and subsequent adaptation to local and African conditions
Innovation in South Africa
Innovation directions in construction

Implement able
• Telematics
• Smaller scale 3D Printing
• Survey technology – Cloud point, Drone survey, GPS
• BIM & Simulation
• 5D Construction planning, estimating and execution
• Collaborative delivery and project integration and information models
• Real-time production tracking

Near Horizon
• Exoskeletons – Partial Robotics
• Drone scanning and progress updating
• Alternative materials further development
• Full scale 3D structure creation

Blue Sky
• Autonomous vehicles
• Self healing structures

Mobile Operator Training Simulators
Simulators in use on mining and earthmoving construction sites.
Innovation in South Africa
Innovation uptake and productive implementation

Uptake impacted by:
• Impetus or driving momentum
• Lack of cohesive central guidance and leadership
• Work Ethics

Impetus
• Freedom rather than necessity? Not central to strategy
• Lack of central guidance and cohesive strategy
• The need and ability to pay for innovative products in our field
• Guided by a current pressing need or political will
• Very little long term thinking happening in our world, a battle for survival and short term solutions

Lack of cohesive central guidance and leadership
• Fixation on matters other than productive delivery
• Experience on the altar of transformation
• Bureaucracy and red tape a big stumbling block
• Lack of funding and support
• No central example of driving national productivity, competitiveness and innovation
Innovation in South Africa
Innovation uptake and productive implementation

Work and ethics

- Poor work ethic
- Low respect for original thinking and development. Copy and paste seems more expedient
- Instant gratification generation
- Our industry perceived as not being sexy
- Poor productivity is the norm
- Sense of entitlement prevails
- Lack of experienced skills
- Argue *why not* rather than *why*

Key Questions

1. *Does Innovation awaken Disruption?*
2. *What are the expected disruptive technologies in the Construction Landscape*
3. *Where will disruption originate?*
4. *Is our industry a ripe target for disruption?*
5. *What are the limiting factors holding back Disruptive innovation*
Key Questions:

Does Innovation awaken Disruption?

- All innovation does not disrupt
- Disruption does not necessarily originate from innovation ??
- Disruption could be incremental, collaborative ..... 

- Innovation however sparks ideas and stimulates the thinking

Key Questions:

Expected disruptive technologies in the Construction Landscape

- Artificial Intelligence and Machine Learning
  - Production
  - Safety and failsafe
  - Autonomously operated equipment
- Photogrammetric and Point Cloud technologies
  - Drone technology
- Augmented Reality, Simulation and Gaming Techniques
  - Pre-construction planning
  - Simulation of risky and complex processes and procedures
  - Training of work crews prior to construction
- Materials and manufacturing techniques
  - Full scale 3D printing
  - Scalable manufacturing facilities
- Remote sensing and management
- Robotics / Exoskeletons
- Equipment ownership and use models
Key Questions:

Where will disruption originate?

Inside or outside our industry?

• From where there is the greatest benefit to be derived.
  
  Could well be totally unaligned business seeing opportunities in the construction industry.

Key Questions:

Is our industry a ripe target for disruption?

The South African landscape and the determinants?

• Total free market not ruling with an industry regulated and in particular state expenditure regulated
• Economic benefit originating in the private sector will be the bow of the ship
• Cost drivers will determine
• Better deployment of scarce resources
  – Spatially / Geographically
  – Trades and skills shortages
  – We need to do more with less

• Our industry productivity is low
The Teicholtz research underscores three key areas that contribute to the drag on labour productivity:

- **Non-integrated IT applications** from design, estimating, job scheduling, job cost and procurement.
- **Procurement processes** built on pure competition versus collaboration.
- **Paper-based system for collaboration** among construction industry partners.

Key Questions:
*Limiting factors holding back Disruptive innovation*

- Data
  - Big data collection and handling
  - Construction Sensing and information collection
- Lack of R&D on local implementation
- Regulatory and political factors
- Connectivity and prohibitive data costs
- Ability to buy in expensive foreign technology
- Policy uncertainty inhibiting investment
- Limiting procurement environment in public sector

Challenges around Disruption and its impact
*What will the determinants for survival be?*

- Organisations with risk and redundancy focus
- Be change “fit”
- Have zero complacence
- Have ability to work with data, analyse and react fast
- Our People:
  - Leaders must:
    - Inspire Passion
    - Create Urgency
    - Signal Importance constantly
  - Need employees that can work with change and uncertainty
  - Creative and continuously learning employees
- Be a learning and innovating business
- Disrupt or be disrupted – Be a disruptor, do not accept status quo
Challenges around Disruption and its impact

How must we prepare our organisations?

Our People
- Out of comfort zone
- Willing to take risks
- Bias for action
- Ambition
- Desire to learn and renew
- Ability to utilise technology and handle information

Our company and its resources
- Reconsider capital expenditure focus and drive
- Do we need to own plant?
- Structure to be nimble and adaptable
- Harness technology
- Focus on alliances and partnerships that compliment

How disruption plays out

Disruption of the delivery channel
- New methods of negotiating and placing contracts
- Different roles in project execution

Design and service disruption
- New and faster design processes
- Integration of design, construction and life long maintenance of structures and facilities
- Live monitoring and evaluation
- Remote sensing
- Simulation and AR
How disruption plays out

**Revenue Stream** Disruption
- Payment and ownership models change
- Financing of projects different
- Involvement of other players in the area

**Cost Model** Disruption
- Radical cost reduction of constructive process
- How we pay for input costs

**Resource base** Disruption
- Owning of plant and equipment
- Own people?

Disruptive impact of globalisation on our industry

- Manufacturing offshore
- Continuous work cycle in project planning, design and preparation. Possibly also project management
- Value added where?
- International trade barriers disappearing?
Schools of Engineering and Construction Management contribution

**Undergraduate course content**
- Good science grounding retained
- Students must learn to self learn and discover ... No spoon feeding
- Think tank and creativity experiences

**Post-Graduate Focus**
- Facilitate life long learning
- Opportunities for continuous refresher and supplementary training
- Distance and e-learning
- The hub for refreshing and updating during a career

**Research Focus**
- Data handling and management
- Risk and redundancy
- New materials and alternative building methods
- Plant and equipment implementation improvement and mechanization
- Factory and production line based manufacturing
- Procurement and construction delivery innovation

Schools of Engineering and Construction Management contribution

**Appealing Traits in new employees**
- Energetic
- Curious
- Focused
- Excited and lively
- Extra circular interests and activities
- Broad perspective
- “Data & information enabled”
- Bias for action
Conclusion

Disruption – Disaster or Opportunity

• Disruption will be inevitable in our industry
• Could be radical
• Will benefit those prepared for it
• We need to constantly prepare and scan the horizon

Be a disrupter and not a disrupted .. Find the opportunity

Thank you

Questions?