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SUPPLY CHAIN OPTINEERING

Construction Process Outsourcing

IPD value chain definitions

value-c horizontally interdependent, profit maximizing activities targeted at producing added value for the customer
how they are managed to control costs to meet targets are some of the mechanisms behind differentiated competitive advantage

s-chain vertically-integrated production activities that processes raw materials and sub-assemblies economically

supply chain management focuses on optimization and operational interventions
driving cost reduction by material tracking and product tractability (*defines value positioning*)

cost reduction levers	cutting procurement costs on goods and services
	slashing infrastructure costs on warehousing and equipment
	reducing inventory, in both WIP and finished goods
innovation levers	new product strategy
	price management, unit or volume increase
risk management lever	reduction of obsolete inventory
	reduction of risk exposure and improvement in risk profile

value chain management focuses on competitiveness and sustainability
building blocks of generating added-value (*defines competitive positioning*)

primary activities	value-creation and delivery of goods and services to customer at controlled costs
support activities	technology, personnel and purchased inputs augmenting primary functions

value systems integrate supply chain activities to establish bargaining power
to achieve the highest levels of customer satisfaction and value while effectively exploiting the competencies of all participating players

HLVP

networked scm adaptive supply chain – agile SCM with real-time communication capabilities
will allow tmt to contract out manufacturing and focus on sales and marketing with variable mode of integration

modular scm snap-on supply chain – expandable on-demand network of suppliers and buyers
will allow tmt to drive collective intelligence without integration

BIM

Value Chain Analyses for Structural Engineering BPO Services

Bangladesh has relatively good performance is in terms of **availability of scientist and engineers**

potential for harnessing this competitive strength in engineering services, therefore, exists

at the national level, however, **university-industry collaboration in R&D is very weak**

at the private sector level, some entrepreneurs have taken initiatives

to hire highly qualified structural engineers to provide BPO services

but **critical challenges remain**

Benchmarking** Availability of Engineers and **University-Industry Collaboration in R&D

Bangladesh and Comparator Countries, 2012

Country	Availability of scientists and engineers	University-industry collaboration in R&D
India	5.0 (16)	3.8 (51)
Malaysia	4.9 (20)	5.0 (17)
Sri Lanka	4.6 (32)	3.0 (118)
China	4.4 (46)	4.4 (35)
Bangladesh	3.8 (81)	2.6 (131)
Philippines	3.7 (91)	3.5 (79)

national **sector branding strategy** should be carefully thought out,

policy support can help improve access to existing funds

particularly the EEF and the JICA-funded SME loan facility

among the goals could be **to bring in an anchor investor in the captive BPO segment**,

which could have **major positive spillovers for the sector** as a whole

or in partnership with the private sector and international consultants

with a focused and sustained promotion campaign and high-profile networking events

to proactively address concerns of players in target markets

Value Chain Analyses for Structural Engineering BPO Services

in the **BPO value pyramid**,

labor costs per employee are 3x t4x higher compared to other BPO service providers

Labor costs dominate most stages of the structural engineering BPO value chain

structural engineering services are significantly **more demanding** in terms of

task complexity, labor skills, & cost

much more expensive to retain

highly skilled and experienced structural engineers and CAD/CAM designers

nature of work is such that **cash flow is more difficult to manage** compared to other BPOs

because projects take longer to complete than projected,

operating expenses that are tied up in work in progress take many months to recover

as a result, structural engineering BPOs are

highly dependent on good access to credit to finance their operations

as can be seen from the value chain below,

financing costs are conspicuously missing; because the firm has no access to external financing

for higher **value–added ITES-BPO** services

extremely difficult for **a sole proprietorship** of a **self-financed operation**

where uninterrupted connectivity with low latency and high bandwidth are necessities to compete

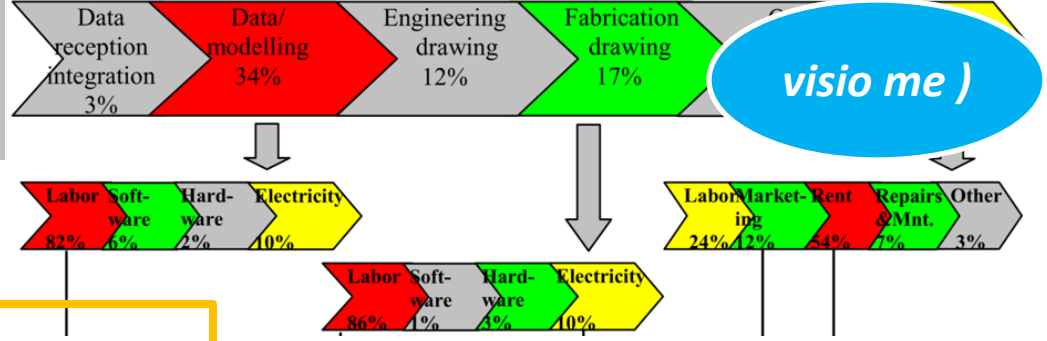
with *extremely poor* marketing skills

took 6 months to *make some inroads with a local bank for a US$120,000 loan*

and *failed to negotiate better Bank Loan terms than the offered 15% annual interest rate*

to convince potential clients that they can get quality structural engineering services in Bangladesh

Structural Engineering Service BPO Value Chain Analysis



DATA RECEPTION & INTEGRATION 3%

DATA MODELLING **34%**

LABOR 82%

typical **worker profile**

Highly skilled and educated, 3–10 years experience.

Experienced management (10 years for a multinational company in finance).

avg monthly wages

Engineers US$750–US$1,000; CAD/CAM designers US$250–US$370; Admin US$250.

ELECTRICITY 10%

major electricity problems: **Captive generation costly**, including repairs and maintenance.

ENGINEERING DRAWING 12%

FABRICATION DRAWING **17%**

LABOR 86%

ELECTRICITY 10%

QUALITY CONTROL + DELIVERY 4%

ADMIN **23%**

RENT 54%

rental prices to increase by 25% next year despite paying for major building improvements.

LABOR 24%

MARKETING

no access to finance.

poor marketing: *Extremely difficult to convince our potential clients that they can get good quality structural engineering services in Bangladesh.*

RAISING RESILIENCE BY **LOWERING CONSUMPTION**

design complexity ∝ *imported BOM* —∝ *order volume* ∝ *global sourcing frequency*

hidden Costs of Procurement can escalate rapidly owing to Inbound Processing
narrow-sighted **sourcing strategies** will quickly accumulate lead-time cross-roads and management overhead
and incur higher administrative costs, cash-flow mismanagement, production delays, and tactical mis-coordination

import input cost pits :
customs speed money, clearance issues with auxiliary supplies, importers & agencies setting ceiling price with duties
note: total lead time has nominal impact on total manufacturing costs

single Cost of Waste is superimposed on Production Cost overheads multi-fold (cost of reworking and secondary supplies)
when auxiliary material costs are included, share of all materials in value chain > 80% for most parts and components
shippers are increasingly reluctant to transport welding gas due to lengthy glitches with final permissions at Customs
for final permission per shipment , company pays for
cost of transportation, lodging + for own employees / intermediaries to handle file personally
at current prices, single container of imported Ar-welding gas
with 260 cylinders costs $11,000 delivered to factory gate in Bangladesh

cutting & welding in steel frame fabrication and assembly stages – which generates bulk of domestic value addition –
are dominated by critical input costs – material supplies, electricity, etc – which makes first-pass QA imperative
and constitutes only 25% of total manufacturing costs wherein the cost of raw materials is continuously rising
thus (% of domestic value added cost over manufacturing price) is diminishing
profitability is increasingly dependant on commercializing design expertise & **broadening qualified supplier netchain to off-load low-production margins**

RAISING RESILIENCE BY **REDUCING EXECUTION ERRORS**

VIRTUOUS CIRCLE evolves from skill-build-up using BIM technology to expand enterprise value profitability

linkage industries ∝ *share of domestic value creation* ∝ *cost control and profitability* ∝ *investor happiness*

Inclusive growth ∝ *skills adequacy and productivity* ∝ *integrated project success* ∝ *client satisfaction*

shifting management focus

PACKAGING

to lead harmonization of standards and drive unified communications in digital modeling
using LOD-defined BIM-Object Library
institute organic knowledge transfer embedded in engagement practice : *FPC – DOP* & *WQMS - AOC*
leverage crowd-sourcing GIS-platform content, plant seeds and build goodwill

PRECISION

to develop skills-base and minimize production downtime, % of WIP jobs, labor idling
build-up stable domestic demand by improving quality of workmanship and productivity, ie CTG/hr
targeting BIM-powered precision fabrication to achieve first-pass QA, standardization and scale economies
unlock complementary opportunities in O&M repair services

PRODUCTIVITY

to off-load labor-intensive steps and shift objectives to rolling assets and commercialization of digital assets
taking a community approach to off-premise material stocking & transportation of supply goods
discover *capital opportunities in new markets in Building Facade/ Interior Design Optionality, Ship-Building –IM*

DFManufacturing	**DFA**ssembly	**DFF**abrication	**DFR**etrofitting	**DFC**arbon
MIN **WEIGHT DESIGN** using less steel in design + fabrication	MIN **COST DESIGN** lean site-scheduling fastest erection cycles	MAX **DESIGN CONTROL** detailing structural steel connections	**STEEL RETROFITTING** repairing existing steel & concrete (sub) structures	material harvester app recycled % in steel d-build Scrap-mill TQM checking & cleaning material reuse
accurate estimating & Mill-ordering	Rethinking Design & construction Recipes			Down-Re-Up -Cycle Scrap for lower-equivalent-or value-added IP

People, Process, & Performance

how assets are managed – moved and controlled – how the building behaves
in other words, the 3Ps determine productivity, and dictate profitability

pivotal to **performance** is in
how the functional interrelationships & tactical coordination between the 3Ps are designed
how they're managed in a single window that
understands the relationships asset information
enabling options to make better utilization of the infrastructure
thereby reducing costs by improving on tactical efficiency of skilled resources

spotting problems early in the construction **cycle** is invaluable in getting projects back on track
the challenge is to **simplify facilities management** without throwing more people at it
build **penalties** into the processes, or have a contingency plan
reestablish / reinvent **incentives** : use the stack rather than the carrot

hello **integrated project delivery**
KPI should reflect a more collaborative approach
not only linked to the commercial reality of the contract
but also to the customer reality of the value
hello **target value design**

fetching *un*-Filtered information for Contractors

- **actively manage the *design-change vs constructibility* using integrated project delivery**
  - include higher contract contingencies
    - and ability to use T&M overtime on projects with aggressive schedules
  - include labor escalation provisions for all projects with potential resource shortages
  - shadow estimates prepared by estimating teams
    - from other business units or regions for all high-risk projects

- **co-locate project team with Owner-team to conduct in-flight project assessments**

- **active senior management project participation at weekly project meetings amongst all stakeholders**
  - management / Deal Committee review for all
    - project bids or contracts that deviate from target metrics
  - review earned value metrics and all potential change orders with senior management
  - report and update top project risks down to subcontract level

people design

Phronetic Rules – What Is Wise To Do (Or Not Do)

design methods to turn **lack of information**, **lack of understanding**, and **lack of knowledge** into **decisions**

by mapping decision-stops with potential danger spots, we can

identify **vulnerable areas** in project management / execution where

deviation is low / past experiences works	we are safe
statistics is unreliable / past experiences were costly	knowledge is questionable
revise **policy making** to absorb these boundaries	rendering knowledge invalid
introduce engagement rules: how to conduct yourself	*what to avoid*

endogenize decisions by

putting a floor on the payoff using insurance, or by changing the allocation.
integrating payoffs in a finite, rather than an open-ended domain, dematerializing the tails outside
creating an organic worst case scenario that is resistant to forecast errors
making the payoff more tractable and no longer open-ended
changing the payoff in reaction to the high degree of unpredictability and the harm it causes
producing positive skewness by raising lower bound for potential adverse outcomes and open upside

the effectiveness of **less is more heuristics**

isolate situations in which forecasting needs to be suspended, revisit decisions, and revise exposure
rely on simple, hard, non-probabilistic risk measures, based on time-tested heuristics
correct overconfidence, the blindness to one's relative performance, with the **method of debiasing**
by letting people know the prediction of others and establish a reference case prediction
remove the agency problem on the part of subcontractors and staff who have upside and no downside
either institute changes in the payoff itself (clipping exposure) or shift exposures away from that part

Phronetic Rules – What Is Wise To Do (Or Not Do)

Avoid Optimization, Learn to Love Redundancy.

Commodity prices can double on a short burst in demand —we no longer have any slack

Systems tend to optimize—become more fragile to the point of maximal vulnerability

Biological systems—those that survived millions of years—include huge redundancies

Option-theoretic analysis

redundancy is like a long option — you certainly pay for it, but it may be necessary for survival

atypicality of remote events past shortfalls does not predict subsequent shortfalls

when we don't understand the structure of external events with similar sample qualities of small probability

we need a tool (alpha) for analyzing

total properties of collective response to changes in the tail exponent

consider the effect on the expected value of losses in excess of a certain amount

Shortfall is multiplied by >10 from a much smaller change (in alpha) than its mean error

Phronetic Rules – What Is Wise To Do (Or Not Do)

Avoid prediction of remote payoffs though not necessarily ordinary ones.

things that have worked for a long time are preferable—as they have reached their ergodic states

subcontractors get rich in spite of negative returns

because compensation for subcontractors is done on a short term window,

causing a mismatch between observation window and necessary window

payoffs from remote parts of the distribution are more difficult to predict than closer parts

it takes much, much longer for a times series to reveal its property,

and should be explored in **climatic analysis**

Do not confuse absence of volatility with absence of risks.

standard deviation sampling error: 70-90% of the Kurtosis means no sample will ever deliver true variance

if we suspect right-skewness, true mean is likely

underestimated by measurement of past realizations, total potential is poorly gauged

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