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Highlights

The RT-Regression Techniques

Competitive Tendering Process

Discovering Thoughts, Inventing Future

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CONTENTS OF THE ISSUE

- i. Copyright Notice
 - ii. Editorial Board Members
 - iii. Chief Author and Dean
 - iv. Contents of the Issue
-
1. A Framework for Assessing the Effectiveness of Competitive Tendering Process for Public Works Procurement at Pre-Contract Stage in Chad Republic. **1-13**
 2. Lean Wastes and its Consequences for Readymade Garments Manufacturing. **15-19**
 3. Implementation of Alternative Solutions in Linear Programming Modeling using the Dual Simplex Method and Duality Method from Primal Problem, Establishing Implementation through the Simplex Methodology. **21-28**
 4. A Literature Survey on TCP-Test Case Prioritization using the RT-Regression Techniques. **29-40**
 5. An Analysis of Industrial Relations Practice in Nigeria and Ghana (Similarities and Differences in their Systems). **41-46**
-
- v. Fellows and Auxiliary Memberships
 - vi. Process of Submission of Research Paper
 - vii. Preferred Author Guidelines
 - viii. Index



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A Framework for Assessing the Effectiveness of Competitive Tendering Process for Public Works Procurement at Pre-Contract Stage in Chad Republic

By Sazoulang Douh

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Abstract- Effective implementation of competitive tendering has the potential for assuring transparency, accountability, fairness, justice and ethical standards in public works procurement. It promotes sound contract practices and growth of indigenous technology. Furthermore, it can reduce time and cost, promote competition, hamper corruption, and strengthen the public service system. Although, competitive tendering appears to be the most acceptable method of selecting contractors everywhere, its implementation in Chad is facing many challenges despite the reforms put in place in 2003 resulting in a very poor performance of government procurement. The lack of effectiveness assessment of the tendering processes at pre-contract stage is one of the main causes. Previous studies have identified a baseline of 38 standards practices along with five critical phases of the competitive tendering, seven relevant criteria and 13 key related measurable indicators. The adopted method is quantitative strategy. Respondents were asked to pair-wise compare phases, criteria and indicators using an Analytic Hierarchy Process scale and relative and composite weights of all identified variables were computed. Based on these findings, a framework for assessing the effectiveness of competitive tendering process at pre-contract stage is developed.

Keywords: *effectiveness assessment framework, competitive tendering process, works procurement, AHP, chad.*

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A Framework for Assessing the Effectiveness of Competitive Tendering Process for Public Works Procurement at Pre-Contract Stage in Chad Republic

Sazoulang Douh

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I. INTRODUCTION

In construction industry, Competitive Tendering (CT) is a procurement method whereby contractors are invited to make a firm and unequivocal offer of the price and terms which on acceptance shall be the basis of subsequent contract (Oladapo, 2000). So, competitive bids are submitted on the same basis, under the same conditions and using the same criteria

for evaluation (Adetola, 2000). Consequently, CT is widely recognized as an attractive procurement mechanism and is commonly advocated by international organizations like World Bank (WB), European Union (EU), African Development Bank (AfDB), and the Organization for Economic Co-operation and Development (OECD). As a result, the majority of developing countries prescribed CT as the prime method of public procurement due to its widespread benefits. These include promoting competition and hampering corruption (Steven and Patrick, 2006), reducing cost by broadly 20% (Simon et al., 2005) and providing the enabling environment for effective utilization of scarce resources in the economy (Dikko, 2000). Although CT is predominantly used in developing economies, OECD (2010) has estimated that losses due to inappropriate procedures of procurement (lack of transparency, public accountability, fairness, and equity for example) at 20 to 30% of aids granted. Not only that, US National Performance Review (2007), claims that the effectiveness of tendering process impacts directly on the value for money and also, the implementation of performance evaluation stimulates the systemic documentation of every stage of the process. Owing to what precedes on one hand, and to various advantages offered by CT method on the other hand, any improvement in effective implementation of CT Process is therefore welcomed in developing countries. Apart from that, many researches were carried out on building projects performance at pre and post occupancy stages based on golden triangle (time, cost, quality); but little has particularly taken into consideration multiple and balanced other criteria and at pre-contract phase (Kogioglou, 2007).

In Chad also, CT is of prime use as prescribed by the Public Procurement Act (PPA) 503 (2003). But, many resulting contracts have failed to meet government expectations (abandoned sites or doubtful works quality) due to poor performance of tendering processes (CCSRP, 2009). As a result, more than 70% of loose of time and cost during construction phase were attributed to 'biased' award of contracts (CCSRP 2009). In addition to excessive delays registered in

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contract award process, massive use of negotiations rather than competition (52%), award of many contracts to incapable contractors, projects' overprices (40%) as compared to private prices, are constantly reported as poor results of CT implementation (OCMP, 2008; CCSRP 2009). Consequently, the ineffectiveness of CT is identified as one of main concerns in public works procurement in Chad (Patrice, 2008). Furthermore, despite the reforms put in place in 2003, field survey reveals that the lack of effectiveness assessment of the tendering processes at pre-contract stage is one of the main causes of a very poor performance of public procurement. Moreover, Patrice (2008) studied specially the effectiveness of government contracts procedures in Chad but the resulting report shows that no studies have been addressing specifically the development of a management tool for assessing the effectiveness of CT Process. Therefore, the present work intends to fill this gap too.

From the foregoing, developing an appropriate tool that helps public contracting authorities to assess the effectiveness of every project at pre-contract phase will result in a substantial improvement of the performance of Competitive Tendering Process. The local construction industry also, will further benefit from it. Therefore, it is indisputable that there is a need for developing appropriate framework for assessing the effectiveness of CT Process in public works procurement in Chad. The present paper is a part of the ongoing PhD work that presents the main components of the developed framework as well as the assessment procedure.

II. EFFECTIVENESS ASSESSMENT IN PUBLIC PROCUREMENT

Before reviewing assessment tools in use, it would be useful to give the working definition of some key words. According to Richard (2006), effectiveness means doing the right things and efficiency means doing the thing right whereas Performance is a means to appreciate if the organization is effective and efficient (Broeckling, 2010). Therefore, effectiveness is considered as an attribute of performance rather than its component and becomes the quality of the overall performance of a process or organization (Metawie & Gimán 2005). According to Evans (2009), assessment is the act of judging, evaluating or estimating the quality of something and also a part of the management cycle that consists in measuring performance. It is an interactive process that provides information about the actual performance in order to improve the final achievement (Stefanos, 2006). In short, assessment means measurement. Indeed, the meaning of effectiveness assessment is better understood in light of performance measurement concept. In fact, performance

measurement has been defined from different perspectives by different researchers with a lack of agreement on a single definition as argued Khan & Shah (2011). In spite of this, Franco-Santos (2007), found that there is an agreement among researchers on the following two features: performance measurement is (1) an evaluation system used to quantify the efficiency and/or effectiveness of an action and (2) a means to achieve certain pre-defined organizational goals and objectives. Besides that, performance cannot be directly measured. So a number of measurable indicators are used on the basis of which inferences are made about the relative performance (Strand, Paula & Erik, 2011). Therefore, performance measurement refers to the use of a multi-dimensional set of measures that includes both financial and non-financial measures, both internal and external measures (Bourne, Neely, Mills and Platts, 2003). Furthermore, performance assessment provides the basis for an organization to know how well it is progressing towards its predetermined objectives, identifies areas of strengths and weaknesses and decides on future initiatives with the goal of how to initiate performance improvements (Van-Weele, 2006). In this context, assessing effectiveness involves necessarily measuring performance and for that, these two words are used interchangeably in the course of the study. Similarly, a Measure of Effectiveness (MOE) indicates how well a system tracks against its purpose or normative behavior. According to Richard (2006), effectiveness could be measured in two different ways: goal-centered view and system-resource view. The goal-centered view is concerned with assessing the organization with respect to its task objectives by finding the difference between performance and objectives. In system-resource view, effectiveness is concerned with resource viability. For the assessment of a process' effectiveness, these considerations should converge as recommended Richard (2006). Therefore, effectiveness measures can be defined in a binary manner (e.g. goal achieved or not achieved) or by specifying a percentage by which the goal has been achieved (e.g. 82% in an assessment). In addition, Bourne et al. (2003) asserted that effectiveness assessment cannot be done in isolation for it is only relevant within a reference plan (Baseline) against which the efficiency and effectiveness of action can be judged. Watermeyer (2013), stated that in the effectiveness assessment process, the starting point is to clearly define objectives and expected outputs/outcomes as well as time lines, cost and levels of quality; then, perform activities and collect data; the end point being to compare the projected outputs/outcomes against the actual ones. In other words, effectiveness assessment process is achieved through setting specific goals and objectives, prescribing the expectations through formalization of rules and roles, and monitoring conformance to these

expectations before concluding (Van-Weele, 2006). Hence, Effectiveness is merely the way of performing pre-established activities to produce the expected output at a high level of achievement. From the foregoing, it can be concluded that effectiveness assessment process starts by setting a baseline including target values (specific expected goals and objectives), selecting relevant criteria and related key indicators; then performing activities, collecting data about relevant criteria, assessing the performance by using measurable predetermined indicators, and finally comparing the actual results to the expected.

In construction industry, Kagioglou, Cooper & Aouad (2007), found that performance assessment is approached in two ways: in relation to the product as a facility, and in relation to the creation of the product as a process. Consequently there are two general types of performance measures: results measures and in-process measures. Results measures which track outcomes after the fact, measure only success or failure of the project, and are not sufficient to assess the 'true' performance of construction projects. Moreover, results measures provide historical or inaccurate information that can be inconsequential for the assessment or may mislead decision-making argued Hoover & Schubert (2007). This is very much unlike in-process measures which track leading indicators and anticipate potential problems before they happen (Kagioglou et al., (2007). More specifically, Watermeyer (2010), stated that assessing the effectiveness of a procurement process begins with the identification of project milestones to be reached, activities to be undertaken, products to be delivered, and/or projected costs likely to be incurred in the course of attaining a project's final goals. Hence, the degree of difference from the expected results is used to evaluate effectiveness that can be qualified as success or failure (Teelken & Smeenk, 2003). However, considering international standard practices, tendering process effectiveness assessment is no more limited only to time, cost and quality but is extended to other criteria such as transparency, fairness, equity, integrity, accountability, compliance with regulations, and openness of the competition which constitute nowadays the main concerns as far as public procurement is concerned.

To develop the intended framework, a conceptual framework grounded on a multi-criteria effectiveness assessment approach using 'in-process measures' employing seven criteria and thirteen key measurable indicators, is adopted. Thus, a reference plan or baseline including 38 Standard common practices of CTP in developing countries is defined. Seven (7) relevant criteria that are Fairness & Equity, Competitiveness, Compliance to laws and regulations and Conformity to rules & procedures, Transparency & public Accountability, Ethics (Integrity and

Confidentiality), Time Effectiveness, and Cost Effectiveness are identified. Thirteen (13) Key Measurable Indicators (KMLs) that are established as follows: Time for tender preparation, Time for tender preparation, Time for tender preparation, Applied Rate of Margin of Preference, Number & Nationalities of Bidders, Degree of Competitiveness, Advertisement total duration, Publicity frequency, Publicity extent, Time Performance Index, Cost Estimate Accuracy, Approvals Compliance Rate, Documentation Compliance Rate, Capacity Qualification Ratio, and Number of complaints or requests generated. The Table 1 in the next page presents these key indicators and their relative target values that will be used in assessing the performance. And, the competitive tendering process was divided into five (5) critical phases as follows: tender planning phase, tender documentation phase, tender solicitation phase, tender evaluation phase and pre-award phase.



Table 1 : Key Measurable Indicators with Target values

Rank	Indicator's designation	Brief description of Indicator	Formula / Expression Unit	Target values
1	Time for tender preparation	Is the actual time the last tenderer get for bid preparation	(Date of bids submission – Date of last tender documents sold); In days	≥ 45 days
2	Advertisement total duration	Actual duration of the tender announcements	(Date of last announcement –Date of first announcement); In days	≥ 15 days
3	Number & Nationalities of Bidders	Combined Number of national bidders and Foreign bidders	(National Bidders + Foreign Bidders) / 2 ; Numerical number	≥ 5
4	Publicity frequency	Frequency of advert diffusions/publication in a week	How many times the advert was published in a week; Numerical number	≥ 2 times
5	Time Performance Index	Is the actual ratio of the time performance and time allocated for the phase	(Time performed / Time allocated) ; Numerical number	≤ 1
6	Number of complaints or requests generated	Expresses a sort of bidders' satisfaction	Number of formal complaints or requests for clarification registered; Numerical number	$= 0$
7	Cost Estimate Accuracy	Is the actual variations of estimates as compared to initial budget	[(Initial Budget – Actual Estimate)/Initial budget]x100; In percentage	> 0 and $< 15\%$
8	Publicity extent	Number of different media used for advertisement	Number of News-paper, radio, TV, Internet, Numerical number	≥ 3 media
9	Approvals Compliance Rate	Is the actual ratio of required approvals and performed approvals along the process	(Approvals performed / Approvals required) x 100; In percentage	$= 100\%$
10	Degree of Competitiveness	Expresses variations among of bids' prices	[(High bid - Low bid) / Winner Bid] x 100; In Percentage	$\leq 10\%$
11	Documentation Compliance Rate	Is the actual ratio of the total number of documents required & recorded and provided along the process	(Recorded Proceedings provided / proceedings required) x 100 ; In Percentage	$= 100\%$
12	Applied Rate of Margin of Preference	Actual rate used for that particular project as compared to the prescribed	Applied fraction of the prescribed Margin of Preference; In Percentage	$\leq 10 \%$
13	Capacity Qualification Ratio	The level of Capacity qualification (appropriate profiles via CVs)	(Qualified members / Non-qualified members) ; Numerical number	≥ 1

III. METHOD

The study adopted quantitative approach with questionnaire as data collection instrument. A questionnaire was designed using Analytic Hierarchy Process (AHP) approach (Saaty 1990). It was pre-tested and reviewed before final data collection. Respondents are asked to pair-wise compare the identified variables using the following simplified AHP scale of 5 points: 1 = Equal Importance, 3 = Moderate importance, 5 = Strong importance, 7 = Very strong, and 9 = Extreme Importance. As mentioned earlier, the first step was to identify criteria and related key measurable indicators that are relevant in characterizing an effective

CTP. In line with the AHP approach, the next step is to establish their respective weights on the overall effectiveness. For that, there are some Multiple Criteria Decision Analysis (MCDA) methods for calculation of these weights but the most popular in industrial performance measurement systems are MACBETH (Measuring Attractiveness by a Categorical Based Evaluation TechNique), Fuzzy Logic (FL), and AHP (Clivillé, 2004; Berrah et al., 2006; Saaty, 2008; Tavakkoli-Moghaddam, 2012). AHP is an emerging method to evaluate performance because an earlier survey provided over 200 known applications in the evaluation of the overall performance (Forman and Gass, 2003; Yang and Shi, 2002; Zahedi, 1986). Since

the research aims at assessing the overall effectiveness of CT using seven criteria and thirteen indicators, so, it is a suitable application. Moreover, AHP is selected for many other following reasons: (1) It uses hierarchy with many levels and permits to calculate mathematically 'Priority Vectors' or 'Weights' at different levels of the hierarchy; that fits perfectly the nature of the problem under study (criteria and related indicators). (2) Rather than qualitative judgments like MACBETH and FL, AHP uses scales of figures that are directly computed without transformation; that can reduce subjectivity at the same time increase objectivity. (3) It uses the Weighted Mean as aggregation operator at the top level of the hierarchy. (4) Calculations can be done by Excel without a specific software package. (5) AHP is open for adaptation and has many modified versions, and still gives reliable results. (6) It is popular and commonly adopted in industrial sector. (7) It has gone through many criticisms, still is giving absolute satisfaction in many areas of multi-criteria decision making. Of course, some concerns have been raised regarding AHP for the arbitrary ranking occurred when two or more alternatives have similar or quasi-similar characteristics (Triantaphyllou and Mann, 1995), or the rank reversal caused by the addition or deletion of alternatives (Dyer, 1990; Perez, 1995; and Tversky & Simonson, 1993). These undesirable effects, however, do not invalidate the AHP method, argued Harker & Vargas (1987) and Saaty & Vargas (1993) and Triantaphyllou and Mann (1995). In fact, ordinal aggregation methods exhibit rank reversal and it has been shown that the rank reversal will not be a problem in real world applications because it is very rare to encounter two alternatives with very similar or same characteristics. In such case, special precautions (e.g., grouping similar alternatives) can easily be taken to avoid any rank reversal (Saaty, 1990). Meanwhile, it is noted that the current study cannot be affected by this problem because it does not focus on alternatives selection but on the weights of variables that affect the overall performance.

The targeted population comprises 60 structures including public procurement entities, consulting firms, contractors, and sponsors. The total population was considered as sample. The analysis tool is an adapted AHP model involving nine following steps: Establishment of specific goal & objectives as well as the baseline (Step-1), Identification of relevant criteria and key related measurable indicators and corresponding target values (Step-2), Construction of AHP Hierarchies (Step-3), Collection of pair-wise comparisons from experts and Verification of the Consistency of respondents (Step-4), Computation of Geometric Means of the consistent ratings and construction of a single pair-wise comparison matrix (Step-5), Computation of weights of Phases, Criteria & Indicators, and also Lambda max, Consistency Index

(CI) and Consistency Ratio (CR) for results testing (Step-6), Computation of Composite Weights and Ranking of Key Indicators (Step-7), Calculation of Elementary Effectiveness at each phase (Step-8), and Calculation of the Overall effectiveness of the whole CTP for the contract award (Step-9).

Of the 60 questionnaires administered, 38 valid completed questionnaires were returned representing 63.32%. The majority of respondents (60.52 %) are construction professionals holding either Bachelor in Science degree (15.80%) or Master degree (84.20%). This means that the results represent the opinion of high qualified construction professionals. Not only that, respondents with more than 10 years of experience in the public works procurement practices have scored 71.05 %, indicating that the results represent the point of view of experienced construction professionals. Moreover, the Consistency Ratios (CR) varying from 0.00 to 0.055 (< to 0.10) are indicating that respondents were very consistent with their rating and results can be considered valid.

IV. DEVELOPED FRAMEWORK

Using the adopted conceptual framework for assessing the effectiveness as described earlier, the quantification of the performance expression can be viewed as a procedure which, in a first step quantifies the elementary performances, the second step then consists in their synthesis in an overall performance thanks to aggregation operator (Berrah et al., 2004 and Clivillé, 2004). For illustration, a graphical model of the developed framework is proposed in Figure below. The model consists of a systematic sequence of six (6) steps involving assessment of elementary effectiveness of the five phases, one after another in ascendance, and the overall effectiveness for the whole process. With respect to specifics of every phase, Key Measurable Indicators (KMIs) are distributed as follows per phase: Phase 1 six indicators, Phase 2 five indicators, Phase 3 six indicators, Phase 4 seven indicators, and Phase 5 seven indicators. See the Figure 1 below for illustration.

The developed framework is divided into six main components: Five (5) distinct sheets corresponding to the five phases including each of the following elements: input and expected output, critical points and issues to look at, standard practices to follow, useful data and documents to provide, specific key indicators to use; and finally the table of assessment of Elementary Effectiveness (ei). One sheet summarises the overall effectiveness assessment including the final decision of the contracting authority.

The Assessment Procedure involves the following steps:

- Examine the quality of the input under assessment,
- Find out if the critical points and issues are properly addressed,

- c) Check the conformity of performed practices to standard practices required,
- d) Get the actual measures through analysis of collected documents & data on the process,
- e) Compare actual measures to target values and use the differences to score the performance of each indicator using the scoring system below.
- f) Get the actual weighted effectiveness value by multiplying the performance value by the weight of the indicator,
- g) Get the elementary effectiveness (ei) by summing up the individual indicators weighted values and divide it by the sum of their weights,
- h) Get the Overall Effectiveness (E) by summing up the five elementary effectiveness values.

**E= OVERALL
EFFECTIVENESS**

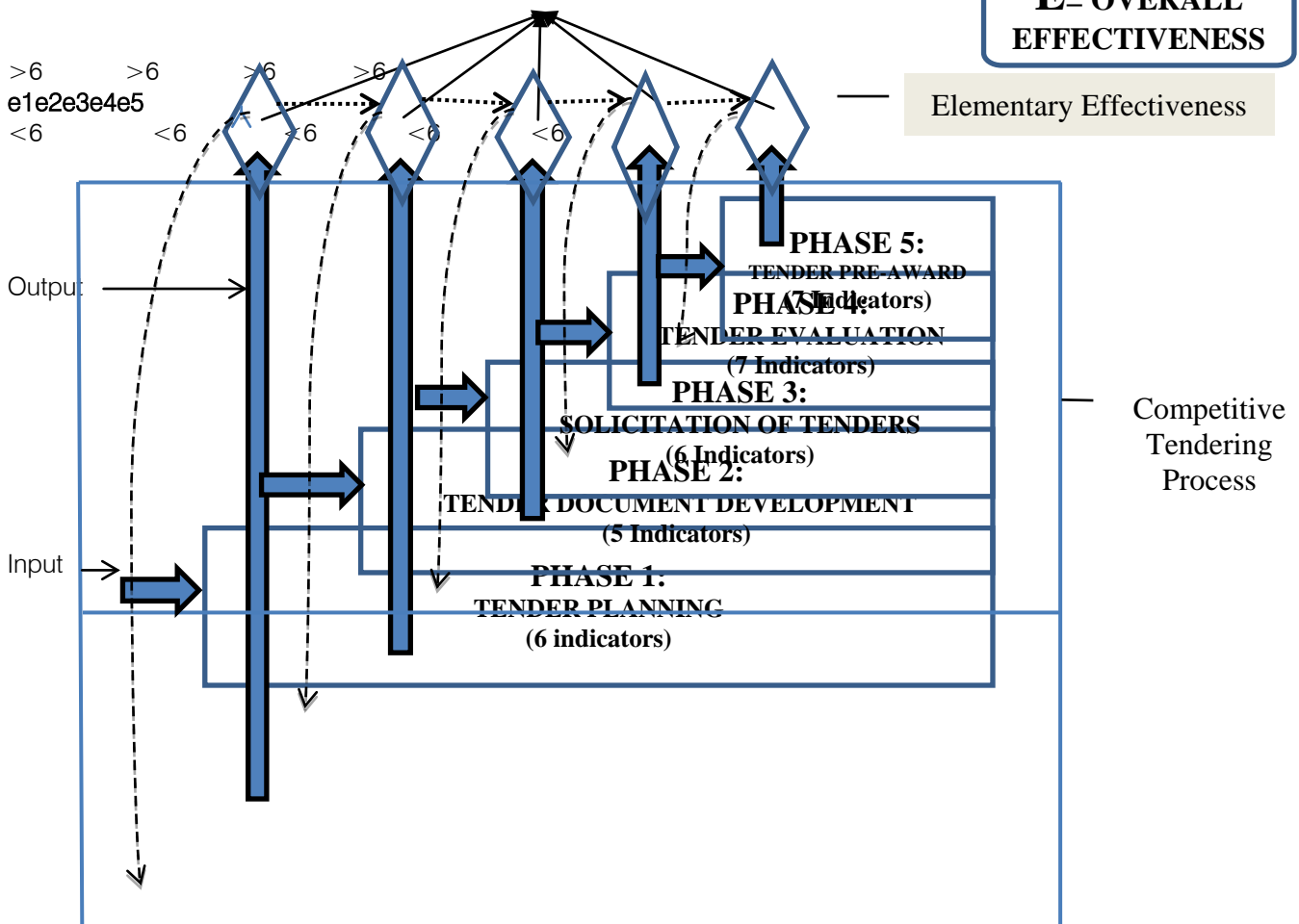


Figure 1 : Graphical model of the developed framework

The adopted scoring system uses the AHP scale of 0 to 9 corresponding to the following qualitative appreciations in Table 1:

Table 2 : Indication of scoring or marking system

Qualitative appreciation	Marks
Perfect	8.0 – 9.0
Excellent	7.0 – 7.9
Very good	6.0 – 6.9
Good or acceptable	5.0 – 5.9
Fair	4.5 – 4.9
Not acceptable	2.5 – 4.4
Nil or worthless	0.0 – 2.4

It is important to note that figures in the above table are an indication and therefore must be handled with flexibility. For example, when the actual measure of the indicator equals to or better than the target value, the score is 9. When the actual measure is less than the target value, the proportionate scale or 'pro rata' needs to be applied to achieve the mark. Ultimately, latitude is given to the assessor to appreciate and mark according to his conviction. The value nine (9) may be considered as target value that has to be attained by every project through a functional tendering process. In the scale of marks proposed above, the figure 6 corresponds to very good; that is why, when elementary effectiveness (ei) is

< 6 , the process has to be re-done. if $ei \geq 6$, the process continues to the next phase. When overall effectiveness E is < 6 , the whole CTP process is to be cancelled; if $E \geq 6$ the contract is awarded to the winner. Lastly, when data are not available or missed or even unreliable, the assessor has to judge and score based on his experience.

Target values are most often provided in laws and regulations of every country. Thus, they may vary strongly with the nature and the surrounding context in which the project is planned as well as objectives to achieve. Some target values are explicit (e.g. time) whereas others are implicit or interpreted or simply inferred (e.g. % of savings). Target values displayed in Table 7.2 are extracted from Chadian context. Also, this table gives full description of established Key Measurable Indicators and their expressions.

The elementary effectiveness assessment follows 3 steps. First, compare collected data to target value and score the actual measure of the Indicator accordingly. Second, the actual measure of an indicator is multiply by its weight to get a weighted value of considered indicator. Third, the sum of weighted values is divided by the sum of indicator's weights to give the score of the elementary effectiveness. As explained earlier, if $ei < 6$, the process has to be re-done; if $ei \geq 6$, the process continues to the next phase. The assessment of the overall effectiveness (E) follows also 2 steps. First, the actual measure of elementary effectiveness is multiply by its weight to get a weighted value of the considered phase. Second, the sum of the weighted ei values gives the Overall Effectiveness. Again as explained earlier, if $E < 6$, the whole process is cancelled; if $E \geq 6$ the contract is awarded to the winner.

V. RESULTS DISCUSSIONS

According to Patrick (2010), procurement performance in construction sector has been attracting great attention from practitioners, academicians and researchers since 1930. As a result, many instruments were developed including Prior-approval or Non-objection mechanisms, Internal control, Independent or External audit, Pre-award risk analysis, Pre-award survey, Pre-contract Effectiveness Audit, Public Procurement Model of Excellence (PPME), and Country Procurement Assessment Report (CPAR) etc... (Adjei, 2012, Agbesi 2009, UNICITRAL, 2004). In fact, as stipulated in public procurement laws, documents like annual procurement plan, project brief, project design & budget, tender documents, tender evaluation report and provisional tender award are all subject to prior approvals by entitled authorities before publication or implementation (see PPAs of Senegal, Cameroun, Chad, Ghana, Rwanda, Uganda, and Kenya). Although approval mechanisms are put in place, they do not

function as they ought to as far as the public funds are concerned except where non-objections are mandatory. As results, many governments have to recourse to independent firms to audit public procurement operations; yet any tangible improvement has been observed. Thus, for the purpose of the present study, three groups of the above instruments are briefly discussed below to demonstrate the need for an appropriate assessment tool of effectiveness of public contract award process.

a) *Pre-award risks analysis/survey or Pre-award Effectiveness Audit*

According to the Construction Industry Development Board – CIDB (2006), Pre-award risks analysis is a means of assessing all risks involved of awarding the contract to a particular bid winner. Then, conclusions are inserted in the evaluation report to inform the final decision. However, Pre-award survey is required only when information on hand or readily available to the contracting authority including information from commercial sources, is not sufficient to make a beneficial decision or when a contract administration office becomes aware of a prospective award to a contractor about which unfavorable information exists or when the prospective contractor is debarred, suspended, or ineligible (US/GAO, 1987; RPPA, 2010). Pre-award survey is also used casually as a verification means whose output can disgrace or credit a contractor alone and fails to assess the procurement institutions and processes. Pre-contract Effectiveness Audit is another means for evaluating a prospective contractor's proposed rates and related internal cost structure before actually agreeing and signing the subsequent contract (Moro, 2011; US/GAO, 2009; Matthew, 2012; CCCA, 2012). Its implementation in USA and Ghana has saved about 20% of initial bid price (Moro, 2011; Agbesi, 2009). But, like an audit, it is solely focused on cost criterion and the output may disgrace or credit a contractor alone. Also, pre-contract effectiveness audit fails to assess the procurement institutions and processes. Therefore, it does not fit for assessing the effectiveness as proposed by the present study.

b) *Public Procurement Model of Excellence (PPME)*

PPME is a software developed by OECD since 2002 to facilitate the collection of data in order to measure the quality of procurement system at the level of procurement entity. Its objectives are: (i) to help in the implementation of a change process to improve procurement at entity, regional & national levels; (ii) to provide objective information for assessing the conformity of the procurement process to the requirements; (iii) to evaluate performance of procurement at various levels and provide recommendations to improve the process; (iv) to lead to

the certification of the procurement entities within the country. The PPME uses 80 key performance criteria and provides two reports: an assessment report on the performance of a particular entity and a comparative assessment results reports Adjei, (2005). According to Agbesi (2009), the software was piloted in Ghana in 2006 and has been used to assess more than 200 entities. And so far, results show significant progress in the performance of public procurement as well as the impact of the Act 663 admitted Adjei, (2010) and Frimpong et al., (2013). Besides that, it has the merits of achieving the assigned objectives by providing managers at all levels with both an analytical tool to compare results and a list of recommendations to improve performance asserted Adjei, (2010). Though PPME exhibits features that comply with the concept of performance measurement system and even covers tendering processes at pre and post-contract stage, it however fails to tell the level of Effectiveness attained by a particular contract even if it is effectively processed. Another weakness is that PPME uses results measures and therefore lagging indicators. Not only that, it is goal centered (focus on entities) rather than process centered. Therefore, it is significantly different from the developed framework.

c) *Country Procurement Assessment Report (CPAR)*

CPAR is an analytical tool designed under the auspices of WB, OECD and UNICITRAL in 1990s and is used to diagnose a particular country's procurement system in order to generate a dialogue with the government. The CPAR stands on four pillars: legal framework, institutional framework and capacity, procurement operations and practices, and integrity of the procurement system (OECD, 2004). It uses 12 indicators and 54 sub-indicators distributed into two main components: Base-Line Indicators (BLIs) and Compliance & Performance Indicators (CPIs). The outputs of CPAR are essentially two tables and the adopted scoring system uses a scale of 0 to 3. With times, CPAR has become an important requirement before committing to lending and it has the merits of being worldwide accepted and applied (Rogati et al., 2004). Its methodology is regularly reviewed and complies perfectly with the performance measurement concept and principles. However, as there are no agreed International Procurement Performance System that can be applied equally to all countries, the CPAR is limited to a short term objective that is to find out the degree to which the country procurement system is following its own regulations. Besides, the perception of compliance (especially where the indicator cannot be measured quantitatively) differs from one country to another as demonstrated by Sanchez et al. (2009), who also assert that indicators alone cannot give a full picture of a whole procurement system that is by its nature complex. Indeed, some indicators are not

amenable to hard measurement in terms of facts and figures and assessing their performance is better accomplished through surveys or interviews with participants in the systems such as professional associations, civil society representatives, independent experts, and government officials (Sanchez et al., 2009). Another issue is that reliable data may not be available in public administrations to the extent asked for in order to satisfy all the 54 compliance & performance indicators. Again, after data collection, validating the results to arrive at the "right score" remains another problem to solve. Worse, the implementation of a CPAR demands a lot of financial and human resources and more often, it is undertaken with exterior financial and capacity supports. Lastly, recommendations made are rarely implemented and always every CPAR implementation is like a re-starting exercise. Once again, CPAR is different from the proposed framework which is fully described thereafter.

In short, the review above has shown that governments are using various but sectorial assessment tools with more or less satisfactory results. Although, it has been proven that some tools are yielding financial benefits despite some weaknesses or limitations; yet some shortcomings have been identified. In addition, the plethora number of indicators and sub-indicators does not facilitate their understanding and adoption in the field. Furthermore, there is still a constant need for more effective control instruments, reporting mechanisms, investigation methods and best practices as far as PP is concerned argued Patrick, (2010) and Cornela et al., (2011). Lastly, none of these tools is formally adopted for assessing systematically the overall Effectiveness of tendering operations at every procuring entity level for every individual construction project. Therefore, there is obviously a knowledge gap that the developed framework could bridge. To back up the description of the developed framework, an example is given below to demonstrate its practical application.

VI. EXAMPLE OF APPLICATION

a) Tender Planning

Measurable Indicators	Target Values	Actual measures	Assess. Score(X)	Weights (Ki)	Actual Values (X*Ki)
1.Time Performance Index	$\leq 100\%$	120%	5	0.077	0.385
2. Cost Estimate Accuracy	$\leq 100\%$	90%	8	0.065	0.520
3. Publicity extent	≥ 3	2	7	0.059	0.413
4. Number of approvals and controls performed	$= 100\%$	100%	9	0.051	0.459
5. Documentation Rate	$= 100\%$	50%	4	0.037	0.148
6.Capacity Qualification ratio (Project team)	$= 100\%$	30%	3	0.013	0.039
Sum =				0.302	1.964
Elementary Effectiveness at phase 1 (e1) = $1.964 / 0.302 =$					6.503

b) Tender Documents

Measurable Indicators	Target Values	Actual measures	Asses. Score (X)	Weights (Ki)	Actual Values (X*Ki)
1.Time Performance Index	$\leq 100\%$	90%	9	0.077	0.693
2.Cost Estimate Accuracy	$\leq 100\%$	80%	6	0.065	0.390
3.Number of approvals and controls performed	$= 100\%$	100%	9	0.051	0.459
4.Documentation Rate	$= 100\%$	80%	7	0.037	0.259
5. Capacity Qualification ratio (Tender commit.)	$= 100\%$	25%	3	0.013	0.039
Sum =				0.243	1.840
Elementary Effectiveness at phase 2 (e2) = $1.840 / 0.243 =$					7.572

c) Tender Solicitation

Measurable Indicators	Target Values	Actual measures	Assess. Score (X)	Weights (Ki)	Actual Values (X*Ki)
1.Time Performance Index	$\leq 100\%$	115%	6	0.077	0.462
2. Advertisement total duration	≥ 21 days	22 days	9	0.148	1.332
3.Publicity Extent	≥ 3	4	9	0.059	0.531
4.Publicity frequency	≥ 3	2	7	0.085	0.595
5.Number of requests of clarifications	$= 0$	2	7.5	0.073	0.548
6.Time allocated for tender preparation	≥ 60 days	75 days	9	0.169	1.521
Sum =				0.611	3.468
Elementary Effectiveness at phase 3 (e3) = $3.468 / 0.611 =$					8.165

d) *Tender Evaluation*

Measurable Indicators	Target Values	Actual measures	Asses. Score (X)	Weights (Ki)	Actual Values (X*Ki)
1.Number and Nationalities of Bidders	≥ 5	4	8	0.145	1.160
2.Time Performance Index	≤ 100%	75%	9	0.077	0.693
3.Cost Estimate Accuracy	≤ 100%	95%	8.5	0.065	0.552
4.Degree of Competitiveness	= 100%	96%	8	0.044	0.352
5.Applied Rate of Margin of Preference	≤ 10%	0%	9	0.034	0.306
6.Capacity Qualification Ratio	= 100%	15%	2	0.013	0.026
7. Documentation Rate	= 100%	100%	9	0.037	0.333
Sum =				0.415	3.422
Elementary Effectiveness at phase 4 (e4) = 3.422 / 0.415 =					8.246

e) *Tender Pre-Award*

Measurable Indicators	Target Values	Actual measures	Asses. Score (X)	Weights (Ki)	Actual Values (X*Ki)
1.Time Performance Index	≤ 100%	98%	7.5	0.077	0.578
2.Number of complaints or litigations generated	= 0	2	7.5	0.073	0.548
3.Cost Estimate Accuracy	≤ 100%	90%	8	0.065	0.520
4. Publicity extent	≥ 3	2	7.5	0.059	0.442
5. Approvals Compliance Rate	= 100%	75%	7	0.051	0.357
6. Documentation Compliance Rate	= 100%	75%	6	0.037	0.222
7. Capacity Qualification Ratio (Award commi.)	≥ 100%	50%	6	0.013	0.078
Sum =				0.316	2.745
Elementary Effectiveness at phase 5 (e5) = 2.745 / 0.316 =					8.687

f) *Overall Effectiveness Assessment*

Main Phases	Elementary Effectivenesses (X)	Weights (Kp)	Actual Values (X*Kp)
1. Tender Planning	6.503	0.363	2.360
2. Tender Documentation	7.572	0.261	1.976
3. Tender Solicitation	8.165	0.161	1.314
4. Tender Evaluation	8.246	0.137	1.130
5. Tender Pre-Award	8.687	0.079	0.686
Sum =		1.000	7.466
Overall Effectiveness E = 7.466 / 1.000 =			7.466

Briefly, according to our scoring system, all the calculated eis are over 6 hence are very good and E is 7.466 meaning that the Effectiveness level is 7.466 / 9 = 0.823 or 82.3 % which is Excellent. So, the contract is awarded to the recommended winner.

VII. CONCLUSIONS

The literature review has shown that governments are using various means with more or less satisfactory results. Although some are yielding financial benefits despite their weaknesses and limitations, none of them is formally adopted for assessing systematically

the overall Effectiveness of tendering operations at every procuring entity level for every individual construction project. Therefore, the present study was undertaken with the objective of developing a framework for assessing the effectiveness of CT in Chad. Indeed, effectiveness assessment process involves setting a baseline of standard practices, establishing relevant criteria and related measurable indicators including target values, then perform activities, collect data, assess the performance by comparing actual results to the expected, and finally draw the level of effectiveness. So, after defining a baseline 38 standard practices, the study has established five critical phases, seven relevant criteria and thirteen indicators. Based on these findings, a framework was developed comprising six components. The assessment process involves the assessment of elementary effectiveness at each phase using corresponding weights of key measurable indicators as well as the overall effectiveness using weights of different phases. An application example is given using a scoring system of 0 to 9. In conclusion, the developed framework is a practical tool for evaluating the overall effectiveness of CTP that informs decision makers to decide objectively when awarding contract that can be implemented in Chad and other developing countries. Not only that, the developed framework bridged a knowledge gap revealed by the literature review. Besides, the study demonstrated a practical application of AHP in the evaluation of the overall performance in public works procurement. For further research, the study made the following recommendations: (1) its implementation in the real world for validation; (2) its computerization for easy usage, (3) development of usage manuals for End users, Assessors and Contracting Authorities.

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Lean Wastes and its Consequences for Readymade Garments Manufacturing

By Sumon Mazumder

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Abstract- Waste is unnecessary for any kind of industry because it raises the manufacturing cost of products. For owners or clients waste is anything that cannot create any value. By effective lean production system it becomes possible to decline the generation of wastes and increase the productivity in any industries. So, it became very significant to identify lean wastes and its effects on productivity and manufacturing cost of RMG products. By this research work it was possible to categorize the lean wastes in four RMG industries. Motion studies during manufacturing also helped to bolstering the work. Strong willingness of management of RMG industries for increasing productivity and lowering the wastes level accomplished the study successful and finally seven dead wastes were recognized. According to lean manufacturing these dead wastes encompasses overproduction, more waiting time and bottlenecks, over transportation, excess inventory, more processing (re-works), excess motion and defects. These lean wastes could not contribute in adding value of different products. However, this research paper mainly underscored on seven lean wastages of RMG industries and its consequences for increasing production cost and hindrance of productivity due to greater production time.

Keywords: lean wastage, bottlenecks, waiting time, Re-works, RMG.

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Abstract- Waste is unnecessary for any kind of industry because it raises the manufacturing cost of products. For owners or clients waste is anything that cannot create any value. By effective lean production system it becomes possible to decline the generation of wastes and increase the productivity in any industries. So, it became very significant to identify lean wastes and its effects on productivity and manufacturing cost of RMG products. By this research work it was possible to categorize the lean wastes in four RMG industries. Motion studies during manufacturing also helped to bolstering the work. Strong willingness of management of RMG industries for increasing productivity and lowering the wastes level accomplished the study successful and finally seven dead wastes were recognized. According to lean manufacturing these dead wastes encompasses overproduction, more waiting time and bottlenecks, over transportation, excess inventory, more processing (re-works), excess motion and defects. These lean wastes could not contribute in adding value of different products. However, this research paper mainly underscored on seven lean wastages of RMG industries and its consequences for increasing production cost and hindrance of productivity due to greater production time.

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I. INTRODUCTION

After World War II, Japanese manufacturers were faced with the dilemma of vast shortages of material, financial and human resources. The problems that Japanese manufacturers were faced with differed from those of their Western counterparts. These conditions resulted in the birth of the “lean” manufacturing concept. According to Rameez and Inamdar in the 1950's Toyota Motor Corporation created Toyota Production System (TPS), then it formatted a new kind of management concept 'Lean thinking' [1]. Agile manufacturing, just-in-time manufacturing, synchronous manufacturing, world-class manufacturing and continuous flow are all terms that are used in parallel with lean manufacturing. According to Kuo et al. lean production is a multi-dimensional approach that encompasses a wide variety of management practices, including just-in-time, quality system, work teams, cellular manufacturing, supplier management, etc. in an integrated system [2]. Benefits of lean manufacturing system are improved productivity, overall wastage or

‘muda’ (the Japanese word for waste) reduction, cost reduction, reduces defects and overall quality improvement according to Chahal [3].

In a company, lean design and lean production can eliminate the seven wastes to create value for the supplier as well as for the client. According to one paper published by Mossman, creating value is the best way as it can eliminate wastes in design and construction [4]. For any industry cost and time related to production and quality management or wastes reductions have important impact on overall factory economy. Internal cost spent by a company and savings made by eliminating non productive works and time are important for management to keep the industry economically sound and safe. According to Islam^d et al. by applying lean tools in the manufacturing industry, seven lean wastes such as overproduction, re-processing (re-work), excess motion, transport, excess inventory, waiting time and defects can be reduced to a great extent which in turn improves the productivity of the organization [5]. The basic purpose of Lean Manufacturing is to manufacture the product with minimal wastage, optimal usage of available resources and at the least cost. To doing this, it uses various techniques like SMED, one-piece flow, kanban, poka-yoke, 5S, total productive maintenance, visual management, line optimization and synchronous manufacturing according to Satao et al. [6]. According to Chakraborty and Paul lean thinking focused on value-added lean and consists of best practices, tools and techniques from the Indian industry with the aims of reducing waste and maximizing the flow and efficiency of the overall system to achieve the ultimate customer satisfaction [7].

In the face of fierce competition resulting from the rapid globalization of businesses in Bangladesh, some companies across the garment industry sector have been practicing lean production to remain globally competitive and create a strong market position. There is a lack of research evidence regarding the impact of lean practices on manufacturing performance improvement in Bangladeshi garment firms. Researchers are mostly soundless on this very important area of production philosophy. According to Ferdousi and Ahmed the entire field of lean remains unexplored in Bangladesh [8]. However, one imperative study should be done in RMG industries of Bangladesh to identify the lean wastes responsible for less productivity and higher manufacturing cost of the

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products. Thus, industry people will be able to control those wastes and profit of the RMG factories will be maximized.

II. ANALYSIS AND FINDINGS

The study had been carried out for six days a week of two months period in four RMG industries (appendix) of Bangladesh having variation in its' production capacity and product category (woven or knit). Seven lean wastes such as overproduction, more waiting time and bottlenecks, over transportation, excess inventory, more processing, excess motion and defects were identified by direct observation and discussion with the people of different sections of RMG industries.

The movement of body parts of the workers was captured for the investigation. The study was mainly conducted to observe how the workers pass their time during working in the industries.

Following lean wastes in RMG industries were identified and represented after the studies:

- a) *Overproduction*: In case of *Style Garden Ltd.* about 6% of products (ski jacket) were over manufactured from the total order quantity factory people received, whereas *Fakir Apparels Ltd.* and *AJI Apparels Industry Ltd.* were found to make 8-10% of more pieces (tank top and t-shirt). Besides, in *Mim Dresses Ltd.* 0.5% over production was found for order quantity of one lac pieces, 1% for order quantity between 20,000-1 lac pieces and 2% over production for order quantity less than 5000 pieces. According to industry people they considered additional quantity to circumvent the likelihood of having short quantity of items due to rejection of defective pieces during inspection process. Thus, overproduction generated wastes and minimized the profit of the industries.
- b) *Waiting time & Bottlenecks*: Waiting time and bottlenecks were found to be mostly common in the sewing section of RMG industries due to lack of engineering and wrong manufacturing layout. Among four industries these types of lean wastes were found greater in case of *Style Garden Ltd.* as around three hours of work breakdown took place there every day due to load shedding. Workers spent idle time for the unavailability of generators which reduced the productivity of the factory. In *Mim Dresses Ltd.* workers were found to spend about 15.33% of the total working time due to waiting for materials. Waiting time and bottlenecks were normal for other two industries. Henceforth, more waiting time and maximum bottlenecks increased the production time and reduced the productivity, which has salient impact on the production cost.
- c) *Over Transportation*: *Style Garden Ltd.* was found with a single production floor which was

unorganized and having manual material transportation system in the sections (sewing, finishing etc.). *Fakir Apparels Ltd.* had an automated material movement system and forklift was used to transport the materials from one place to another place. In *AJI Apparels Industry Ltd.* since different sections were at different floors, so it consumed more time for the movement of material from one section to another section due to having manual handling system. There were many people worked as loaders who carried materials from one floor to another section and each loader was suggested to carry 30 kg of materials at a time. *Mim Dresses Ltd.* was also found with same material handling system like *AJI Apparel Industry Ltd.* A fixed number of workers were involved for overall material handling and they were found to carry maximum 10 kg at a time. Over transportation also increased the manufacturing time and declined target productivity.

- d) *Excess Inventory*: The inventory section was found completely un-organized in *Style Garden Ltd.* and 3-4 % extra materials (fabrics and accessories) were purchased. Besides, in *Fakir Apparels Ltd.* and *AJI Apparels Industry Ltd.* inventory section was found to be organized and 2-3% excess inventory took place after placing orders by the buyers. For *Mim Dresses Ltd.* inventory section was found organized and 2-5% of more fabric and 1-3% of extra accessories were purchased considering allowances and nature of the materials. In case of sensitive products, 20-30% of extra materials were purchased in that industry. Excess inventory decreased the profit maximization as it did not add any value to products.
- e) *More Processing*: In case of *Style Garden Ltd.* 40% of Ski-jacket and 20% of Men's pant were found defective and thus re-worked. About 15% of the defective pieces (tank top) were found to be re-worked and 24% of garment items (t-shirt) were found to be re-ironed which was of great concern to the authority of *Fakir Apparels Ltd.* 12-15% of the defective products (polo shirt) were found to be re-worked in *AJI Apparels Industry Ltd.* In *Mim Dresses Ltd.* 5-10% of products (men's half shirt) were found to be re-worked for minor defects and 2-3% of pieces were re-worked for major defects. More processing has been observed in all industries which declined the productivity of the lines and increased manufacturing cost of the products.
- f) *Excess Motion*: In *Style Garden Ltd.* it was observed that, maximum workers were used to sit idle or engage themselves in gossiping during waiting time. On an average, every worker was used to waste 12.5% of total working time doing nothing. Comparatively less unnecessary movement was

found in *Fakir Apparels Ltd.* and *AJI Apparels Industry Ltd.* But, productivity of those industries deteriorated up to 15-18% after the lunch break due to less consistency of work pace. Besides, in *Mim Dresses Ltd.* about 10% of total workforce were found in wander here and there and in engage themselves for gossiping with each other. However, workers of those industries were found to spend their time through working, waiting and movement. Following pictures were captured from RMG industries while workers were found in working, in movement (unnecessary) and in waiting for materials and instructions of supervisors. Some videos were also recorded and some variations were found in the movement of workers to perform the same task.



Figure 1 : Pictorial views in RMG industries

- g) **Defects:** Defects or faults were common for four industries. About 35% of the products were found to be defective in one hour in *Style Garden Ltd* and 10% of those were rejected and residual went to re-work. In *Fakir Apparels Ltd.* 15-18% of the products was found to be defective in one hour and of those about 3% was rejected and remaining

amount went for re-work. 18-22% of the products was found to be defective within one hour in *AJI Apparels Industry Ltd.* and of those 5-6% products was rejected and residual went to re-work. About 15% of the products were found to be defective in one hour in *Mim Dresses Ltd.* and 2% of these completely rejected and remaining pieces went for re-work. Following types of errors made defective pieces at different stages in four industries-

Chart -1 : Category of defects found in four RMG industries

Types of Defects/ Factory Name	Fabric defects	Sewing defects	Finishing defects
Style Garden Ltd.	Oil spot, dust mark, fabric holes, wrong placement of embroidery design.	Open stitch, skipped stitch, zigzag stitch, bar take missing, sewing line displacement, wrong placement of zipper, inaccurate shapes. About	Uncut thread, care label missing, hang tag missing.
Fakir Apparels Ltd.	Oil spot, dirty spot, color spot and GSM variation.	Needle hole, open stitch, missing stitch, body mismatch, bar take missing.	Uncut thread, improper ironing, missing of care label & hang tag.
AJI Apparels Industry Ltd.	Oil spot, dirty spot, color spot, fabric shading and GSM variation.	Needle hole, open stitch, missing stitch, body mismatch, bar take missing.	Uncut thread, improper ironing, missing of care label & hang tag.
Mim Dresses Ltd.	Unwanted spots, uneven shade.	Uneven hems, misaligned buttons, open stitch, slipped stitch, incorrect stitch density, needle hole, wrong fusing.	Uncut thread, missing of care label & hang tag.

The variation in the amount of lean wastages stipulated above was found in different industries. Among seven wastages, some wastage was found more than the acceptable level and some were in considerable limit according to buyers' perspective. Besides technical causes more defects were generated at different sections of the industries due to following reasons-

- Lack of attention of workers towards work

- Lack of quality knowledge
- Improper co-ordination among different sections
- Lack of proper supervision
- Defective fabrics and accessories

Thus, excessive defects led more rejections and re-works of RMG products which finally generated wastes, maximized production time and reduced productivity of four industries.

III. CONCLUSION

Waiting time and bottle-necks were found in greater amount for manufacturing of RMG products which can be minimized to a considerable level through balanced work load distribution among the workers by line balancing technique. Line balancing can also reduce unnecessary motions of the workers during working time. After the study and analysis RMG industries were asked for providing proper training facilities to the workers before integration to the production floor. Besides, industries must have a good strategy to motivate and encourage the workers through offering various incentives and reward schemes for their performance through productive works. *Fakir Apparels Ltd.* was found with newly introduced incentive scheme, which improved productivity and declined wastes from earlier time. The industry also has traffic light performance assessment system by which workers became more attentive towards their works and thus fewer defects were produced in a line. In this process they were found to prepare a check sheet and were attached in every workstation beside the workers. An assigned person observed how many defected products a worker made in one hour. According to workers' performance they get the color mark GREEN (no defects), YELLOW (first time warning) and RED (second time warning). Using of this system can be imperative for other industries for the improvement of its productivity with quality products.

Other effective lean tools like 5S, KAIZEN, JIT, KANBAN, SMED, TPM, and VSM may also be employed in the RMG industries for the reduction of these lean wastes. These tools are effective enough to minimize the production time and increase the productivity which will help readymade garments (RMG) industries to compete and survive with less manufacturing cost and higher product quality.

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APPENDIX

RMG Industry Profile

Name of the Industry:

Style Garden Ltd.

Location	: Mirpur-12, Dhaka-1216.
Type	: Only garment making
Nature	: Supporting industry
IE activities	: None
Certification	: None
Clients	: Exposures Ltd.
Production lines	: 01
Production capacity/day	: 550 pieces

Workforce : 150
Type of products mfg. : Ski Jacket and Long Pant

Fakir Apparels Ltd.

Location : BSCIC, Hosiery Industrial Estate, Narayanganj.
Type : Composite (Knitting, Dyeing, Printing & Garment)
Nature : 100% export oriented industry
IE activities : Yes
Certification : Oeko-Tex and WRAP
Clients : H & M, Gap, Levi's, Esprit, S.Oliver, Tesco etc.
Production lines : 90
Production capacity/day : 1, 40, 000 pieces
Workforce : 7,500
Type of products mfg. : T-Shirt, Polo Shirt, Tank Top, Mens Shorts etc.

AJI Apparels Industry Ltd.

Location : 226, Singair Road, Hemayetpur, Savar, Dhaka.
Type : Composite (Knitting, Dyeing, Printing & Garment)
Nature : 100% export oriented industry
IE activities : Yes
Certification : ISO
Clients : Carrefour, Tesco, Wal-Mart, Sears, K mart etc.
Production lines : 44
Production capacity/day : 48, 600 pieces
Workforce : 2, 200
Type of products mfg. : Mens Polo Shirt

MIM Dresses Ltd.

Location : Baishaki Super Market (2nd Floor), Mirpur-1, Dhaka.
Type : Only garment making
Nature : Sub-contract industry
IE activities : None
Certification : None
Clients : New Yorker
Production lines : 02
Production capacity/day : 2, 400 pieces
Workforce : 200
Type of products mfg. : Mens Half Shirt and Ladies Skirt



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Implementation of Alternative Solutions in Linear Programming Modeling using the Dual Simplex Method and Duality Method from Primal Problem, Establishing Implementation through the Simplex Methodology

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The idea can be adopted and adapted for companies that are working with problems to large scale with the possibility of obtaining solutions in polynomial time and perceive Previews Solution Real-time results shocking Search As Different criteria in Methodologies conclude similar solutions, either The prospect which allows the formulation of Mathematical Models Seeking code programming for try to do Improvement in The compilation and solving them.

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Objective

Show different ranges of alternatives that can provide solution to linear programming problems that may from feasible to optimal or optimal to feasible solution through analysis of their primal and dual models, which enable you to get valuable information for managerial decision making and the search for increased productivity as well as waste minimization maximizing available resources. It is unusual as detailed three most important methodologies at the same time for identifying solving tools in linear programming problems that can achieve large-scale analysis.

I. INTRODUCTION

The interest in linear equations goes back to ancient times of the year 1700 BC where the Egyptians left writings on your papyri mathematical problem solved with the use of algebra, later the Babylonians in the year 600 the BC left evidence that came from their work with Cuneiform Inscriptions where writing their participation in the mathematical problem solving equations using second grade, which is inferred taking

too elemental use of basic linear Equations additionally they don't know negative numbers, they inferred that values did not exist, there is evidence that problems were resolved in systems with five equations and five unknowns variables.

In Ancient Greece around the year 300 BC the Greeks troubleshooting developed with construction of linear equations that through the application of algebra could be solved, including Theodore from Cyrene and Eudoxus from Cnido consolidated their jobs between geometric advances, worth mentioning that the center of scientific activity occurred in the city of Athens. The School of the Greek mathematician Pythagoras incorporates elements of Babylonian algebra.

Around 1700 as Euler's attachment theory calculations of variations on movement of considerations assuming constant flux densities at any time and strength on surface elements among others. Also Isaac Newton in his treatise of mathematical composition and resolution work wrote his book calculation to find approximate solutions which seeks to find the roots of equations and higher order.

Moreover Guillaume L Hopital Sainte, Lord marquees from Mesme in France in the seventeenth century work on the analysis of the infinitely small and established the rule of L Hopital for analysis and study of mathematical problems within the differential calculus.

Also Joseph Louis Lagrange in the eighteenth century in his "miscellaneous works taurinensa" results obtained by implementing linear equations applied to problems over straight line movement and analysis of the dynamics of their movements.

After World War II ended where George Dantzig job in the Air Force of the United States through the Combat Analysis Branch of Statistical Control. Where he found the problems that lead him to make his great discoveries, considering the progress of the Nobel laureate economist Wassily Leontief in 1947 and met the general problem of linear programming, commented at the time that it started watching the feasible region of a

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geometric space and how the process could be improved movements take place within its endpoints. So it was like in the summer of 1947 could solve the first problem of linear programming in the area of food.

That same year he met Von mathematical Newmann Hungarian mathematician who since 1928 had been working strategy games whose work was published in 1944 (died in 1957) with renowned mathematician Morgenstern Australian economist who established the beginning of game theory consisting to define a logical instrument that assesses the competitive behavior of a rational human being under consideration, then Dantzig perceives the importance of the theory of duality. Because the linear programming model of a player who maximizes your chance of winning will be equivalent to linear programming model other player that minimizes your chance of losing the game. It was observed as if it were equivalent problems began with basic feasible solutions.

II. METHODOLOGY

The simplex method is a method that solves linear programming problems, where you try to optimize a maximum function or minimum satisfying a set of constraints embodied in forms of equations such that while meeting other conditions given as fundamental method requirements are met.

Restrictions can be of three types.

(<=) Less than or equal, which are passed form the equality restriction adding a slack variable.

(=) Just which way to go to equal or standard by adding an artificial variable.

(> =) Greater than or equal which are passed to the form of equal or standard form you need to deduct a slack variable and increasing an artificial variable.

Once covered this requirement, it is necessary to empty the information in tabular form where information of the coefficients of the objective function and constraints that accompany the issue is placed. The process is iterative and each stage is verified if the optimal value obtained by checking the line $Z_j - C_j$, sought where if the value is zero or positive will have

reached the optimal solution of a maximization problem, moreover if values are all zero or negative will have reached the optimal value for the case of minimization.

a) Maximize case

In the event that the values are negative or zero in the case of maximization have to create a new database inside inverse matrix by performing elementary row operations column, the basis for the minimization problem is updated by removing the most negative value in row $Z_j - C_j$ and entering the ratio between the minimum vector of the right side and the elements of the incoming column. Breaking ties arbitrarily.

b) Minimize Case

In the event that the values are positive or zero in the case of minimization have to generate a new database inside inverse matrix by performing elementary row operations column, the basis for the minimization problem is updated by removing the most positive value in row $Z_j - C_j$ and entering the ratio between the minimum vector of the right side and the elements of the incoming column. Breaking ties arbitrarily.

General, Model

$$\text{Max, } z = c \ x$$

st

$$Ax \leq b$$

$$\text{With, } x \geq 0$$

Where "A" is the original matrix with "m" row by "n" columns

b= vector of available Resource in "m" rows

c= coefficient of Known variables in objective function (Maximize or Minimize) in "n" columns

x= nonknown variable also is called decision variable. Therefore, when we try to solve linear programming in simplex table we are making the matrix operations.

The operations performed within the Table simplex matrix can be explained manner as shown below.

Where;

$$Z_j = Cb * B^{-1} * A_j(1) \quad Cb = \text{Coefficients, in, base}$$

$$Z_j - C_j(2) \quad B^{-1} = \text{Inverse, Matrix}$$

$$A_j = \text{Coefficients, out, base}$$

$$C_j = \text{Coefficients, of, variables, in, objective, function}$$

$$Z_j = \text{value, for, each, var iable, in, optimization, process.}$$

In equation 2 is where you can check if it has reached the desired optimality or should continue

iterating through the inversion of the matrix to enhance your solution and approach the expected value.

III. DUALITY THEORY

All primal problem is associated with another called dual problem are so called because they both have the same information but some in the form of row and other column addition to exchanging the coefficients of the objective function in the vector on the right side and this in once, in a reciprocal manner. It is assumed that if the primal feasibility is then possible to find the same optimal solution to the primal and the dual.

A primal problem will have "m" equations and "n" variables and the dual problem will be reverse.

Primal, Problem Dual, Problem

Max, $z = c^T x$ Min, $w = b^T y$

st *st*

$Ax \leq b$ $A^T y \geq c^T$

With, $x \geq 0$ With, $y \geq 0$

Economic interpretation of the dual.

The knowledge of how much profit or cost change with an additional unit of each several resources can be valuable information.

$$Z^* = Cb^* B^{-1} * b = Cb^* XB = w^* * b$$

Therefore w^* is the rate of change of optimal objective function value

Considering Dual $\partial z^* / \partial b = Cb^* B^{-1} = w^*$

Finally economically, w^* is a vector of shadow prices for the vector b which is available resource.

IV. DUAL SIMPLEX METHOD

The linear programming problem solved with normal simplex method has the basic idea from a feasible basic solution and move through endpoints to reach the optimum point basic solution. But sometimes it can happen that the linear programming problem starts being optimal but far away from feasibility, it can happen when we just change the signs of the objective function as well as the constraints and sense of inequality.

V. PROCEDURE

Step 1. Be sure that the restrictions are in position infeasibility is easy to identify by the negative sign on the right side of the resources available.

Step 2. Ensure that the restrictions are in standard form i.e. in the form of equity using slack variables and artificial depending on the direction of the inequality.

Step 3. Identify the variable that will leave the base which will be one that has the most negative value in the associated resource available (b) column.

Step 4. Identify the variable that enters visualizing the smallest ratio considering the absolute value of the row $Z_j - C_j$ between the values of the corresponding row to the more negative variable, it will happen in the case of maximization problems, by other hand in the case minimization problems the most positive ratio is chosen without considering absolute value of row $Z_j - C_j$ and elements of the more negative variable that leaves the base.

Step 5. The other elements of the simplex table is updated with elementary row column Operations thus the inverse matrix iteratively updated to display the elements in row $Z_j - C_j$ remain all zeros or positive in the case of maximization and are zero or negative for minimization. Do not forget to check that column vector on the right side should be kept positive values associated to the decision variables that provide the solution to the linear programming problem.

a) Implementation and Experimental results

Primal Problem							
Maxz = $3x_1 + 5x_2$							
subject to							
$x_1 \leq 4$							
$2x_2 \leq 12$							
$3x_1 + 2x_2 \leq 18$							
$x_1, x_2 \geq 0$							
First iteration							
Cj	\rightarrow	X	3	5	0	0	0
\downarrow	x	b	X1	X2	H1	H2	H3
0	H1	4	1	0	1	0	0
0	H2	12	0	2	0	1	0
0	H3	18	3	2	0	0	1
Zj		0	0	0	0	0	0
Zj-Cj			-3	-5	0	0	0
Second Iteration							
Cj	\rightarrow	X	3	5	0	0	0
\downarrow	x	b	X1	X2	H1	H2	H3
0	H1	4	1	0	1	0	0
5	X2	6	0	1	0	1/2	0
0	H3	6	3	0	0	-1	1
Zj		30	0	5	0	2 1/2	0
Zj-Cj			-3	0	0	2 1/2	0
Third Iteration							
Cj	\rightarrow	X	3	5	0	0	0
\downarrow	x	b	X1	X2	H1	H2	H3
0	H1	2	0	0	1	1/3	-1/3
5	X2	6	0	1	0	1/2	0
0	H3	2	1	0	0	-1/3	1/3
Zj		36	3	5	0	1 1/2	1
Zj-Cj			0	0	0	1 1/2	1
Solution		Testing					
Z*=36		X1+H1=4		2(2)=4			
X1*=2		2X2+H2=12		2(6)=12			
X2*=6		3X1+2X2+H3=18		3(2)+2(6)=18			
		Z*=3(2)+5(6)=36					

b) Implementation and Experimental Results

Dual Problem									
Min W = 4Y1+12Y2+18Y3									
subject to									
Y1+3Y3>=3									
2Y2+2Y3>=5									
Y1,Y2,Y3>=0									
</									

c) Implementation and Experimental Results

Dual Simplex Problem							
Max Z = -4Y1-12Y2-18Y3							
subject to							
-Y1-3Y3<=-3							
-2Y2-2Y3<=-5							
Y1,Y2,Y3>=0							
First iteration							
Cj	X	b	-4	-12	-18	0	0
0	H1	-3	-1	0	-3	1	0
0	H2	-5	0	-2	-2	0	1
Zj		0	0	0	0	0	0
Zj-Cj			4	12	18	0	0
Second iteration							
Cj	X	b	-4	-12	-18	0	0
0	H1	-3	-1	0	-3	1	0
-12	Y2	2 1/2	0	1	1	0	-1/2
Zj		-30	0	-12	-12	0	6
Zj-Cj			4	0	6	0	6
Third iteration							
Cj	X	b	-4	-12	-18	0	0
-18	Y3	1	1/3	0	1	-1/3	0
-12	Y2	2 1/2	-1/3	1	0	1/3	-1/2
Zj		-36	-2	-12	-18	2	6
Zj-Cj			2	0	0	2	6
Solution				Testing			
Z*=36			-Y1-3Y3+H1=-3			-2(0)-3(1)+0=-3	
Y1*=0			-2Y2-2Y3+H2=5			-2(3/2)-2(1)-0+0=-5	
Y2*=3/2							
Y3*=1			Z*=-4(0)-12(3/2)-18(1)=-36				

VI. ANALYSIS OF RESULTS

- You can see at the out put of experimental results are proven solutions using equations models of primal, dual and dual simplex Methods.
- Interesting to see how the values of the dual problem can be found in the Zj-Cj row of the primal model.
- The ability to reach optimal solutions based on different scenarios of linear programming and algebraic conditions required.
- The results are obtained from tabular models which work the basic operations column line, to generate the inverse matrix iteratively.
- You can see how in the implementation of Dual Simplex Method the column associated to vector of right side starts with negative value and in the third table the values associated to column of available

resource finished being positive. Is to say we starts being optimum solution but infeasible and after the problem finished being optimum and feasible therefore all the values of decision variable are positive.

- Mathematical models are solved shown three different linear programming techniques and in all cases the solution is reached in $Z^*=36$.

VII. CONCLUSIONS

- It is important to show the importance knowing of these important linear programming methods as alternative optimal solutions from a feasible basic solution or when there is already optimality. In everyday life can be in any of these scenarios and certainly this research paper help in making administrative decisions and engineering at the management level as complementary tools, where you can go from one to another depending on the

knowledge, skills and interests of your responsible established.

- For young people who are in the process of learning methodology mathematical programming, knowing the different criteria and rules that each of these three methods have will help them understand and manage properly solve their modeling. Also knowing where to find the dual values may allow determining future economic investments without going to perform the method of duality.
- Many real life problems can be treated using the dual simplex algorithm where an initial optimality to the actual feasibility of resources and goals, many goals can be adjusted with the methodologies presented in this investigation is determined.
- The possibility of creating your own code can flow as software tailored look that strengthens the cognitive process in abstract and complex problem to practice problem solving large-scale solutions in polynomial time given.
- Many times we are accustomed to use software that solves the problem of linear programming but we cannot identify the type of methodology used, certainly we lost the opportunity to identify areas of opportunity such as post-optimality analysis and economic interpretation of decision variables as a way to integrate into the management of productive enterprises or services.

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A Literature Survey on TCP-Test Case Prioritization using the RT-Regression Techniques

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Abstract- This paper focusses on the regression testing (R/T) for the test case prioritization (TCP). An attempt had been put up over here to explore the investigations carried out, conclusions obtained and the future works planned for almost ninety research papers and to decide upon a tentative title for the future research work as a plan of action. For this, various prioritization techniques, algorithms, tools & metrics, strategies, softwares used, etc were combined/compared/collected in-order to come to the summarization and discussion on the TCP using RT.

Keywords: regression techniques, test case prioritization, metrics, strategies, algorithms, tools.

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A Literature Survey on TCP-Test Case Prioritization using the RT-Regression Techniques

R. Surya Kiran ^α, Prof. (Dr.) Chandraprakash ^σ & Koneru Srinivas ^ρ

Abstract- This paper focusses on the regression testing (R/T) for the test case prioritization (TCP). An attempt had been put up over here to explore the investigations carried out, conclusions obtained and the future works planned for almost ninety research papers and to decide upon a tentative title for the future research work as a plan of action. For this, various prioritization techniques, algorithms, tools & metrics, strategies, softwares used, etc were combined/compared /collected in-order to come to the summarization and discussion on the TCP using RT.

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I. INTRODUCTION

The purpose of the R/T is to fix-up the adverse affects due to the addition / deletion of old / new features in the softwares. The test case prioritization (TCP) is essentially to schedule the execution in-order to maximize the objective functions or the goals leading to the rate of the fault detection in the software use / development works. For the same cause, understanding the needs of the various sources of variation that impact the usefulness of the software for R4-Reusability, Retrievability, Revision and Retain is very essential. A very predicate capability with the new tool for the development with some-what better techniques highlighting the practical implications are to be explored. Then proper procedures with the statistical significances are to be adopted for the future developments with the graphical evidences.

II. LITERATURE REVIEW

The below is the literature review (information-generated) out of the journals that had been selected for the survey.

- This paper investigated into a hybrid technique combining modification, minimization and prioritization using a list of source code changes.
- The paper investigated into the branch coverage, Total statement coverage, Addl statement coverage, Total fault exposing potential (FEP), Addl fault exposing potential (FEP) prioritization.

- The paper investigated into the total function coverage, total statement coverage, Addl function coverage, Addl statement coverage, Total fault index, Addl fault index and optimal.
- The paper investigated into the Random ordering, Addl statement coverage, Addl function coverage, Addl fault index prioritization.
- The paper investigated into 09 different test case P/T namely No prioritization, Random, Optimal, Total statement coverage, Addl statement coverage, Total branch coverage, Addl branch coverage, Total fault exposing, potential (FEP), Addl fault exposing potential (FEP).
- The paper investigated into two new algorithms were presented -one for the test suite reduction and one for the test suite prioritization that considers the Modified Condition / Decision Coverage with the new test suite reduction algorithm -test case redundancy and test case essentiality.
- The paper investigated into Comparator techniques -Random Ordering and Original Ordering; Statement level techniques -Total statement coverage, Addl statement coverage, Total FEP, Addl FEP prioritization techniques. Functional level - Total functional coverage, Addl functional coverage, Total FEP, Addl FEP, Total fault index, Addl fault index, Total FI with the FEP coverage, Addl diff, Addl diff with FEP prioritization techniques.
- The paper investigated into Retest -all techniques, random / adhoc, minimization, safe techniques.
- The paper investigated into Two new test suite reduction algorithm (Break-Down & Build-Up) and two subjects for the study- TCAS and SPACE basing its contribution computation on the MC / DC.
- The paper investigated into two model based P/T - Selective and model dependance based P/T. Model state based software systems: EFSM-Extended Finite State Machine, SDL-Specification Description Language, SC-State Charts.
- The paper investigated into value driven approach to PORT-Prioritization of the requirements for test and based on the four factors- Requirements Volatility, Customer Priority, Implementation

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Complexity and Fault proneness of the requirements.

- The paper investigated into Java-based tool Java code coverage for the test coverage reporting which supports the testing related activities by recording the test coverage for variables code-elements and updates the coverage information when the code being tested is modified.
- The paper investigated into problems and choice of the fitness metric, characterization of landscape modality and determination of the most suitable search techniques to apply. Also two meta-heuristic search techniques -HILL CLIMBING and Genetic Algorithm together with three greedy algorithms - greedy, addl greedy and optional greedy.
- The paper investigated into a new technique for the black-box RT to improve the effectiveness of fault detection when performing the RT in the black-box environment.
- The paper investigated into CIT-Combinatorial Interaction Testing which systematically samples all t-way combinations of input parameters.
- The paper investigated into enhanced Bayesian Network (BN) which integrates the different types of the information to estimate the probability of each test case finding bugs with an introduction to feedback mechanism and a new change information gathering strategy.
- The paper investigated into particle swarm optimisation (PSO) algorithm to prioritize the test cases automatically based on the modified softwares.
- The paper investigated into historical-Value based approach which is based on the historical information to estimate the current cost and the fault severity for the cost cognizant test case prioritization. Also functional coverage test case prioritization was discussed.
- The paper investigated into the solution using the six sigma methodology to support the quantitative analysis of the problem and evaluation of the developed solutions.
- The paper investigated into the several model-based test prioritization heuristics resulting in the study suggesting that system models may improve the effectiveness of the P/T wrt early fault detection.
- The paper investigated into a Quota -Constraint test case prioritization for SCS's- Service Centered Systems and also proposed a quota- constraint strategy to maximize testing requirement coverage.
- The paper investigated into the rates of severe fault detection for both the regression testing and the non-regression testing.
- The paper investigated by extending the prioritization methods to parallel- scenarios and defines the P/T in such scenarios and applies the task scheduling method to algorithms to help partitioning a test suite into multiple prioritized subsets.
- The paper investigated a model for the system level TCP-Test case P/T from the software requirement specification to improve the user-satisfaction that can be cost effective to improve the rate of severe fault detection.
- The paper investigated into a system based modelling as a widely applicable technique to model -state based systems. And also compared the code based test prioritization to model based test prioritization.
- The paper investigated into whether the R/T are effective in reducing the residual defects across the system's lifetime. The proposed heuristics with the feedback techniques were effective in reducing the occurrence of the residual defects.
- The paper investigated into the heuristics techniques used were conventional code coverage and Bayesian network to determine the relative cost-benefit of P/T wrt baseline technique .Introduction to the partial prioritization to lower the analysis costs.
- The paper investigated into the five search algorithms were chosen namely, total greedy, additional greedy, 2-Optional greedy, hill climbing & genetic algorithms. The ratio of the overlapping is the criteria for preferring the choices.
- The paper investigated into the five different location based services with the five different quantitative metrics, POI aware P/T were evidenced better than the random ordering or input-guided P/T.
- The paper investigated into the dependance analysis based on the TCP for analyzing the dependance relationship using the control and data flow information in WS-BPEL to describe the service composition. A weighted dependance propagation model to facilitate the prioritization process.
- The paper investigated into a method to measure the distance using the coverage information and the proposed method enabled ART to be applied all the kinds of the programs. This method reduced the number of the test cases for the detection of the first failure.
- The paper investigated into a CA model based testing approach supporting a supporting the black-box testing approach. Minimization of the costs through the tracking of the model changes at the edit-time, recording change time-stamps and ability to combine specification based concerns with the model changes.

- The paper investigated into a model based test prioritization using the activity diagram to identify the difference between the original model and the modified model. This draws the paths for each of the test cases and identify the most promising paths .As compared to the code-based approach, the presented approach provides the most beneficial path from an activity diagram.
- The paper investigated into a cost cognizant test case based P/T based on the use of the historical records and a genetic algorithm was proposed .The proposed technique avoids the situations where the test-cases and fault severities are considered without analyzing the source code, improves the prioritization performance.
- The paper investigated into an optimization of the R/T activity by adopting a test case P/T called as Failure Pursuit Sampling. By using the test information available from the previous versions, the technology could be driven to the achieve the higher rates of the improved efficiency.
- The paper investigated into a TCP using the sequences in XML messages to reorder the R/T cases for composite web services against the tag based techniques . Sequence coverage from the input and output messages associated with the R/T suites were proposed.
- The paper investigated into the current manual processes as well as the effects of the proposed new methods. And was conducted at Sony Ericsson Mobile Communications. The success rate was comparable with the other techniques.
- The paper investigated into a quantitative evaluation indicating for the possibility to improve the efficiency, while qualitative evaluation supporting the general principles of history based testing. Construct validity, Internal validity, External validity and Reliability were checked.
- The paper investigated into a CBSS-Component Based Software System and the state changes were converted into CIG-Component Interaction Graph to describe the interrelation among the components. This used two criteria-maximum number of state changes and database access was occurred by the test cases for determining the TCP.
- The paper investigated into a new metric, APFDD was introduced .A comparison between the - prioritized and non-prioritized test cases were done. The prioritized cases were more effective.
- The paper investigated into the challenges descending from the limited testability of the external services and to encompass the traditional R/T. Possible ways towards the online-offline testing, detection of changes in the services, test case selection, minimization and prioritization, definition of the test oracles were discussed.
- The paper investigated into the consideration of the cost based objectives, value based objectives with the MORTO optimization constraints. MORTO approach is long overdue.
- The paper investigated into an In-process and the most up-to date test suite to re-order the test cases. Dynamic prioritization could generate the up-to-date TCP.
- The paper investigated into the art efacts used in the model based test generation for the from the state machines. Allowed for reducing the test execution to 80% of regression in some scenarios.
- The paper investigated into a new approach using the information retrieval to match with the service change description with the code based portions exercised by the relevant test cases. Only specific combinations with the input/output channels were affected by a specific service change.
- The paper investigated into a TCP algorithm with a fitness function with the average block coverage to quantify the possibility of finding the errors. The algorithm based on the baseline testing was considered in finding the rate of the test sequence errors.
- The paper investigated into a database regression testing for the functional black box R/T for complex legacy data base applications was done .Full integration of the DART with the daily test operations of the projects and predictive testing.
- The paper investigated into a model for the R/T in SaaS to abstract the events and a case study to validate the approach. The failures that were uncovered from this methodology were not identified by the earlier methods.
- The paper investigated into the fault localisation problem involving the focus on the CIT techniques for the experiments on FLEX and MAKE. Provided a framework evaluated through the empirical studies.
- The paper investigated into a new equation for the historical effectiveness of the test for the historical effectiveness of the test cases in the fault detection. This new approach considered the time constraints for executing a fraction of the prioritized test suite.
- The paper investigated into an approach JUPTA for prioritizing the JUNIT test cases in the absence of the coverage information. JUPTA T and JUPTA A outperform the untreated orderings.
- The paper investigated into an examination of system configurable software driven not only by the fault detection but also by the cost of the configuration and set up time moving between

different configurations. In the new light, the actual time to run the same number of the configurations varies greatly depending on the order in which they run.

- The paper investigated into a formulation for the new test case prioritization strategies using the tags embedded in XML message to reorder the R/T cases and to reveal the test cases use the interface specifications of the services. WSDL information facilitates the effective R/T. The empirical results showed that the techniques used are effective.
- The paper investigated into an eclipse IDE plug-in for managing the JUNIT test cases, to manipulate the test cases through the GUI was adopted. To use the coverage based techniques in the real world software development.
- The paper investigated into a set of ART prioritization guided by the white-box coverage information was proposed. The branch level techniques were comparable to the statement level and both of them proved to be more effective than the functional level techniques. Art-br-maxmin P/T is good candidate for the practical use.
- The paper investigated into a suite of metrics and initialised them demonstrate input-guided techniques and point-of-interest aware test case prioritization technique. The performance of the P-O-I aware techniques are more stable and cdist is the most effective and stable technique
- The paper investigated into case-retrieval, re-use, solution testing and learning and used the prioritization strategies included general, specific, general ignore ,additional general ignore, random prioritization and no prioritization.
- The paper investigated into the impact of the test oracles on the effectiveness of the testing and improvement in the rate of fault detection relative to both the random and structural coverage based P/T when applied to the faulty versions of three synchronous reactive systems. The results showcased a potential for oracle-centric P/T to improve on coverage -based approaches.
- The paper investigated into a two-level prioritization approach using FDG-Functionality Dependency Graph & IFG-Inter procedural control graph.
- The paper investigated into three hybrid combinations - Rank, Merge and Choice and demonstrated the usefulness in two ways. The time-aware prioritization techniques out-performed the other prioritization techniques.
- The paper investigated into a new methodology using a modular based test case prioritization as the same was found to be more effective than the

overall program TCP. The major work was based on the fault coverage.

- The paper investigated into the earlier PFD-Page flow diagrams and PTT-Path test trees and showcased the reusability of the black-box generated test path for the white box testing of the websites.
- The paper investigated into a genetic algorithm for improving the prioritization of the test suites by a new fitness function considering the weights of the test cases, fault severity, fault rates and the number of structural coverage items covered by each test case. A fully automated TCP for the whole process was quite achievable.
- The paper investigated into the requirements based clustering approach to incorporate the traditional code analysis information.
- The paper investigated on a refactoring based approach for selecting and prioritizing regression test cases.
- The paper investigated into a TCP with the use of the model checkers and with the introduction of a new property based P/T .Several -critical embedded systems were illustrated and the techniques were based on the functional model of the programs. The model checkers do not pose any problems to the prioritization.
- The paper investigated into a history based TCP and source code information .This speaks about the version aware approach for the detection of the faults.
- The paper investigated into a unified view basic and extended for the generic strategies in TCP. There were many strategies which were effective between the total and the additional strategies than the either of those strategies.
- The paper investigated into an adaptive TCP which combines the test case prioritization process and test case execution process .The adaptive approach was more significant than the total approach and more competitive than the additional approach.
- The paper investigated into two heuristics methods and in-order to prioritize the variable strength interaction test suite. The random prioritization had the smallest NAPFD metric values.
- The paper investigates on the Fuzzy Expert system to aid in the decision making process for a particular software version and this method also proved to be effective in addressing the limitations addressed by the other P/T strategies.
- The paper investigated to address the automated program repair called as FRTP with a goal to reduce

the number of TCP. A tool called as TRPAUTOREPAIR was implemented.

- The paper investigated into ROCKET-Prioritization for continuous regression testing of Industrial Video conferencing software and simultaneously the results revealed 30% more faults for the 20% of the test suites executed.
- The paper investigated a technique that is a hybrid of TCP based on the risk exposure to facilitate the achievement of the quality product.

III. METHODOLOGY

Generally the sources of the information were divided into the primary sources of the information and

the secondary sources of the information. For this survey, the sources of the information were collected from the IEEE journals.

IV. ANALYSIS

- The information for the purpose of the seeded and the non-seeded based fault detection could be well classified into the code-based and non-code based, coverage and non-coverage based prioritization informations.
- The analysis softwares used were SAS and SPSS.
- The metrics that were used were as tabulated below:

Table 1 : Metrics for the Effectiveness

APFD	APBC	TPFD	Var	Pcov
APFD _c	APDC	TSFD	Entropy	
APFDD	APSC	ASFD	Cdist	
NAPFD	WPDF	AFMC	Pdist	

[APFD-Average percentage of the faults detected, APFD_c- Average percentage of the faults detected per cost, APFDD-Average percentage of the faults dependency detected, NAPFD-Normal Average percentage of faults detected, APBC- Average percentage of block cover, APDC- Average percentage of Decision cover, APSC- Average percentage of

statement coverage, WPDF- Weighted percentage of faults detected, TPFD- Total percentage of faults detected, TSFD- Total severity of faults detected, ASFD- Averageseverity of fault detected, AFMC- Average percentage of fault effected module cleared per test case].

- The TCP techniques that were discussed were as tabulated:

Table 2 : Test Cost Prioritization

No prior.	Random Prior.	Optimal prior.	Total branch prior.
Addl Branch Prior.	Fault exposing potential prior.	Addl fault exposing prior.	Total statement coverage prior.
Addl statement coverage prior.	Random prior.	Addl Function coverage prior.	Addl Fault Index prior.
Total FI with FEP prior.	Addl FI with FEP prior.	Total diff prior.	Addl diff prior.
Total statement coverage prior.	Addl statement coverage prior.	Total method coverage prior.	Addl method coverage prior.
Srivatsva & Thiagarajan prior.	Total CC prior.	Total BN prior.	Addl CC prior.
Addl BN prior.	Untreated prior.	Method Total prior.	Method Addl prior.
Total test ability based prior.	Addl test ability based prior.	POI awareness structural coverage prior.	-----

- Other Strategies that were discussed were as mentioned below:

Table 3 : Strategies for Test Case Prioritization

QCTB	QCAB
TB	AB

[QCTB- Quota-Constrained Total Branch, QCAB-Quota-Constrained Total Branch, TB-Traditional Branch AB-Additional Branch]

- The Algorithms that were discussed were as mentioned below:

Table 4 : Algorithms for the Test Case Prioritization

Greedy Algorithms	Addl Greedy Algorithms	2-Optimal Algorithms	Hill Climbing	Genetic Algorithms
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g) The tools that were used were as mentioned below:

Table 5 : Tools used for theTCP

TIM	ATEI	TTEI	DART
[TIM-Testing Importance of the Module, ATEI-Average Test Effort Index, TTEI-Total effort Effort Index, DART-Database Regression testing]			

h) Some of the major participating companies discussed were as mentioned below:

Table 6 : Major companies involved in TCP

Sony Ericsson Mobile Communications	Siemens	SaaS	E-Bay	Google
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i) Some of the major softwares that were discussed were as mentioned below:

Table 7 : Softwares used for Analysis Purpose

SAS	SPSS
[SAS-Statistical Analysis Software, SPSS-Statistical Package for Social Sciences]	

- The major modelling systems that were discussed were as mentioned below:
EFSM& EVOMO

V. SUMMARIZATION & DISCUSSION

Any general or the version specific TCP could be very well carried-out with the aid of the survey analysis, provided that there exists a statistical significance in the form of the graphical evidences. The same also remains factual for both the controlled and the non-controlled TCP. But there should be an insight into the cost factors as well and the benefits of the various parameters that could be considered apart. The software testing amounts to almost 50% of the total development cost. The path testing itself could detect upto 65% of the errors in the software.

VI. CONCLUSION

This had been concluded from the survey of the ninety papers of IEEE that a fully automatic modular and historical information based TCP should be developed .And the research should orient towards the genetic algorithms with the major focus on the residual defects as well. Then the metric that could be used for the effectiveness testing could be taken as APFDD and in the end a fitness function could be incorporated.

The tentative title for this academic research could be

"An auto-TCP with the stat-comp regression testing ".

More work could be carried out on the FUZZY EXPERT SYSTEMS (FES)- ADAPTIVE RANDOM TESTING (ART) for the cost effective decision- making for the incorporating the study on the residual defects for the regression testing. An Analytical Hierarchy Process (AHP) may be prioritized for prioritizing the testing process of regression. MORTO-Multi-Objective Regression Test Optimization could be incorporated for the proper results along with the fitness function. The philosophies, theory, axioms, principles, practices and adopted formulae are to be combined properly in the studies for the effective implications. At each and every

step, the steps adopted for the development should possess both the industrial and the institutional applications for the structured, semi-structured and the un-structured problems and their solution, resolutions and the dissolutions that might be obtained from time-to-time. Finally before the implications of any type, care should be taken in such a way that 6W's and 2H are satisfied. Thus this work would try to produce a complement to the existing technique in-order-to produce a modern ones with an additional benefits to compare.

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An Analysis of Industrial Relations Practice in Nigeria and Ghana (Similarities and Differences in their Systems)

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Abstract- This research work compare and contrast industrial relations practice in two West African countries paying a particular attention to Ghana and Nigeria, showing the area of difference and similarities between the two nations.

I. INTRODUCTION

Industrial relations have been defined broadly as dealing with everything that affects the relationship between workers and employers, Imafidon (1996). It involves anything which affects the employee from the time he joins the organisation until he leaves his job. The whole idea of industrial relations emerged as a result of the inability of employers and employees to have a proper dialogue concerning the terms and conditions of services. Kochen (1986) and Fashoyin (1988) opined that industrial relations involves actors and institutions such as government and its agencies, trade unions with its workers and employers and its' associations and the relationships between them. Issues like strikes, collective bargaining, joint consultation and how they relate to various government agencies are all within the purview of industrial relations.

The main focus of labour relations in industry is seen as the one which emphasizes the development of peaceful relations, mutual respect for each other in an industrial organisation. Specifically, it focuses on how collective agreements are implemented and interpreted. One of the actors in industrial relations is the trade union which has played a prominent role in the promotion of industrial relations in West Africa State. There is therefore the need to look at their activities in West African countries.

II. ORIGIN OF UNIONISM IN WEST AFRICAN STATE

Nigerian case- The Nigerian Civil Service Union which was founded in 1912 received a kind of government acceptance; the union remained mainly a social club for the senior public officials for many years. It was initially not a protest movement established mainly to fight for higher wages and improved employment conditions. By the end of the First World War however, the Nigeria Civil Service Union had assumed the true functions of a trade

union. For instance, the union fought and won for its member's percentages of their salaries as war bonus shortly after the First World War. It also agitated for the promotion of Nigerians to the senior professional and administrative posts which were up to the 1940s, reserved almost exclusively for colonial officials. Other early development in Nigeria included the strike of the mechanics union at the end of the First World War, the 1921 strike of railway workers and 1925 strike of teachers at Calabar.

The pre-1939 development of trade unionism in West Africa was also affected by the great depression of 1930 to 1932 which affected all sectors of the British economy and had its repercussions on the economies of colonial territories; the result was that unemployment rose and wages fell considerably. The resultant unrest prompted the formation of new trade unions and rapid increase in the membership of the existing unions.

III. GHANA & SIERRA LEONE CASE

In 1929, a labourer's union was formed in Sierra Leone, the Ashanti drivers in Ghana also formed a union which became effectively organised in line with one earlier organised in Nigeria. (Oyebola 1970) The British government became directly concerned with the growing labour problems in its overseas territories. She therefore decided on some minimum conditions that should determine the employment of people of the colonies through the passage of the Recruitment of Indigenous Workers law in 1936 and acceptance of minimum wages Convention in 1937. The enactment of trade union ordinances by the colonial administration between 1938 and 1939 provided an impetus as well as a legal foundation for the rapid growth of trade unionism in the West African. Labour departments were set up and laws were passed to regulate the compensation that should be paid to workers or their dependants in case of accidents or death. In the English-speaking territories of West Africa, the unionist helped to nurture some new trade unions until they obtained registration permits. With the outbreak of war in 1939, many West Africans joined the armed forces and there was scarcity of labour. In some cases colonial governments adopted forced labour in order to find workers for their industries. (Oyebola 1984).

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IV. INDUSTRIAL RELATIONS PRACTICE IN GHANA

Amanor, k. (2003) is of the view that an important aspect of trade union development in Ghana was the encouragement given by the government towards the formation of a few financial viable unions as well as a strong virile central labour organisation. The Industrial Relations Acts of 1956 and 1958 gave legal recognition to the Ghana Trade Union Congress (T.U.C) which became the only central labour movement in Ghana. Under the 1965 Act, compulsory memberships of the Trade Union Congress empowered the union to make deduction of members' union dues from their incomes which is known as "*the check off system*". The T U C was also empowered to bargain for higher wages and improved conditions of employment, and agreements reached by it were enforceable by the law. The firm control exercised by the Nkrumah government on trade unions was prompted by the belief in realisation that the country's socialist objectives and rapid economic growth must be pursued through democratic centralism, the nation's manpower resources must be effectively utilised by means of a dynamic workers' body. The pattern is different in Nigeria where there are far more unions than that of Ghana. Oyebola (1970). Tracing the history of T. U. C. in Ghana. Adewumi (1998) stated that the trade union congress in Ghana was founded in 1945; its chequered history through the various civilian and military regimes provided a wealth of experience for trade unions struggles. The union played an active role in the struggle for independence, of Ghana as a nation.

The government assisted the labour movement to establish business enterprises like Ghana National Trading Corporation, the state Construction Corporation and many others. During the Second Republic in Ghana (1969-1972) the labour movement activities was entirely on industrial relations. This stance however did not absolve the movement from harassment, in fact, in 1971; the government of Dr. Kofi Busia passed an act of parliament to dissolve the T.U.C. This measure was the government's response to the persistent struggle of the T.U.C. for a revision of the minimum wage. The T.U.C was restored when the Busia administration was overthrown in January 1977 by the military.

The Second military take over of government in 1977 led by colonel General Acheampong. During this period, the labour movement adopted a policy of cautious participation. Incidentally, it was during this period that labour movement made significant gains for its members. Notable among them were the introduction of housing, transport and canteen allowances for all category of workers in Ghana.

During the transition to civil rule in the third republic, the T.U.C .decided to sponsor the formation of

a political party named the Social Democratic Front (S.D.F) .The S.D.F. won only one seat in 120 National Assembly. It is also won significant seat in rural area of the northern region where the labour movement's presence was minimal. However, the military rule of the P N D C, (Provisional National Defence Council) (1981-1982) brought major challenges to the Trade Union Congress. In April, 1992, a group of radical trade union activists in Accra/ Tema organised themselves into what is called Association of local Unions (ALU) which chased out the leadership of the national union and the T.U.C .from office, accusing them of "bankruptcy". It is not clear whether this group was organised by the military regime. What was clear however was that they received active patronage of the regime? The leaders of ALU for instance had curfew passes which enabled them to "break" the dusk to dawn curfew initially imposed on the whole country at the time. They also had direct access to the regime and served on various committees that were set up to "clean" the country of corrupt officials. The take over of ALU was the first challenges to the independent existence of the TUC under the P. N. D. C's rule. The Second challenge it faced was from the Workers Defence Committees (WDC s) who has a touch in industrial relations matters. At the end of the day, the union survived after developing strategies to collaborate with the W. D. C s. Again the PNDC formed the council for Indigenous Business Associations (CIBA) as the informal organisation for workers in that sector. Against all these, the PNDC introduced the IMF/World Bank sponsored structural Adjustment Programme which fully stretched the endurance and capacity of the trade unions through SAP related measures like retrenchment, trade liberalization, devaluation etc-which had adverse consequences on the organised and wage earning labour.

The fourth Republic which was ushered in on 7th January 1992 brought fresh life to the TUC. During the transition programme, the TUC had 10 representatives in the 250 member Consultative Assembly that drew up the Constitution of the Fourth Republic. The TUC presented a blue print of its expectations in the new constitution. All these needs were adequately met as its representatives worked with other members of the Assembly to ensure that those needs were reflected in the Constitution. As a result respect for human rights and trade union rights are adequately entrenched in the Constitution. Since the inception of the fourth Republic, the TUC has again gained the confidence of the general membership and the population at large. The T.U.C. Congress in 1992 underlined the neutrality of the organisation by banning all its leaders and elected national officers of national unions from actively participating in the activities of any political parties.

The TUC has an effective relations with the press as well as other civic society organisations like the Third World Network, the University Teachers Association, and the Civil Servants Association among other workers' groups not affiliated to it.

The TUC serves on several statutory bodies. Some of these are:

- The National Media Commission
- The Ghana Free Zones Board
- The Board of Social Security and National Insurance Trust,
- Divestiture Implementing Committee
- The Tripartite Committee
- The National Advisory Committee on Labour
- The Regulatory Commission.

V. SOME SPECIFIC INDUSTRIAL RELATIONS PRACTICE IN GHANA

Trade unions are governed by the Industrial Relations Act (IRA) of 1958, as amended in 1965 and 1972. Organized labour is represented by the trade union congress (TUC), which was established in 1958. The IRA confers power on government to refuse to register a trade union; however this right has not been exercised by the current government or the previous military government. No union leaders have been detained in recent years nor have workers' rights to associate freely been otherwise circumscribed.

The Right to organize and Bargain collectively-: the IRA provides a framework for collective bargaining and protection against anti-union discrimination. The IRA provides a mechanism for conciliation and then arbitration before unions can resort to job actions or strikes. "Wildcat" strikes do, however, occur occasionally, labour unrest took the form of two strikes. One, against a timber concern controlled by the United Africa Company developed into riots that resulted in the shooting of three workers. The other was a ten-day strike in July by railroad engineers during which the government supported the strikebreakers. Shortly after the strike, the government rejected Trade Unions Congress demands that minimum wages (\$0.75 a day) be doubled, and it announced in presenting its new budget that no salary increases would be permitted during the coming year.

Prohibition of Forced or Compulsory Labour-: Ghanaian law prohibits forced labor, and it is not known to be practiced. The International Labor Organization (ILO) continues to urge the government to revise various legal provisions that permit imprisonment with an obligation to perform labour for offenses that are not countenanced under ILO Convention 105, ratified by Ghana in 1958.

Minimum Age of Employment of Children-: Labour legislation in Ghana sets a minimum employment age of

16 and prohibits night work and certain types of hazardous labour for those under 18. The violation of child labour laws is prevalent and young children of school age can often be found during the day performing menial tasks in the agricultural sector or in the markets. Observance of minimum age laws is eroded by local custom and economic circumstances that encourage people to become wage earners at an early age. Inspectors from the Ministry of Labour and Social Welfare are responsible for enforcement of child labour laws. Violators of laws prohibiting heavy labor and night work by children are occasionally punished.

Acceptable Conditions of Work-: A tripartite committee of representatives from government, organized labour, and employers established a minimum wage of 780 cedis (less than one dollar) per day. The standard working hour in a week is 40 hours. Occupational safety and health regulations are in effect sanctioned which are occasionally applied to violator through the labour department of the Ministry of Health and Social Welfare.

VI. INDUSTRIAL RELATIONS IN NIGERIA

Nigeria today is a country undergoing fundamental political, economic, and social change. It has been said that 'revolution' is 'evolution' speeded up. Davison (1977) If so, few can doubt that many of the institutions in modern Nigeria are in a state of revolution following the departure of the British in 1960, when Nigeria became a sovereign independent state, the political and industrial relations structure which the British had left behind changed drastically within the space of six years. Many of the institutions that were bequeathed to Nigeria-trade unions amongst them-were inappropriate to the social structure. Nigeria is now engaged in the challenging task of finding her long term solutions not only to the question of government but also to subsidiary, but important, problems such as the development of an appropriate system of industrial relations. On the industrial relations front, the government viewed with the growing concern of the formation of a single central labour organisation. The N L C, which came into being at the end of 1975 at which date four competing central labour organisations went out of existence. The trade union structure, however, remains highly unsatisfactory with a large number of trade unions of about 2000. Many of them miniscule and almost totally ineffective.

In February 1976, the federal Government set up a tribunal of inquiry into the trade union movement intended to investigate the activities of the various central labour organisations, some of their officers and individual unions back to 1960. The term of reference of the tribunal do not specifically ask for recommendations on the future policy but it seems reasonable to assume that some far-reaching government initiative designed to reorganise and strengthen the administration of trade

unions at all levels will emerge. There is a general feeling that unions should be built on industrial line (the German and Ghana models are possible examples) but no consensus has yet appeared as to what should be done, or how it should be done. A conference on industrial relations held in Kano in August 1975 under the joint sponsorship of the Federal Ministry of Labour and Ahmadu Bello University (ABU) Zaria, Department of Adult Education enabled some ideas to be formulated but no clear picture emerged at that time. Although the government is committed in principle to the establishment of a Trade Union Education Institute to provide systematic training for trade union officials, no public moves have been made so far to bring this much needed institution into being.

A fundamental change in the law of labour relations came with the issue on 19th February 1976 of Trade Disputes Decree No. 7 which was deemed to have come into force on 1st January 1976. This measure swept away in the wake of the civil war which had completely banned strikes and lockouts and gave almost unlimited power to police and military to restrain any unofficial strikes or lockouts. To a large extent the draconian powers of the previous legislation-which did nothing to enhance the image of Nigeria as a country dedicated to freedom of organisation and trade union activity-had been shown to be quiet ineffective in the earlier part of 1975 when a wave of –short lived-industrial disputes swept the country following the implementation of the Udoji and later Williams awards. Once again workers had demonstrated that if they feel too outraged by what they regard as injustice the most severe powers of military and police regulation will not stop them from downing tools collectively in protest.

The new machinery for trade disputes recognises this and has removed the objectionable features of the earlier legislation. However, the system is still based on the premise that strike and lockout are illegal until all the machinery has been exhausted. As this machinery involves the compulsory reporting of disputes and the compulsory reference arbitration, if necessary, and furthermore, as it is illegal to strike against the award of arbitration, National Industrial Court or duly registered collective agreement, it is difficult to see in what circumstances a 'legal' strike could take place at any time.

The stress of the system is upon collective bargaining (in the private sector at least).

And the aim is also to try the decentralize decision making on personnel matters in the public sector. It remains to be seen how far this new system of industrial relations, particularly when allied to a revised trade union structure will result in the growth of genuinely free trade unions, free of domination by either government or foreign paymasters, a virile system of collective bargaining, a de-emphasis on legal formalities for the settlement of disputes, an upsurge in productivity

and the emergence of labour movement equipped and willing to play a leading role in the future economic and political development of Nigeria.

The Adebisi Report established the fact that most union leaders were using trade unionism for their political and selfish interest without serious concern for the welfare of the members. Secondly that there was no single workers' solidarity because of conflicts-inter intra among unions.

Thirdly, that most of the unions affiliated themselves with foreign trade unions with different political instability of the country. As a result many of the union leaders were banned never to participate in trade unionism in Nigeria again. The Adebisi Report led to the appointment of Abiodun as the Sole Administrator for all the unions, he was to restructure the about 2000 house unions in a sizeable one in line with the industrial society. The report was submitted to the government in which the Nigerian Industrial Relations are now divided into three major categories;

- The workers through the N L C
- The Senior Staff Association
- The Employers Association

The Abiodun recommendation was adopted with 42 Industrial unions affiliated to the N.L.C the birth of which came on 28th February, 1978 when Alhaji Hassan Summonu was elected as the first President of the N L C in line with the practice of industrial relations in industrialized countries.

Although there have been series of socio-economic and political changes in the Nation's environment, the industrial relations system too has witnessed some evolutionary adaptation to the environment. The Nigerian system is the outcome of environmental forces interacting with human intelligence to find expression in a particular set of institutions. These institutions do inevitably change as the environment changes and human intelligence perceives the situation in a different light and as new theories are developed.

Nigerian Industrial relations practice has come to stay but has since 1978 undergone series of social economic and political changes. Some of the changes as identified by Fajana (1995) are the following;

- In 1978 the restructuring exercise was announced and enable by an amendment to the Trade Union Act of 1973. 70 unions were created; 42 industrial unions, 15 senior staff associations, 9 Employers associations and 4 professional unions.
- In 1979 the legalisation on labour matters was reserved for the exclusive list, the regional assemblies were precluded from passing labour law. Also section 37 of the constitution of Nigeria provides for the freedom of assembly, political partying, and trade unionism.

- In 1979 Trade Union Amendment Decree NO 22 Precluded executives and senior staffers from being organised in the same union with junior workers. A further amendment (no 36) defined projection of management.
- In the year 1981 the National Minimum Wage Act set the lowest pay at one hundreds and twenty– five naira, in the same year A general strike that lasted for three days was embarked upon by Nigerian workers to press home their demand. Also Onosode Cookey commission respectively worked on conditions of service in the parastatals and the universities.
- Adamolekun Commission worked on conditions of service in other educational institution in the year 1982.
- The Michael Imoudu institute for labour studies was established at Ilorin in 1985.
- Nigeria adopted the structural adjustment programme and set up the second tier Foreign Exchange Market in the year 1986.
- Trade Union (Miscellaneous Provisions) Decree was passed, banning the affiliation of senior staff associations (S. S. A s.) With the N L C, removing automatic membership and check off for S. S A s in year 1986.
- The Factories Acts 1958 was reviewed so that a factory is defined as “any premises where one or more persons are employed.”
- Academic Staff Union of Universities was proscribed as a result of strike action in the year 1988.
- In 1993, the striking academic Universities were sacked as their employment status's were deemed terminated on the account of the strikes.

VII. COMPARATIVE ANALYSIS OF INDUSTRIAL RELATIONS SYSTEM PRACTICE IN GHANA & NIGERIA

From the above explanation the similarities and differences in industrial relations practice in Ghana and Nigeria can be identified. An examination of the real position of labour force in West Africans will confirm that the situation of industrial relations of one nation differs from the other .In Nigeria as an example in early 90s, Stock (2006) gave the total number of labour force as 28millions out of which 20 million or over 70%of this figure engage in farming, fishing and husbandry, More than 4 Million i.e. over 15% are in commerce. Also, out of the actual labour force of about 28 million self-employed people in non agricultural activities like crafts transport, trade, e. t. c are just under three million. The above figure as related to actual labour force can be compared to that of Ghana where only 5% (7,945,000) of the total population of 493,000 000, are in wage

employment. Oyebola (1984) and Owusu-Ansah (2006) stated that in the year 2004 Ghana labour totalled (9.6million) people of these 55 percent were involved in agriculture, 31percent in services and 14 percent in industry. Despite an expanding private sector, the state continues to be the largest employer of labour. Making a reference to labour in the year, Stock (2006) stated that in 2004 labour force in Nigeria totalled 46.7million, up from 30million in 1980 .Women made up of 35percent of the force, men 65 percent, an estimated 3 percent of all workers worked in agriculture, down from 54 percent in 1980; 75percent worked in the service sector, and 22 percent worked in industry including mining, manufacturing. Data on Nigerian's labour force, however, have limited value because most Nigerians earn their living in more than one field. Urban workers “moonlight” to make ends meet and rural dwellers have second job to supplement farming. Accurate unemployment rates are difficult to obtain and generally mean little in a society where many who work are marginally employed and where begging is a social occupation. Nigeria's central labour congress (N L C) which comprises numerous specialised industrial & professional unions. Union activities have increased with the economic downturn of the 1980s and 1990s and the government's efforts to strictly limit wage increases. Among the most active unions are those representing petroleum workers and the university teachers which have challenged the government not just on salary and economic issues but also on abuses of human rights and autocratic rule. Strike called for by the N L C have periodically disrupted the Nigerian economy since the early1990s.The first trade union in Nigeria (the Nigerian civil services union) which was founded in 1912, and that of Ghana the Trade Union Congress received a kind of government acceptance at the period of their formation and development Adewumi (1998). From the point highlighted above, it can be concluded that the government of both nations encouraged the development and the growth of unions in their domain at the beginning of industrial relations, also it can be deduced that the population of the labour force in Nigeria is more than that of Ghana the reason for this may be due to the greater number of people engaged in labour force to earn a living and the total population of each country.

Looking at the activities of trade unions as one of the actors in industrial relations in Africa Fashoyin (1992) citing Lloyd, pointed out that before the advent of colonialism in Africa, there existed a well-developed social institution, mutual-aid societies and guilds which provided many of the services now offered by modern day trade unions. The creation of wage labour and money economy in Africa has been adduced to colonial settlements, while the resultant class formations were organised to fight for social justice and against others ills of colonialism. But before the emergence of unions in

the two nations under consideration there had been spontaneous strikes and protests to request for good working conditions for example in Nigeria, unorganised workers protests occurred in 1897 and in Ghana 1919, there was a protest among workers in Public Work Department for better welfare. Damachi (1979) and Omole (1989).

In both countries (Ghana and Nigeria) the workers unions played an active role in the struggle for independence Ecki (1998) and Gabre (1988). The colonial government before independence passed laws to regulate wages and conditions of work, Oyebola (1978) and Gabre (1988) stated that as far back as 1945 in Nigeria, the colonial government investigated into the conditions of work in several trades and wages being paid. While in Ghana the colonial government in Gold Coast (Now Ghana) fixed minimum wages and working conditions for retail trade employees. In spite of trade unions' involvement in the campaign for the independence in the two countries above, it would be wrong to say that the unions had as much political objectives as nationalist movements. Buttressed this view Berg and Butler (1964) as cited by Fashoyin (1992) argued that Africa unions during the independence struggle had low commitment to politics and parties. Making a reference to the general economic environment in some African countries that includes Nigeria and Ghana Fashoyin saw wage employment as constitutes a small proportion of labour force in those countries furthermore, he stated that in the urban areas like Nigeria where wage employment opportunities exist, the growth of employment has been sluggish thereby providing job for few Nigerians, the same situation also exist in Ghana. Obeng-Fosu (1993) One other area that attention should be paid to in industrial relations systems in Nigeria and that of Ghana is on the role of industrial employers' associations toward the promotion of industrial relations systems Fajana (1995) and Fashoyin (1992) both stated that in some countries, such as Egypt, Kenya, Nigeria, and Ghana, industrial employers' associations played significant roles in the industrial relations systems, while making reference to the roles of industrial employers' associations in Kenya Fashoyin (1992) citing Stewart (1979) stated that the employers associations played an active part in the conception and implementation of tripartite agreements on employment, income and maintenance of industrial peace in the 1970s and 1980s.

Furthermore, the government and unions had played a significant role in West African industrial relation systems. The government being one of the actors in industrial relations that employs the larger percentages of labours roll out the laws that guide the other actors in order to maintain industrial peace in the world of work, while the unions fight for the welfare of their members Damachi (1974) says that change in

labour laws was immediate in Ghana, while changes in Nigeria came rather slowly.

In Ghana the country complied with the International Labour Organisation convention 105 that prohibit force labour, infact the convention was ratified by Ghana in 1958, however, this I L O convention was absent in Nigeria.

On the issue of exercising workers rights through collective bargaining Gabre (1988) saw that a large number of African countries accept the principle of collective bargaining as stipulated in I L O conventions 98 Nigeria and Ghana were among the countries that ratified the convention. Here both countries practice collective bargaining and allowed its work force to engage in dialogue on the issue that affect labour & management relations.

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Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
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- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

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Approach:

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- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Describe the method entirely
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- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
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- Resources and methods are not a set of information.
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The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently. You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.



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- Present a background, such as by describing the question that was addressed by creation an exacting study.
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- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

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References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



INDEX

A

Arbitration · 59, 61

B

Bolstering · 28

C

Cognizant · 45, 46, 50

F

Flange · 6

P

Permutations · 34

Polyhedron · 34

R

Repercussions · 56

T

Tableau · 36, 37

Tripartite · 59, 63



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