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Impact of the Work Flexibility on Organization

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Abstract:
This paper has described theoretical intends to study the various aspects of systems analysis, systems of production and the constraints of the production management. It consists of three parts. The first part is dedicated to the presentation of a bibliographic study on the systemic approach and its applications in production systems .An overview about the different methods of balancing of production lines is illustrated in the second part. The second part is to present a new approach of work flexibility for balancing production lines proposed and algorithms of its operations with improved use of conventional methods through the development of the approach of the shaft assignment. The third part is dedicated to the presentation of specific cases and an experimental validation of the method.

Keywords: *QSE, systemic approach, balancing positions, stress, constraints, flexibility.*

1. Introduction

Several societal events marked the evolution of the work-life relationship in the past such as industrialization and urbanization (Barrier-Maurisson 1992; Brochier, 1998; Lemieux & Mercier, 1992). The labor market has been more recently affected by the phenomenon of globalization. Organizations had to meet the demands of customers by increasing their rate of production to lower cost in order to meet competition (Duxbury & Higgins, 2003). The time spent at work has increased according to research by Duxbury and Higgins (2001). Between 1991 and 2001, the number of employees accumulating more than 50 hours per week has increased from one in ten to one in four. These are sometimes hours worked outside the organization, including through the latest technologies through. Stress at work is linked as to how the hours are distributed at actual hours worked. Long working hours represent a health risk and have a negative effect on family and personal life since the employee has less time available to it to other areas of his personal life (Rochon, 2000). A relatively short work week arranged on shift work evening or night can also cause balance problems (Audet, 2013).
Management of a production system must allow efficient use of material, human and immaterial. To this end, the management should take into account various parameters that have a direct or indirect impact on the productivity and competitiveness of the production entities. In this context, the load balancing can only be a very important factor that can allow to optimize the design of production lines of an industrial system and to minimize the delay times while meeting various constraints production.
The methods and tools used in the field of balancing production lines consider various aspects either at the consideration of the constraints or at the operating modes of the methods.
This paper has three parts. The first part is dedicated to the presentation of a bibliographic study on the systemic approach and its applications, the system, methods and systems analysis tools, production systems, methods and channels of balancing tools production with a presentation of the status of work of this memory in relation to research into and consideration according to the constraints.
An overview on the various channels of balancing methods is illustrated in the second part. This also presents the research model operated by the work of the memory and the new proposed approach for balancing channels and algorithms of its operations with improved use of conventional methods through the development of approach "the assignment tree."
The third part is dedicated to the presentation of specific experimental cases (MIB Company) and validation of the new method.
The changing needs and demands of consumers and technology development organizations today have led to follow a stream of improving management practices including those of the production system in an industrial process.
Indeed, production management depends both methods of analysis of the affected system, and secondly how to control a number of constraints which are the keys to sustainable development of production systems.
Thus, during an experience in MIB, there has been recognition of a high number of complaints concerning the delay in the product delivery time. Indeed, these claims have materialized through phone calls and movements, customers to solicit a response to the request already made.In this context we note that the total time actually found was around 18 days and that: the launch date of the

purchase order to delivery of the product. An interview with officials showed that this period may be reduced to seven days and assuming normal production conditions (all factors are controlled: no malfunction). The real quality expected is 7 working days with a tolerance of 3 days.
Thus we propose to study in this paper the various theoretical aspects of systems analysis, the system, the system of production and the constraints of the production management. Therefore the question is: How to implement at balancing production lines other than the usual constraints those of quality, safety and the environment (QSE)?

2. State of the Art Production Systems
The term production system is not new by cons it takes today a new force. The concept of production system can no longer be separated from the systemic approach (Enmer, 1989).
A production system is the set of processes by which an organization produces a good or service to satisfy a request by using inputs acquired on the market. Each production system has objectives such as target quantities produced, quality objective, objective cost, time goal and purpose flexibility (Lakhoua, 2012) (Cauffriez, 2013) (Al-Jallad, 2012).
Also, all the means of production (labor, land, equipment / tools ...) ensures production of a well to meet the expectations of a client (Ghosh, &al., 1989) (Judith, 2015).

2.1. Production Constraints
The new economic environment has spawned various constraints both in terms of the functionality of a production system at the level of its organization. These constraints consider all levels of a production system from the policy level to the operational level. To this end, the mastery of performance parameters of a production system is a resultant allowing survi and sustainable development of the system. Moreover, to ensure the success of a production manager level, managers must handle adequately and in timely times relevant factors of production and that are justified by the productivity, efficiency and flexibility and balancing chains while ensuring the QSE(Baybars, 1985) (Landry, 2000).

2.1.1. Productivity
Productivity is the criterion of economic progress of any industrial organization; it measures the efficiency of production. Labour productivity is dependent on several factors such as the nature and quantity of work items used for the production, integration of new technologies and suitable management system. The productivity growth is an important factor for the organization as it reflects the degree of competitiveness of the organization, this is an important measure of the performance of manufacturing systems (Lesert, 2006).
In the case of Industrial Organizations productivity is equal to the ratio between the quantity produced in a time period (one day, one week, one year) and the total number of hours worked during this period.

2.2.2. Reactivity
Responsiveness is the ability of an organization to respond quickly to changes in its environment through the implementation of the flexibility of resources. In fact, it is the ability of a production system to respond to disturbances affecting the objectives set in the production system (Salvenson, 1955).

2.2.3. Flexibility
Flexible working has become the key analysis of the situation of industry organizations. Improving flexibility depends on the evolution of the workers by increasing their skills; it can be defined as the ability to respond to a change in demand. The ability to adapt under the double constraint of uncertainty and urgency.
Labour flexibility is one of the means that allows an organization to react to various developments. This is a performance criterion used to challenge the organization to adapt to the constraints of the production system including changes in the environment, internal (machine breakdowns, staff absences...) or external (urgent orders, supply delay...) while maintaining the average balance as an indicator for better industrial reactivity (Thomopoulos, 1970).

2.2.4. Efficiency
The efficiency of a production system is a production factor related to the reliability and availability of equipment, it is the ability to reach the objectives set in terms of quality of time and cost. Efficiency is the ratio between the degree of customer satisfaction and the means implemented to achieve the objectives. Efficiency is the ability of an organization to be able to meet the target on one hand and to ensure customer satisfaction on the other which reflects, among other things, the dimensions of organizational success (Dar-El, &al., 1979).

2.2.5. Balancing Items
Optimizing the operation of mass production lines is a significant problem that the complexity justified the research efforts of solving the problem of balancing methods of production lines. The balancing problem of the production lines and in particular the joining lines was first formulated by Salveson in 1955.

The problem of ALB (Assembly line balancing) was the starting point of the design methods of assembly systems. The new research has identified two types of models:

- The simple model (SALBP - Simple Assembly Line Balancing Problem).
- The general model (GALBP - General Assembly Line Balancing Problem).

The approach of balancing production stations is based on the determination of a graphical formalism of importance to establish the precedence between work items and to create an operating model for balancing methods of production lines (Starfield, 2008).
Several methods were proposed to solve the balancing problem and aim to obtain distributions of work items in order to balance loads. These work items will be arranged in various possible groups and each group is the sum of the durations of work items that must be performed by a given position. Thus, we try in the following to give some terminologies the domain:

- Chains of production: it is the set of successive positions.
- Production line: is a string whose transfer between items is automated.
- Balancing Evaluation of expenses related to production jobs and tasks arrangement between workstations in order to have a balanced load while respecting the criterion of precedence among the elements of work and the cycle time.

To put the work of this thesis, we process a literature review of the balancing field of posts. According to the literature we find that there are works which consider other constraints from the basic constraints. According to the research we have studied and that process the problem of balancing production lines we find the use of several tools whatsoever heuristic methods, mathematical modeling and stochastic algorithms.
The paper aims to solve the balancing problem of mixed-model production type positions and affect transactions to workstations in order to meet the precedence constraints and that each operator has time to achieve, during the cycle time, all operations which are allocated to it, taking into account other stresses.
The author proposed several methods of optimization of balancing production stations:

- Mathematical model
- Heuristic method
- Stochastic Algorithm

The methods proposed in this paper lead to good results (minimizing the number of posts), the author has outlined several constraints against, in applications, it has considered the constraints of charging stations, cycle time and precedence.
On the other hand we find works that treat the problem of balancing production stations using unconventional methods such as genetic algorithms (Anderson, & al., 2010).
We find the proposal of a genetic clustering algorithm which ensures a type of production balancing ALPB III which aims to minimize the workload for a given number of mail.
A genetic clustering algorithm is different from a genetic algorithm at the encoding scheme, which allows to bring the relevant structures of the grouping of problems which become genes into chromosomes, on the other hand GGA operators work with the section Group of chromosome to change the composition of groups.
The objective of this paper is to minimize the burden related to the position of production from the average absolute deviation, which measures the amount of work at each station.
The proposed clustering algorithm is an iterative procedure in the event of crossing of assigning the work items that use the same type of machine in the same position and in the case of a mutation is to change an element of Working from elements of another position but uses the same type of machine.
The application of genetic clustering algorithm on two examples shows that the absolute difference in the burden of each position has declined relative to that found by a standard genetic algorithm. The results obtained by GGA are more efficient than those of GA in the case of simple production lines.
In this section we find the conventional consideration constraints (the cycle time and the precedence) against for by the application of this algorithm leads to the constraints of efficacy, cost, reliability, stock buffer and the number of machines (Boutevin, & al., 2003).
This paper deals with the problem of balancing production lines in the automotive industry in order to minimize certain criteria while satisfying several constraints within this framework we see the application of stochastic algorithms on two neighboring systems.
The first step in the application of the stochastic algorithm is the definition of the set of variables or parameters then, the mathematical formulation of these parameters modeling the considered constraints. Modelled constraints are used to test the reliability of the solutions found. A stochastic algorithm is presented as a resolution tool of the balancing problem of production lines; in this context two systems are proposed:

- A random (R): a work item is chosen at random from a position j1 and is moved to a position j2.
- A guided system (G): a selection of the element that has the highest Te and is moved to a position that j2 is randomly selected.

The author presented in the paper stochastic algorithm, a proposed application on three examples. The author claims that the use of the system G gives better results than the R system in the number of production jobs.

2.2.6. Security

Among the strategies of an organization is the integration of a security policy that guarantees the development and continuous improvement. One of the main strategies of the security management is risk prevention. Industrial safety is used to control the risk

minimization within the organization, and ensure the safety of property and people. The industrial activities that pose hazards to be monitored. In this context safety management is based on some aspects such as:

- Prevention: This is the set of measures to avoid a situation (social, environmental, economic...) from deteriorating, or an accident, epidemic or illness occurs. Also, protection is to limit the serious consequences of a dangerous phenomenon without changing the probability of occurrence.
- Accident: This is a sudden event, unwanted, resulting in damage to persons, property or the environment.
- Hazard: A hazard is a situation where it lacks a single factor for there to be an accident.
- Risk: The risk may be defined as the inclusion of exposure to a hazard; risk behavior does not always lead to an accident.

The major risks of the industry are related to accidents, having a significant impact on the work environment. A security management's main task is to protect workers and prevent risks.

Statistics are very important in industrial safety management. It identifies the areas or positions that require more security to develop the appropriate plan of action. The establishment of an occupational safety management system can effectively contribute to reduce and prevent risks and improve the productivity of the organization (AFNOR, OHSAS 18001).

The establishment of security management enables the organization to:

- Minimize turnover and absenteeism.
- Increase the ability to cope with stress and changes.
- Improve productivity.
- Reduce the number of accidents.
- Increase job retention rate for new recruits.
- Improve the degree of membership and disseminate organizational culture.

2.2.7. Quality

Today, the fundamental principle of the quality aims to give a state of balance between work performed and the level of achieved results, without trying to obtain an extreme state of absolute perfection. (AFNOR, ISO 9001: 2015)

The International Organization for Standardization (ISO) defines quality as "the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs". To this end, quality is a measure of conformity of a product to meet the expectations and customer requirements. Quality management was based on two aspects: control of the quality of products made and management of after-sales service. An improvement in the quality of production can simultaneously result from an increase in the competitiveness of the organization and a reduction of its production costs.

A quality management system to ensure:

- The globalization of trade.
- The operating safety requirements and environmental protection.
- The diversification of demand.
- Technological changes.
- The new expectations.

2.2.8. Environment

The environment is an issue that must be controlled by the organization. The integration of an environmental management system within an organization is an industrial policy that ensures sustainable development.

An environmental management system is a system which includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources in order to establish, implement, achieve, and maintain environmental policy.

The establishment of an environmental system is linked to the integration of ISO 14001 is based on continuous improvement, pollution prevention and regulatory compliance commitments (AFNOR, ISO 14001).

The advantages of the establishment of an environmental management system:

- Improved organization in protecting the environment.
- Identification and systematic assessment of laws and other requirements.
- An economy caused by the systematic account of the environmental concept at all levels.
- An improvement of the environmental performance of the organization with the integration of environmental quality in products and services.
- An increase customer confidence, local authorities, banks and insurance companies and the public through the environmental performance of the organization.
- An employee motivation and enhanced identification.
- A strengthening competitiveness and the competitive aspect of the activity.

3. Balancing Production Jobs

Balancing production lines is an approach for assigning tasks to individual workstations, in a fair manner, in order that the total time required for each position is approximately the same. In most cases, this task is difficult and does not allow a perfect balancing.

In this section we analyze the problems of balancing production lines quoting the classical methods used in this area and then we try to emphasize the principle of Safety Quality Environment method "QSE".

3.1. Presentation of Criteria Balancing Positions

The problem of balancing positions requires a thorough knowledge of the production process studied one hand, and methods used on the other hand, their application limits. Moreover, to meet the various constraints of balancing positions it seems imperative to extend the application of tools and methodological approaches beyond the original boundaries. In this context, we integrate a comprehensive management policy. To this end, we propose to add new constraints that we consider important in sustainable development of industrial organization and can help to cope with competition. The consideration of new constraints (QSE) causes a change in the application of balancing methods and at different evaluation parameters.

For classical approach of balancing production stations we consider the following parameters:

- n: The number of work item for the production of a given product.
- T_{ej}: Time processing element j.
- T_e: The ideal cycle time of the production line. This is one of the criteria for a balancing of positions as it is the longest processing time of a position.
- T_{we}: The time required for total content of work (amount of work) is given by the following formula:

$$T_{wc} = \sum_{J=1}^{n} T_{ej}$$

The evaluation criterion of balancing production lines is the determination of equilibrium delay "d" which is also called loss of balance the other way is the extent of inefficiency resulting line an idle time , we consider a balanced production line perfectly if its balance is close to zero delay . This delay time is assessed through the following expression:

$$d = \frac{nT_C - T_{wc}}{nT_C}$$

3.2. Methods of Balancing Production Lines

The balancing production background includes positions that are manual methods of heuristic approaches such as: The Rules of the candidate the biggest, the method Kilbrige and Wester and method of ranking Importance of Position CIP, and others methods that are computerized, such as: COMSOAL, ALPACA and CALB method.

3.2.1. Rule of the Largest Candidate

The largest candidate rule is the easiest method to be used manually. The working elements, in this case, are chosen to be assigned to different positions on the basis of their values. W_e develop an organizational chart (Figure 1) to present the approach of this method and its stages.

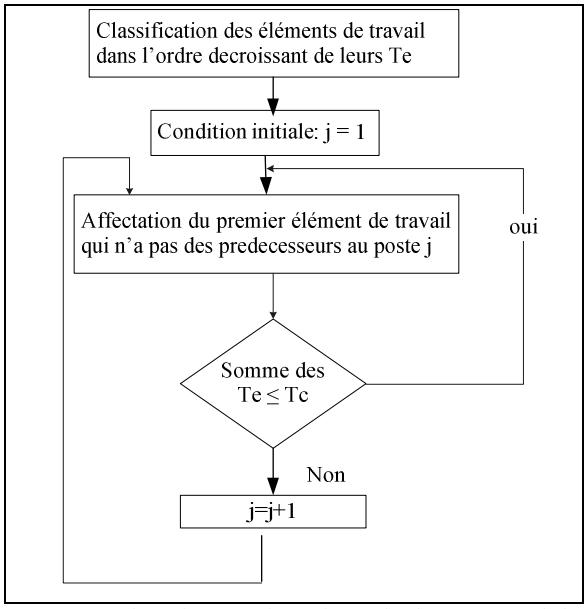

Figure 1: Flowchart of the rule of the largest condidat

3.2.2. Kilbrige and Method of Wester

The method Kilbrige and Wester has received much attention from researchers since its appearance in 1961, is a heuristic procedure that selects the work items to assign them to different work stations according to their position in the precedence graph. We develop an organizational chart (Figure 2) to present the approach of this method and its stages

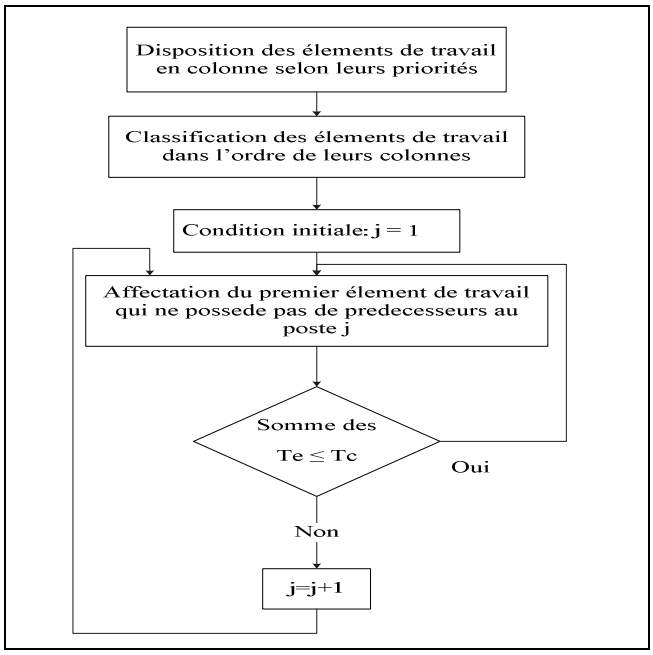

Figure 2: Flowchart of the method of Kilbrige and Wester

3.2.3. Ranking Method by Important Position (CIP)

The procedure for the classification procedure by important position was introduced by Helgeson and Birnie in 1961. This method combines the strategies of the rule of the largest candidate and method Kilbridge and Wester.

The method of ranking by importance of position can be calculated for each element value of the ranking position of importance (CIP). The calculated value includes the sum of the processing time of all work items immediately following the element in question and its own processing time. This method relies on determining the precedence graph. To complete the steps in the CIP method we developed the flowchart in Figure 3.

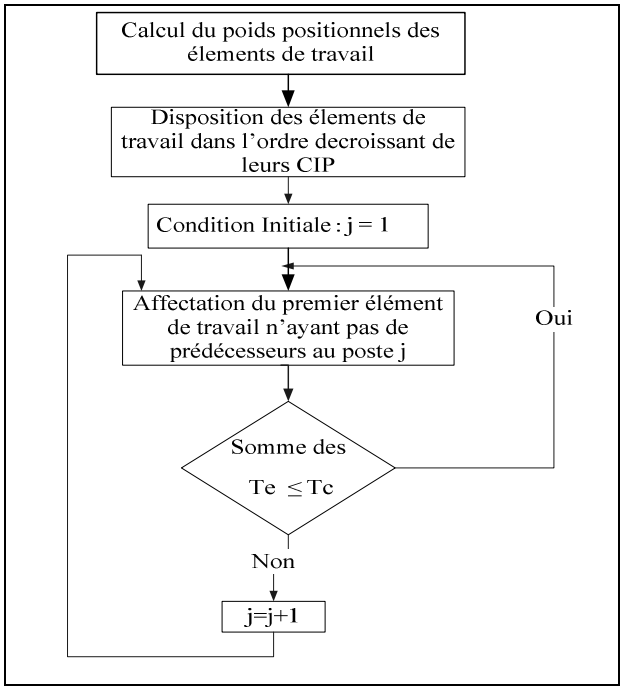

Figure 3: Flowchart of the method of CIP

COMSOAL "Computer Method One of sequencing operation for assembly line" is a method that was developed by Chrysler and published by Arcus in 1966. The procedure advocated by the COMSOAL method allows walking through a suite of solutions and alternative data that must each time make the best.
CALB"Computer Aided Balancing Line" is a method that was developed in 1968, it has almost become the standard program in the industry. CALB The method can be used for single model or mixed model chains. The implementation of this program requires the availability of information relating to the processing time for each work item, the maximum and minimum time that each workstation can be granted as well as data on the cycle time.
ALPACA"Assembly Line Planning and Control Activity" is a method that was created by General Motors in 1967. The method allows balancing interactive channel in which the user can transfer work from one post to another along the chain and immediately be able to assess the relative effectiveness of changes. The user can quickly determine what changes to make in the repair work items to maintain a reasonable balance chain.

4. Conclusion

This article has allowed proposing a definition to systems analysis to understand how a production system to identify management criteria to ensure the improvement of the usefulness of balancing channels production in the context of quality, safety and environment.
So we studied the problem of balancing items, conventional methods by proposing a new strategy of allocating work items to simplify the process. In this article we studied the production system in the MIB Company focusing on a few failures in the line of "EM" while developing measures to improve its performance. In another part we applied the QSE balancing method which we see minimizing the number of workstations as well as the cycle time which makes an equilibrium delay reduction to 47%, so we went from an unbalanced line to a balanced line despite the deficiencies previously. The effectiveness of the QSE method is remarkable and it can be better if the reorganization measures will be implemented with an investment in automated machines especially for transactions that pose bottlenecks.

5. References

i. AFNOR, (2015), De l'OHSAS 18001 à l'ISO 45001 : les dernières avancées du projet de norme ISO sur la santé et la sécurité au travail.
ii. AFNOR, (2015), ISO 14001, Système de management environnemental - Exigences et lignes directrices.
iii. AFNOR, (2015), ISO 9001, Système de management de la qualité - Principes essentiels et vocabulaire.
iv. Al-Jallad M.(2012), REA Business Modeling Language: Toward a REA based Domain Specific Visual Language, Department of Computer and Systems Sciences.
v. Anderson J. and Staines, J., (2010), A genetic algorithm for Grammars.
vi. Audet, S., (2013), La conciliation travail-vie personnelle dans le secteur de la santé et des services sociaux.
vii. Baybars, I. (1985), on currently practised formulations of the assembly line balancing problem, Journal of Operations Management, pp. 449-453.
viii. Boutevin, C., GourgandM. and NorreS., (2003), Bin Packing Extensions for Solving Industrial Line Balancing Problem. Soumis à ISATP'03.
ix. Cauffriez L., Renaux D., Bonte T. and Cocquebert E. (2013), Systemic Modeling of Integrated Systems for Decision Making Early on in the Design Process, Cybernetics and Systems: An International Journal, 44:1–22, Taylor & Francis.
x. Dar-El, E. M. and Rubinovitch, Y. (1979), MUST – A Multiple Solutions Technique for Balancing Single Model Assembly Lines. Management Science 25 (11), pp. 1105.
xi. Enmer, A., (1989), Équilibrage des chaînes d'assemblage : bibliographie et proposition d'une méthode permettant le parallélisme, Mémoire de DEA, INSA, Lyon, France.
xii. Ghosh, S. and R. Gagnon (1989), A comprehensive literature review and analysis of the design, balancing and scheduling of assembly systems, International Journal of Production Research, Vol. 27, No. 4, pp. 637-670.
xiii. Judith B. and Lussier R. (2015), Success Factors for Small Businesses in Guanajuato, Mexico, Vol. 6, N°11.
xiv. Lakhoua M.N. (2012), Systemic analysis of an industrial system: case study of a grain silo, Arabian Journal for Science and Engineering.
xv. Landry, M. and Banville C. (2000), Caractéristiques et balises d'évaluation de la recherche systémique, Revue Tunisienne des Sciences de Gestion, Vol.2, N°1.
xvi. Lesert, A., (2006), Evaluation de la flexibilité de l'atelier montage d'une usine terminale automobile, Thèse de doctorat.
xvii. Mintzberg et al, (1999), Safari en pays stratégie, L'exploration des grands courants de la pensée stratégique.
xviii. Salvenson, ME., (1955), The Assembly Line Balancing Problem, The Journal of Industrial Engineering, Vol.6, pp. 18-25.
xix. Starfield, B., J.Hyde, J.Gervas and I. Heath, (2008), The concept of prevention: a good idea gone astray, p 62:580–583, J Epidemiol Community Health.
xx. Thomopoulos, N.T. (1970), Mixed Model Line Balancing with Smoothed Station Assignments. Management Science 16 (9), p. 593-603.