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A literary study on the bonding of the Six Sigma with the Service Quality for the enrichment of the Service Sector(S) for the Construction Projects .

[With A approach towards the Construction Management and Technology]

[1]R.Surya Kiran, [2*]Vikas Kumar Singh, [3]Manoharreddy Chinnam [3]Likiel Lankireddy [3]Maninder Singh

[1]Assistant Professor , Dept. Of Industrial Engineering , GIT ,GITAM University , Visakhapatnam-45
[2] Director, Neusso Solutions, Vikaspuri New Delhi-110059
[3]Student, Department of Civil Engineering, GIT, GITAM University, Visakhapatnam-45

Abstract
Purpose: This research paper focusses on the merger of the six sigma with the service quality for the improvement of the services for the service sectors .
Approach: This paper approaches towards the resaons for the poor performance of the six sigma in the service sectors ,key factors necessary for the implementation of the six sigma and the barriers / difficulties to the implementation of the same .
Findings: This paper drives towards the problems ,outcomes and the benefits obtained through the implementation of the six sigma for the service sectors and the significant and the insignificant contribution concerned with the implementation fo the six sigma towards the service quality .The companies or the organisation who had been the beneficiaries is also discussed .
Implications:The implications of this paper is to call for the redisgning a framework necessary for the implementation of the six sigma with the service quality for the other major sectors as well .
Originality : This paper provides a fresh look into the six sigma applications to services by combining the thorough analysis of the concepts .
Keywords : Six Sigma , Service Quality
Paper Type : Research Paper (Study) based upon the research results and the literary results obtained through the various listed and non-listed journals of the Mechanical,Civil,Industrial and Information Technology Works with an orientation towards the Mechanical , Manufactuing and Management .

I. Introduction

A service can't be stored on a shelf ,touched ,tasted or tried on for a size .Services are generally obtained by engaging the an interactive process with the provider (Harvey,1988) ,where as six sigma refers to the philosophy ,tools and the methods used to seek ,find and eliminate the causes of the defects or the mistakes in the business processes by focuusing on the outputs that are important to the customers (Snee 2000,Kumar & bauer ,2010).
The hierarchy of the customer expectations (Worst-Ideal) :
Worst Possible , Low Expectation ,Minimally Acceptable ,High Expectation , Should Expectation and Ideal .[1]
Therefore , this becomes essentially important that the Service Quality is to be further improved . From the literature point of view ,
I. The various reasons for the poor performance of the six sigma to the service sector are as mentioned below :

Table-1 Poor performance of Six Sigma

High Customer Satisfaction	Lack of the Quality Information
Various Customer Needs	Lack of the Quality Indicators
Relatively Unpredictable Volumes	Lack of the Quality Factors
Variant business strategies	Lack of the Quality programs
Unpredictable nature of the tasks	Performance of the Six Sigma

II. The various key factors which could prove to be necessary for the implementation of the Six Sigma (Pulakanam & Voges , 2010) are as mentioned below :

Table-2 Key Factors

Senior Management Commitment	Training and Education
Linking Six Sigma to business strategy .	Project Selection
Linking Six Sigma to the Customers	Project Prioritisation
Organisational Readiness	Project Tracking
Project Management Skills	Project Review
Management of cultural change	Incentive Programmes
Company wide commitment	Linking to employees
Integration of six sigma with the financial accountability	Linking to suppliers
Understanding Six Sigma methodology	

III. The Barriers / Difficulties to implementation could be summarised as mentioned below :

Table-3 Barriers / Difficulties to Six Sigma Implementation

Lack of knowledge about the six sigma methodologies .	Internal resistance .
Lack of the resources – people , budget , time .	Allowing the time for the training .
Lack of the eductaion of the nature of six sigma .	Lack of the top management and the leadership.
Poor project selection .	Difficulty in identifying the process parameters .
Overcoming the business cultural barriers .	Difficulty in collecting the data .
Lack of the education and the training .	Too complex to use .
Insufficient inter-departmental communication .	

Other quotes :

1. Satisfaction is a psychological outcome and the service quality is a service outcome and are not the same thing (Crompton & Mackey 1989) .
2. Customer perception should equal or exceed customer expectations to give them satisfaction .
3. Expectations measure the normative standards also known as the zone of the tolerance theory which identifies the norms for the service standards (Desired Service and Adequate Service) (Parasuraman et al .)
4. Dimensions change with the type of the service (Crompton & Mackay , 1989).
5. The five dimensions are confirmed to be unstable (Taylor et al ,1993).
6. The dimensions change with the type of the service (Crompton & Mackay , 1989) .
7. Maintaing the five dimensions is only applicable to the homogeneous services (Scott & Shieff , 1993) .

Literature :

About Six Sigma :

1. Six Sigma is a practical application of the theoretical statistical measurement that equates to 3.4 defects per million opportunities i.e. towards a position of practically zero defects for any service process . This leads to the ideology that practically all the errors ate preventable (Behera et al .) .
2. Six Sigma is a philosophy that aims at reducing the variation in business processes based on the customer critical quality issues and the data driven decisions (Antony & Fergusson , 2001) .
3. Six Sigma as a methodology is an implemnentation following a well-defined problem solving roadmap and tools such as DMAIC ,DMADOV , DMADV , etc.
4. Six Sigma as a metric is 3.4 defects per million opprotunities which allows organisations to implement a measurement based strategy that focusses on process improvement and variation reduction .
5. Six Sigma process is a part of the management system to achieve the business excellence in the organisation (Starbird , 2002).

About Service / Service Quality :

1. A service is a application of the specialised competencies (Skills & Knowledge) (Vargo & Lusch).
2. A service means an entire manifestation of a business and not for the profit (Woodall).
3. A serrvice means a structure perceived to reside within the service – Service as an Organisation (Woodall)
4. The key commercial output of a service organisation-Service as a core product (Woodall) .
5. Any peripheral activity designed to enhance the delivery of a core product -Service as a product augmentation (Woodall) .
6. Any product or the customer oriented activity that takes place affter the point of the delivery -Service as a producr support (Woodall).
7. Service as a mode of the behaviour -Service as an act (Woodall).

8. Service quality is the extent to which a service meets the customers needs / expectations (Lewis & Mitchell , 1990) .
9. The starting point in developing the quality in services is the analysis and the measurement (Lewis & Mitchell ,1990).
10. Delivering the quality service is an essential strategy for the success and survival of the service organisations (Dawkins & Reichheld , 1990).

The service quality is more difficult for the consumer to evaluate than the product quality .The service quality perceptions result from the comparison of the sonsumer expectations .With the actual service perfromance , quality evaluations are not based solely on the outcome of a service but also involve the evaluation of the delivery process (Ghobadian et al , 1994 , Gronroos , 1982).

The cost of the quality in the service organisatins are greater relative to the manufacturing (Asher , 1987) .Six Sigma has the tools and the power to cut the ice , where the hot air has contributed little in the past (Tennant) . The Data is Data whether represent the defects or invoice errors , the information relates to machine settings , process variables ,prices ,quantities ,discounts ,customers or supply points is irrelevant , the techniques could always be used (Oakland) .

"Statistics could be transferred to the Services"

In the business world , it is the result that counts and in this aspect Six Sigma has been very successful (Hammer & Goding ,2001).

Research Methodology :

The tools used by the various companies / Organisations could be summarised as the common tools (C), latest tools (L) and the other tools (O).

Table-4 Rank-wise arrangement of Tools

Rank	Tools	Rank	Tools
1	Brainstorming -1c	12	Benchmarking -c
2	Control Charts -o	13	Normal Probability Plot-o
3	Root Cause Analysis	14	Process Mapping -c
4	Affinity Diagrams -o	15	Analysis of Variance -o
5	Run Charts -c	16	COPQ-o
6	Pareto Anaysis -c	17	FMEA-o
7	Scatter Plot -o	18	Matrix Analysis -o
8	Process Capability Analysis-l	19	Design of the Experiments -l
9	Histograms -o	20	SIPOC Model -o
10	Quality Function Deployment -l	21	Taguchi Method -o
11	Regression Analysis-o		
Additional			
Change Management Tools		Kano Model	
Statistical Process Control		Poka Yoke	
Gap Model			

DMAIC (Define-Measure -Analyze-Improve-Control) Grid for the Service Processes:

DMAIC	**Meaning**	**Tools / Techniques**
Define	Identify specific problems ,Define the customer requirements ,Set the Goals , Set the high level process maps .	Process Mapping , Brainstorming , Quality Costing , SIPOC, Gantt Chart ,Cost-Benefit Analysis , QFD, Project Team Charter .
Measure	Measure the data collection plan ,Identify the CTQ's,Plot the FMEA diagrams .	Quality Costing ,Servqual ,Gantt Chart , Process Capability Analysis , Benchmarking , Histograms , Service FMECA, Kano Model .
Analyze	Draw the conclusions from the data verification ,Analyse the process capability analysis ,Determine the root causes . Map the cause & the effect diagrams .	Brainstorming , Root Cause Analysis , Hypotheses Testing , SIPOC , Gantt Chart , Regression Analysis & Correlation Analysis , Pareto Analysis , Histograms , Affinity Diagrams .
Improve	Create the improvement ideas ,Create the Situation	Brainstorming , Root Cause Analysis , Quality

	statements ,Implemnent the Improvement solutions .	Costing , SERVQUAL , Gantt Chart , Process Capability Analysis ,
Control	Monitor the improvement progress ,Make the need adjustments ,Establish the standard measures to maintain the performance .	Gantt Chart , Control Chart .

Data Collection :

The data was collected based upon the problems , outcomes and the benefits received by various companies/ Organisations .

Table-5 Problems (P), Outcomes (O) & Benefits(B)

HEALTHCARE P1- Increase radiology throughput and decrease cost per radiology procedure in a hospital. O1-Sufficient improvement in radiology throughput and reduction in cost per radiology procedure . B1-33 % increase in radiology throughput (Thommerson , 2001).
P2-Poor patient safety due to high medication and laboratory errors . O2-Reduced medication and laboratory errors . B2-22 % reduction in cost per radiology procedure and 1.2 million pounds in savings (Buck , 2001).
P3-Overcrowded emergency department . O3-Reduced time to transfer a patient from the ER to an impatient hospital bed . B3-Improved patient safety significantly and 6,00,000 pounds per year as profit .
BANKING P4-Reduced customer complaints O4-Significant reduction in customer complaints increase in the customer satisfaction . B4-10.4 % increase in the customer satisfaction and 24 % decrease in customer complaints (Roberts , 2004).
P5-Excessive internal / external call backs plus unacceptable credit processing time . O5-Reduction in both . B5-Reduced internal call backs by 80% (Rucker 2000)
P6-High number of flaws in customer facing processes . O6-Reduced flaws . B6-Increased customer satisfaction ,Improved process efficiency & reduced cycle time by over 30 % .
P7- High returned renewal credit cards per month in a leading bank. O7-Significant reduction in the number of the returned renewal credit carrds . B7-Defect rate reduced from 13500 DPMO to 6000 DPMO (Keim 2001).
P8-Excessive market losses on trading errors , high cost associated with the elctronic order corrections in an investment banking unit . O8-Significantly reduced trading errors and the reduced costs associated with the order corrections . B8-Several millions of dollars in savings and improved employee morale within the banking unit (Stusnick , 2005).
FINANCIAL SERVICES P9-High administartive costs. O9-Reduction inthe administrative costs . B9-Savings generated from this project are 75000 pounds per year .
P10-Unacceptable wire processing time customers . O10-Reduced wire processing time by 40%. B10-Savings generated from this project are 700000pounds per year .
P11-Problems in accounts receivable within an accounting department . O11-Improved cash flows . B11-Annual savings are estimated to be well over 350000 pounds .
UTILITY SERVICES P12-Poor service delivery. O12-Improved service delivery. B12-Annual savings from this project is of the order of over 1.5 million pounds .
P13-High contract complaints resulted in customer dissatisfaction and high costs . O13-Reduced number of the complaints. B13-Complaints reduced from 109 to 55 on an average per year .
MISCELLANEOUS P14-Poor delivery performance in a logistics company .

O14-Reduced number of the delayed deliveries . B14-Sigma quality level of the process improved from 2.43 to 3.94 resulting in a saving of 400000 pounds approximately.
P15-Significant errors in a monthly publications -wall street investors and traders . O15-Reduction in the accounting and reporting errors . B15- Savings estimated to 1.2 million pounds .

Data Analysis :

The data was analysed to explore out the the benefits , critical success factors for the Six Sigma implementation and the significant & the insignificant contributions of the Six Sigma towards the service quality are as mentioned below :

I.The benefits gained through the Six Sigma implementation .

Table-5 Benefits of Six Sigma Implementation

Decrease in	**Increase in**
Scrap Rate .	Bottom line savings .
Process Variability .	Productivity .
Cycle Time .	Profitability .
Customer Complaints .	Sales .
Variability of process .	Company image .
Checking / Inspection .	Employee Morale .
Costs.	Product Development .
	Entry into new markets .
Integrates the human aspects and the process aspects .	
Links the tools and the techniques in a sequential manner.	
Creates a powerful infrastructure for the trainings.	
Improved attribute of the employees towards the quality .	
Improved attribute of the employees towards the Problem-Solving.	
Improved attribute of the top management towards the quality .	
Improved attribute of the top management towards the problem solving .	

II.The critical success factors for the Six Sigma implementation .

Table-6 Critical Success Factors for the Six Sigma Implementation

Links to the Business Strategy .	Incentive Program.
Links to the Customers .	Company-wide Commitment .
Links to the project management skills .	Links to the suppliers .
Organisational Infrastructure & Readiness .	Links to the employees .
Effective Leadership -Senior Mgt.	Links to the human resources .
Project selection & Prioritisation .	Sustained & Visible Mgt. Commitment.
Mgt.of the cultural change .	Continuing Education .
Integration with the Finance .	Setting clear expectations
Understanding the methodology.	Selecting project leaders carefully.
Training & Education .	
Project tracking & reviews .	

IV. The significant and the insignificant contributions of the six sigma towards the service quality .

Significant Contributions -

The significant contributions were observed towards the service quality philosophy ,continuous improvement methodology ,change agent ,service quality specifications ,actual service delivery ,service performance gaps ,External communications about the service delivery ,reliability of the service delivery ,responsiveness of the service delivery ,assurance of the service delivery ,empathy of the service delivery and the tangibles of the service delivery .

Insignificant Contributions -

The insignificant contributions were observed towards the service quality standards ,customer expected service

,customer perceived services ,difference of the customer expected services and the customer perceived services ,consumer expectations of the quality ,management perceptions of quality ,difference of the consumer expectations of the quality and management perceptions of the quality , management perceived quality determinant ,service specifications ,difference of the management perceived quality determinant and the service specifications .

Service strategy of the performance evaluation matrix (Lambert & Sharma , 1990)

Importance

37	57	77
35	55	75
33	53	73

Performance Evaluation

33	Maintain	35	Improve	37	Definitely Improve
53	Reduce / Maintain	55	Maintain	57	Improve
73	Reduce / Maintain	75	Reduce / Mainatin	77	Maintain / Improve

Zone	Service Strategy
High Imp , High Perf.	Maintain / Improve Service Quality
High Imp , Med. Perf.	Improve Service Quality
High Imp , Low Perf.	Definitely Service Quality
Med. Imp , High Perf.	Reduce / Mnaintain Service Quality
Med. Imp , Med.Perf.	Maintain Service Quality
Med. Imp , Low Perf.	Improve Service Quality
Low Imp , High Perf.	Reduce / Maintain Service Quality
Low Imp , Med. Perf.	Reduce / Maintain Service quality
Low Imp , Low Perf.	Maintain Service Quality

V. Discussion :

Six sigma is a like a wild fire and the organisation which had got benefitted from the implementation of the Six Sigma in their Services are Motorola ,General Electric , Allied Signals , Honey well ,Johnson, Texas Instruments , Caterpillar , Maytag ,Lockheed Martin , Northrop Grumman , Kodak , Boeing ,American Express , fidelity ,Lloyds ,ABB ,Sony ,J.P.Morgan Chase ,Citibank , Bank of America , G.E. Financial ,Sun Trust Bank Inc , Federal Express , Xerox , Alled Signals , Dupont , Johnson & Johnson , Grumman & Zuric Financial Services .

According to the Nordic Perspective (Gronroos), the two dimensions of the service quality are Functional and Technical .

According to the American Perspective (Parasuraman) , the five dimensions of the service quality are RATER – Reliability ,Responsiveness ,Empathy , Assurance & Tangibles .

So based upon the above , this could be easily confirmed to certain extent that the bonding of the Six Sigma with the Service Quality becomes an essential tool for the improvement fo the Service Sectors .

Directions for the Future Work :

I . Areas where the Six Sigma could be employed as the Service Function

Sectors	Problems
Banking	Wire transfer procdessing time ,Number of the processing errors , Number of the customer complaints received per month ,Number of the ATM breakdowns ,Duration of the ATM breakdowns .
Healthcare	Proportion of the medical errors ,Time to be admitted into an emergency room ,Number of the successful surgical operations per week ,Number of wrong diagnoses ,Waiting time to be served at the reception in a hospital .
Accounting & Finance	Payment errors ,nvoicing Errors ,Errors in inventory ,Inaccurate report of income ,Inaccurate report of the cash flow .

Public Utilities	Late delivery of the service ,Number of the billing errors ,Waiting time to restore the service after a fault has been reported ,Call center of the Utility Company.
Shipping & Transportation	Wrong shipment of the items ,wrongshipment due to the wrong address ,Late shipment ,Wrong customer orders .
Airlines	Baggage handling , Number of the mistakes in the reservation ,Waiting time at the check in counter .

II. The above mentioned principles and the conventions could be very well tried to be converted into the following links :

http://www.calculatorpro.com/calculator/excavation-cost-calculator/
Flooring :- Carpet Calculator,Concrete Slab Calculator,Deck Stain Calculator,Flooring Cost Calculator,Metric Carpet Calculator,Metric Tile Calculator Square Footage Calculator,Square Metre Cost Calculator,Tile Calculator
Materials Needed:-Board Foot Calculator,Bricking Calculator,Circular Room Paint Calculator (meters),Concrete Calculator,Concrete Column Calculator,Concrete Footing Calculator,Concrete Round Column Calculator,Concrete Slab Calculator,Concrete Square Column Calculator,Concrete Step Calculator,Deck Stain Calculator,Gravel Needed Calculator,How Many Litres of Paint Do I Need Calculator,How Many Metric Tons In A Cylinder Calculator How Much Paint Do I Need Calculator,How Much Wallpaper Do I Need Calculator,Material Needed Calculator,Material Needed Calculator (Circle),Material Needed Calculator (Triangle),Materials Volume Estimator Calculator,Metric Carpet Calculator,Metric Material Needed Calculator,Painting Calculator,Premix Concrete Calculator,Sonotube Calculator,Window Shade Calculator,Wood Square Footage to Linear Footage Calculator
Miscellaneous:-Compost Use Calculator,Cost Per Square Foot Calculator,Driveway Sealer Calculator,Excavation Cost Calculator,HVAC Financing Calculator,LED Resistor Calculator,Resistor Calculator,Solar Panel Shadow Calculator,Solar Power Calculator,Square Footage Cost Calculator,Square Metre Cost Calculator,Thin Brick Calculator,Wheelchair Ramp Calculator
http://www.blocklayer.com/CalculatorDirectory.aspx
http://www.blocklayer.com/Stairs/
http://www.blocklayer.com/Roof/
http://www.blocklayer.com/DeckCalculator.aspx
http://www.blocklayer.com/Gazebo.aspx
http://www.blocklayer.com/ConcreteCalculator.aspx
http://www.blocklayer.com/ConcreteCalculator.aspx
http://www.blocklayer.com/CentersLevel.aspx
http://www.blocklayer.com/Scale-Rule.aspx
http://www.blocklayer.com/Woodjoints/
http://www.blocklayer.com/BlockCalculator.aspx
http://www.blocklayer.com/TankHorizontal.aspx
http://www.blocklayer.com/Trig-RightTriangles.aspx
http://www.blocklayer.com/ConvertLength.aspx
http://www.blocklayer.com/Fraction-Multiply.aspx
http://www.blocklayer.com/Text-Templates.aspx

III. Some of the other important links for the works related to the Construction Management and technology could be very well noted down from the below mentioned :
Calculators exclusively for the Civil engineering problems
http://civilengineer.webinfolist.com/mech/bmcalc.htm

http://civilengineer.webinfolist.com/mech/bmcalc.htm [BENDING MOMENT & SHEAR FORCE FOR SIMPLE SUPPORTED BEAM]	
Bending Moment Calculator for Varying load on simply supported beam	http://civilengineer.webinfolist.com/mech/bmcalcpvl.php
Bending Moment Calculator for Varying load on simply supported beam	http://civilengineer.webinfolist.com/mech/bmcalcpvl.php
Bending Moment Calculator for point load on simply supported beam	http://civilengineer.webinfolist.com/mech/bmcalcp.php
Bending Moment Calculator for applied moment on beam span	http://civilengineer.webinfolist.com/mech/bmcalcm.php
Bending Moment Calculator for uniform load on part of beam	http://civilengineer.webinfolist.com/mech/bmcalcu.php
Bending Moment Calculator for applied moment on beam span	http://civilengineer.webinfolist.com/mech/bmcalcm.php
Bending Moment Calculator for uniform load on part of beam	http://civilengineer.webinfolist.com/mech/bmcalcu.php
Bending Moment Calculator for moment on supports of the beam	http://civilengineer.webinfolist.com/mech/bmcalcmm.php
Bending Moment Calculator for uniform load on full span of simply supported beam	http://civilengineer.webinfolist.com/mech/bmcalcuf.php
Bending Moment Calculator for uniform load on left part of beam	http://civilengineer.webinfolist.com/mech/bmcalcul.php
Bending Moment Calculator for Varying load on simply supported beam	http://civilengineer.webinfolist.com/mech/bmcalcvr.php
Bending Moment Calculator for uniform load on right part of beam	http://civilengineer.webinfolist.com/mech/bmcalcur.php
Bending Moment Calculator for Varying load on simply supported beam	http://civilengineer.webinfolist.com/mech/bmcalcv.php

Bending Moment Calculator for Varying load on simply supported beam	http://civilengineer.webinfolist.com/mech/bmcalcvl.php
http://civilengineer.webinfolist.com/mech/bmcalc2.htm[BENDING MOMENT & SHEAR FORCE FOR CANTILEVER]	
Bending Moment Calculator for point load on Cantilever	http://civilengineer.webinfolist.com/mech/cbmcalcp.php
Bending Moment Calculator for uniform load on left part of Cantilever	http://civilengineer.webinfolist.com/mech/cbmcalcul.php
Bending Moment Calculator for uniform load on part of Cantilever	http://civilengineer.webinfolist.com/mech/cbmcalcu.php
Bending Moment Calculator for uniform load on right part of Cantilever	http://civilengineer.webinfolist.com/mech/cbmcalcur.php
Bending Moment Calculator for uniform load on part of Cantilever	http://civilengineer.webinfolist.com/mech/cbmcalcu.php
Bending Moment Calculator for uniform load on full span of Cantilever	http://civilengineer.webinfolist.com/mech/cbmcalcuf.php
Bending Moment Calculator for uniformly varying load on Cantilever	http://civilengineer.webinfolist.com/mech/cbmcalcv.php
http://civilengineer.webinfolist.com/str/sdcalc.htm[SLOPE & DEFLECTION FOR THE SIMPLE SUPPORTED BEAM]	
Slope & Deflection Calculator for uniform Load on full span of simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcuf.php
Slope & Deflection Calculator for point load on simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcp.php
Slope & Deflection Calculator for Uniform Load partially applied on simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcup.php
Slope & Deflection Calculator for moment on one support of simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcms.php
Slope & Deflection Calculator for Uniform Load partially applied on right side of simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcur.php
Slope & Deflection Calculator for moment on span of simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcm.php
Slope & Deflection Calculator for uniform Load on partially applied on span of simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcu.php
Slope & Deflection Calculator for moment on right-hand support of simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcmsr.php
Slope & Deflection Calculator for moment on both supports of simply supported beam	http://civilengineer.webinfolist.com/str/sdcalcmslr.php
Slope & Deflection Calculator for Varying Load on full span of Beam	http://civilengineer.webinfolist.com/str/sdcalcv.php
http://civilengineer.webinfolist.com/str/sdcalc2.htm[SLOPE & DEFLECTION FOR THE CANTILEVER]	
Slope & Deflection Calculator for point load on Cantilever	http://civilengineer.webinfolist.com/str/sdcantp.php

Slope & Deflection Calculator for UDL on full span of cantilever	http://civilengineer.webinfolist.com/str/sdcantuf.php
Slope & Deflection Calculator for UDL on left part of cantilever	http://civilengineer.webinfolist.com/str/sdcantul.php
Slope & Deflection Calculator for Varying Load on full span of cantilever	http://civilengineer.webinfolist.com/str/sdcantv.php
Slope & Deflection Calculator for UDL on right part of cantilever	http://civilengineer.webinfolist.com/str/sdcantur.php
Slope & Deflection Calculator for moment applied on Cantilever	http://civilengineer.webinfolist.com/str/sdcantm.php
http://civilengineer.webinfolist.com/str/micalc.htm[MOMENT OF INERTIA FOR THE PLANE SECTIONS]	
Calculator for Moment of Inertia of Rectangular section	http://civilengineer.webinfolist.com/str/micalcr.php
Calculator for Moment of Inertia of hollow Rectangular section	http://civilengineer.webinfolist.com/str/micalcrh.php
Calculator for Moment of Inertia of hollow circular section	http://civilengineer.webinfolist.com/str/micalcch.php
Calculator for Moment of Inertia of I section	http://civilengineer.webinfolist.com/str/micalci.php
Calculator for Moment of Inertia of Channel section	http://civilengineer.webinfolist.com/str/micalcchn.php
Calculator for Moment of Inertia of Circular section	http://civilengineer.webinfolist.com/str/micalcc.php
Calculator for Moment of Inertia of T section	http://civilengineer.webinfolist.com/str/micalct.php
Calculator for Moment of Inertia of Angle section	http://civilengineer.webinfolist.com/str/micalcl.php
http://civilengineer.webinfolist.com/fbcalc.htm[FIXED BEAM CALCULATOR]	
Fixed Beam Calculator for point load	http://civilengineer.webinfolist.com/fb/fbcalcp.php
Fixed Beam Calculator for Varying load with maximum at center	http://civilengineer.webinfolist.com/fb/fbcalcvc.php
Fixed Beam Calculator for uniform load on full span	http://civilengineer.webinfolist.com/fb/fbcalcuf.php
Fixed Beam Calculator for Varying load increasing from right to left	http://civilengineer.webinfolist.com/fb/fbcalcvl.php
Fixed Beam Calculator for uniform load on left part of beam	http://civilengineer.webinfolist.com/fb/fbcalcul.php
Fixed Beam Calculator for Varying load increasing from left to right	http://civilengineer.webinfolist.com/fb/fbcalcvr.php
Fixed Beam Calculator for uniform load on right part of beam	http://civilengineer.webinfolist.com/fb/fbcalcur.php
Fixed Beam Calculator for applied moment on beam span	http://civilengineer.webinfolist.com/fb/fbcalcm.php
Fixed Beam Calculator for uniform load on part of span	http://civilengineer.webinfolist.com/fb/fbcalcu.php
http://civilengineer.webinfolist.com/mdcalc.htm[MOMENT DISTRIBUTION FOR THE CONTINUOUS BEAM]	
Point Loads on the Left span and uniform load on the right span	http://civilengineer.webinfolist.com/md/mdcalcpu.php
Point load on the left span and UVL on the right span	http://civilengineer.webinfolist.com/md/mdcalcpv.php
UDL on the left span and UDL on the right span	http://civilengineer.webinfolist.com/

	md/mdcalcuu.php
Point load on the left span and varying load on the right	http://civilengineer.webinfolist.com/md/mdcalcpvl.php
Point load on the left span and varying load on the right span	http://civilengineer.webinfolist.com/md/mdcalcpvr.php
Point load on the left span and uniform load on the right span	http://civilengineer.webinfolist.com/md/mdcalcppul.php
UDL on the left span and varying load on the right span	http://civilengineer.webinfolist.com/md/mdcalcuv.php
Uniform load on the left span and point load on the right span	http://civilengineer.webinfolist.com/md/mdcalcup.php
Point load on the left span and UDL on part of the right span	http://civilengineer.webinfolist.com/md/mdcalcppur.php
Point load on the left span and moment applied on the right span	http://civilengineer.webinfolist.com/md/mdcalcpm.php
http://civilengineer.webinfolist.com/ohbcalc.htm[OVERHANGING BEAM]	
Calculator for Overhanging Beam with Point Load	http://civilengineer.webinfolist.com/ohb/ohbp.php
Calculator for Overhanging Beam with Uniform Load	http://civilengineer.webinfolist.com/ohb/ohbu.php
http://civilengineer.webinfolist.com/design/beamanalysis.htm[STRENGTH FOR RCC BEAM]	
Reinforced concrete beam with one layer of tension layer (FPS)	http://civilengineer.webinfolist.com/design/beamanalysis1.php
Reinforced concrete beam with two layers of tension layer(FPS)	http://civilengineer.webinfolist.com/design/beamanalysis2.php
Reinforced concrete beam with one layer of tension layer (SI)	http://civilengineer.webinfolist.com/design/beamanalysism1.php
Reinforced concrete beam with two layers of tension layer(SI)	http://civilengineer.webinfolist.com/design/beamanalysism2.php
http://civilengineer.webinfolist.com/design/beamanalysism.htm[STRENGTH FOR THE RCC BEAM]	
Reinforced concrete beam with one layer of tension layer (SI)	http://civilengineer.webinfolist.com/design/beamanalysism1.php
Reinforced concrete beam with two layers of tension layer(SI)	http://civilengineer.webinfolist.com/design/beamanalysism2.php

IV Some of the other important links mainly meant for the Construction Management and Technology are as mentioned below :

1. http://www.cecalc.com/CivilandStructuralCalcs.aspx
2. http://www.engineersedge.com/calculators.htm
3. http://www.q-cogo.com/
4. http://www.easycalculation.com/engineering/civil/civil.php
5. http://www.surveysystem.com/sscalc.htm
6. http://onlinecalculators.brainmeasures.com/civilEng/VerticalCurveOffset.aspx
7. http://www.blocklayer.com/CalculatorDirectory.aspx
8. http://www.calculatorsoup.com/calculators/construction/index.php
9. http://www.calculatoredge.com/
10. http://www.jklakshmi.com/calculator.html
11. http://homes4india.com/MaterialEstimator.aspx
12. http://www.building-cost.net/CompMatrix.asp
13. http://www.custombuildingproducts.com/support/interactive-tools.aspx

V. Other Additional Future Works

The following formulae had been cited from The Journal for CMA's ,
The Management accountant ,April 2014 ,Volume -49 , Number-4
Which had been proved to be in the case of an Academic Establishments:

Institutional requirements Vs Construction requirements (An assumption)

Location of the Institute - Location of the Site
Governing Body - Management Body
Number of branches - Number of the Sites
Provision for studying the Interdisciplinary Courses - Provision for connectivity of the Inter-Disciplinary Performances .
Physical Infrastructure [Class-Rooms, Laboratories , Seminar Halls , Play -Grounds , Auditoriums] - Physical facilities provided
Library Facilities - Connectivity with the knowledge tools
E-Learning Facilities -E-Learning Facilities
Quality of Students - Quality of the Product
Administration - Administartion
Professional Growth Opportunities -Professional growth Opportunities
Scope for the Entertainment -Scope for the Entertainment
Living expenses -Living Expenses
Extent of the Medical facilities - Extent of the Medical facilities
student evaluation systems -product Evaluation systems
Faculty evaluation systems -Employee Evaluation systems
Fee Structure - Cost of the projects
Training and Placements - Training and Placements
Research and Development - Research and development
Entry Students -Type of the Products
Teaching Assessments -Work assignments and Work-Orders
Faculty Student Ratio -
Faculty Spending
Student Results - Product Results
Grants and Donations received
Alumni Association
Industry-Institute Linkages - Industry -Institute Linkages

IC=(AC+ADC)/N
where IC=Institutional Cost ,
N=Number of the enrolled students ,
AC= Academic Cost ,
ADC = Administrative Cost .

Acdemic Cost AC = (TC+ASC+SWAC) / N
where AC = Academic Cost per student ,
TC = Teacher Cost ,
ASC = Construction services Cost
SWAC = Student Welfare activity cost
N= Total enrolled students

Total Administration Cost ADC = (GAC+ODC+CSC) / N
where GAC = General administartion Cost
ODC = Other Departmental cost
CSC = Common Services General Charges
N = Total Students

For the above mentioned , a pilot study is to be carried out considering
the following changes so that the same could be proved to be effective for the
construction Industry as well :

IC= Total Project Cost
Ac = total construction cost
ADC = Total Administartion Cost
N= Total Number of the Employees

Ac =Total construction cost per Unit
TC = Single Employee Cost
ASC = Total construction services cost
SWAC = single employee welfare activity cost
N = Total number of the employees

GAC = General Administration cost
ODC = Other Departmental cost
CSC = Common Service General charges
N = Total number of employees

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[14.] A noice approach to solve tghe engineering and technology problems with the most updated tools IJOER ,Vol-2,Iss-4
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