Optimizing a multiple criteria dynamic layout problem using a simultaneous data envelopment analysis modeling
Optimizing a DLP using DEA

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Abstract - The main characteristic of today's manufacturing environments is volatility. Under such a volatile environment some parameters like demand is not stable. To operate efficiently under such environments, the facilities must be adaptive to change production requirements. From a layout point of view, this situation requires the solution of the dynamic layout problem (DLP). Layout design has a significant impact on the performance of a manufacturing or service industry system. So designing an efficient layout considering different criteria is interesting for researchers. But dynamic layout problems usually are solved just considering cost criterion. This paper is to consider different criteria in addition to cost to suggest an efficient solution for dynamic layout problem. To this purpose, at first we use classic models for DLP[1] to generate a good solution from a cost point of view. Then defining DMU[2]s and their inputs and outputs based on the classic DLP solution, a multi-objective combined DLP -DEA[3] model is proposed and solved using GC[4] method to select some efficient situations for efficient rearrangement of facilities.

Key words - Dynamic layout, Efficiency, Data envelopment analysis

I. INTRODUCTION

This research is going to design some efficient layouts in a dynamic environment. This section explains DLP and efficiency separately. It helps to join these concepts better.

A. Dynamic layout problem

The arrangement of facilities in a production area which is known as facility layout has a significant effect on performance and cost of manufacturing. As Tompskin et al. reported a good placement of facilities leads to efficient operations and can reduce until 50% the total operating costs [1]. So facility layout problem has been an important problem favored by researches. In addition, nowadays the main characteristic of commercial and manufacturing environments is volatility. Under such a mutable environment, companies must be able to have a good and quick reaction to changes in demand, production volume and product mix. However, the change in product mix results in having a variable material flows and thus can influence layout. So the previous layout may be inconsistent with new data and cause extra costs. The mentioned issue has drawn authors' attention and lead to appear dynamic layout problem (DLP). Traditional approaches in DLP considered a planning horizon which is generally divided into periods that may be defined in weeks, months, or years. For each period, the estimated flow data remains constant. Solving a DLP in this approach leads to find a layout plan consisting of series of layouts, each layout being associated with one period [2]. To this end, planners examine all the ending points of time periods and decide whether layout should change or not. Recently, another approach has been introduced to solve a DLP which doesn't necessitate having constant material flow within each time period [3].We call it new approach in opposite to traditional approach.

Another important issue involved in solving DLP problems, is planning horizon which can be fixed or rolling. In rolling horizon if planning horizon consists of m period, at the end of period 1, data for period 1 is replaced by data for period m+1. This data replacement continues after finishing each period [4]. But fixed planning horizon just considers the first m period data without any replacement. In fixed horizon field,

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[1] Dynamic Layout Problem
[2] Decision Making Unit
[3] Data Envelopment Analysis
[4] Global Criteria

researchers have been studied on both traditional and new approaches. But rolling horizons just has been studied for traditional approaches. If we consider stochastic layout problems as a kind of dynamic layout problem, then fig. 1 shows categories of dynamic layout problems. It is necessary to say that we are not going to explain stochastic problems here and to introduce it we refer to [5].

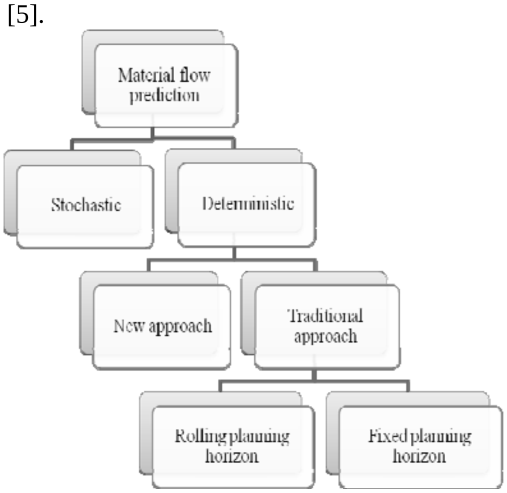

Fig 1.Categorization of dynamic layout problem

Besides the manner in which material flow change, there is a point that almost all the DLP models have in common and that's their objective function. DLP literature review shows that authors just consider cost criterion in their evaluations so that their objective function is defined as minimizing the sum of the layout rearrangement costs and the material handling costs over the planning horizon. Therefore, there is a lack of investigation on DLP using more criteria except cost to design a proper efficient layout plan for a planning horizon.

This paper proposes a combined DEA-DLP model to design an efficient layout plan for a dynamic layout problem considering fixed planning horizons and paying attention to some criteria in addition to cost.

B. DEA

Measuring the performance of a system has been an important task in management for purpose of control, planning, etc. One technique widely applied to measure the relative efficiency of a set of systems or units, is Data Envelopment Analysis (DEA), which was appeared from Farrel's article about measuring the efficiency of agricultural productions in US [6] and was extended by Charnes et al. [7]. The under evaluating units or systems, called DMUs (Decision Making Units), are supposed to be homogenous, i.e., they utilize the same inputs to produce the same outputs [8]. Furthermore one advantage of DEA is that inputs and outputs can be used in their natural physical units without normalizing or transforming them into some common metric such as dollars [9]. To calculate relative efficiency, DEA uses the ratio of sum of weighted outputs to sum of weighted inputs and tries to maximize this ratio (efficiency) for each DMU by varying weights of inputs and outputs as decision variables. To say in detail, let I_{ik}, i = 1,. . . ,I, and O_{jk}, j = 1, . . . , J, be the ith input and jth output, respectively, of the kth DMU, k = 1,. . . ,n. Also u_j and v_i are the weights of jth output and ith input respectively. The first DEA model for measuring the relative efficiency of a DMU is fractional Programming model (FPM). It is qualified to say that we have used the notation of Klimberg et al.[10] to show FPM as following:

$$\text{Max } w_r = \frac{\sum_{j=1}^{J} u_j O_{jr}}{\sum_{i=1}^{I} v_i I_{ir}} \qquad (1)$$

s.t.

$$\frac{\sum_{j=1}^{J} u_j O_{jk}}{\sum_{i=1}^{I} v_i I_{ik}} \le 1 \quad \text{k} = 1,\ldots,\text{n} \qquad (2)$$

$$u_j, v_i \ge 0 \qquad (3)$$

The objective function (1) is the fraction of efficiency that is going to be maximized. Furthermore to get relative efficiency, it is required to limit all DMU's efficiencies to be less than or equal to 100% in constraints (2). These constraints limit variation of decision variables. The results of this model, show that how much each DMU is efficient (in comparison with other DMUs) in converting inputs to outputs.

Since it is difficult to solve this fractional programming, Charnes, Cooper and Rohdes proposed to transform this model to an equivalent linear program [7]. Because of the first letter of the authors' names, their suggested model is called CCR. The Equation (4) shows the objective function of CCR model which aims to maximize the numerator of efficiency fraction by fixing its denominator to 1 in constraint (5). Constraint set (6) is obtained from multiplying the both side of constraint set (2) by the sum of the weighted inputs.

$$\text{Max}\, w_r = \sum_{j=1}^{J} u_j O_{jr} \qquad (4)$$

$s.t.$

$$\sum_{i=1}^{I} v_i I_{ir} = 1 \qquad (5)$$

$$\sum_{j=1}^{J} u_j O_{jk} - \sum_{i=1}^{I} v_i I_{ik} \le 0 \qquad \text{k} = 1,\ldots,\text{n} \qquad (6)$$

$$\text{u}_{\text{j}}, v_i \ge 0 \qquad \forall \text{j,i} \qquad (7)$$

Other researchers continued studying on DEA and presented various models in according to problems they faced. One of these models presented by Klimberg and Ratick is called SDEA[5] which aims to solve DEA models simultaneously for all DMUs [9]. Formulas 8 – 13 show SDEA model.

In this model a new variable d_r is defined as inefficiency of DMU_r which is defined in second set of constraints (equation 10). In other words $w_r = 1 - d_r$ is the efficiency of DMU_r. So the objective function (8) aims to maximize sum of all DMUs' efficiencies. The constraints (9) and (11) are also the same as (5) and (6) in model CCR by this difference that they repeat for all DMUs. In constraints (12), a correction is made about lower bound of weights by setting it to an infinitesimal value (ε). This prevents weights to be 0. We use SDEA as the base of our proposed model for applying DEA in DLP. In the next section we review the researches on DLP, and DEA application in designing efficient layouts. Then our proposed method will be explained in section 3.A numerical example is presented in section 4. Finally section 5 includes conclusion.

5 Simultaneous data envelopment analysis

$$\text{Max} \sum_r w_r = \sum_r (1 - d_r) \qquad (8)$$

$s.t.$

$$\sum_{i=1}^{I} v_{ri} I_{ir} = 1 \qquad \forall \text{r} \qquad (9)$$

$$\sum_{j=1}^{J} u_{rj} O_{jr} + d_r = 1 \qquad \forall \text{r} \qquad (10)$$

$$\sum_{j=1}^{J} u_{rj} O_{jk} - \sum_{i=1}^{I} v_{ri} I_{ik} \le 0 \qquad \forall \text{r}, \forall \text{k}, \text{k} \ne \text{r} \qquad (11)$$

$$\text{u}_{\text{rj}}, v_{ri} \ge \varepsilon \qquad \forall j, i, r \qquad (12)$$

$$d_r \ge 0 \qquad \forall r \qquad (13)$$

II. LITERATURE REVIEW

The first main research on the DLP was done by Rosenblatt in 1986 [10]. He solved the DLP using a heuristic dynamic programming. Other researchers continued his study and presented different procedures to solve this problem. Urban developed a heuristic procedure using a steepest descent pair-wise exchange similar to CRAFT [11]. We are not going to explain all DLP researches in details. But our review indicates that almost all of DLP studies have an important point in common and that's the DLP modeling. Researchers have accepted a common basic structure for modeling DLP and just add some extra constraints in accordance with special conditions they face. Following shows this basic modeling (classic DLP model) according to Balakrishnan et al. notation [12]:

$$Min \sum_{t=2}^{P} \sum_{i=1}^{N} \sum_{j=1}^{N} \sum_{m=1}^{N} A_{tijm} Y_{tijm} \qquad (14)$$

$$+ \sum_{t=1}^{P} \sum_{i=1}^{N} \sum_{j=1}^{N} \sum_{m=1}^{N} C_{tijkm} X_{tij} X_{tkm}$$

$s.t.:$

$$\sum_{i=1}^{N} X_{tij} = 1 \qquad \text{j} = 1,\ldots,\text{N} \quad \text{t} = 1,\ldots,\text{P} \qquad (15)$$

$$\sum_{j=1}^{N} X_{tij} = 1 \qquad \text{i} = 1,\ldots,\text{N} \quad \text{t} = 1,\ldots,\text{P} \qquad (16)$$

$$Y_{tijm} = X_{(t-1)ij} \times X_{tim} \qquad \text{i, j, m} = 1,\ldots,\text{N} \qquad (17)$$

$$\text{t} = 2,\ldots,\text{P}$$

$$Y_{tijm}, X_{tij} = 0 \; or \; 1 \qquad (18)$$

To understand better, suppose that there are N equal sized departments for arrangements in N equal sized sites in a planning horizon of P periods. x_{tij} =1 if department i locates at site j in period t otherwise x_{tij} =0. y_{tijm} is a 0,1 variable for shifting department i from site j to site m at the beginning of period t. A_{tijm} is a fixed cost of shifting i from j to m at period t. C_{tijkm} is cost of material flow between i located at j and k located at m in period t. The objective (14) is to minimize the sum of the layout rearrangement costs (first term) and the material handling costs (second term) over the planning horizon. Constraints set (15) require every department to be assigned. Constraints set (16) require every location to have a department to assign. Constraints set (17) assign y_{tijm} a value of 1 only if department i is shifted in period t. This formulation is nonlinear and can be solved optimally only for small problems. Thus most researches about DLP have been done on finding a solution procedure for this NP hard model. The main researches have been done in conditions of fixed planning horizons, having constant material flow through each period and deterministic material flow. The first solutions proposed in these conditions were exact or heuristics. For example Rossenblatt and Balakrishnan et al. used dynamic programming to solve DLP [10],[13]. Branch and bound is used by Batta and Urban [14],[15]. Urban proposed a pair-wise exchange heuristic to find a proper solution for NP-hard DLP problem [16] which was improved by Balakrishnan et al. [13]. Recently, researchers have been interested in metahuristic algorithms to solve dynamic layout problem. Conway, Venkataramanan [17], Balakrishnan and Cheng [18], Balakrishnan et al. [19] and Dunker et al. [20] used genetic algorithm to solve their DLPs. Simulated annealing was proposed by Baykasoglu and Gindy [21], Erle et al. [22] and Mackendall et al. [23] for finding DLP solution.

Fewer researches are done in other conditions. For example, Balakrishnan and Cheng using dynamic programming investigated on DLP in rolling planning horizons [4]. Krishnan et al. [3] allowed material flows to be changed during each period of planning horizon (new approach) and suggested a hybrid genetic-Wagner Whitin algorithm to find optimal layout plan. All above mentioned studies considered minimizing cost as their objective. To design an efficient robust layout design, Ertay et al. use data envelopment analysis to evaluate their layouts and consider following criteria as inputs and outputs for DEA to evaluate alternatives (layouts) [24]. They calculate these criteria using a special software package:

- Inputs: Cost ($), Adjacency score
- Output: Shape ratio, Flexibility, Quality, Hand-carry utility

They used AHP to convert qualitative criteria to quantitative values. Then these quantitative values are used as inputs and outputs for DEA to evaluate some alternatives which was previously generated by VisFactory software package. Their proposed framework finds the best layout from some good pregenerated layouts which aren't optimal necessarily. So there is no guarantee not to find any better layout. In addition they used a robust approach that suggests one layout for all periods in planning horizons. This paper aims to model this problem without requiring any special software package. In addition the proposed method uses the solution of classic dynamic layout problem as an initial solution and improves it. So it will present a layout plan not just one special layout. Therefore it will be proper for different conditions discussed in literature review. In other words, just having a solution for classic DLP in any conditions, it is warranted that answers resultant from our proposed method are never worse than classic solution.

III. PROPOSED METHOD

The proposed method requires at first to solve a classic dynamic layout problem just considering cost. Then this achieved solution will be improved at the next stages considering all other criteria in addition to cost. So it is required to calculate, all evaluating criteria for produced layouts from classic solution. Defining changing layout i to layout j as DMU_{ij}, their inputs and outputs will be determined based of calculated criteria of produced layouts in previous stage. Finally, we have some alternatives (changing between pairs of produced layouts) and criteria to evaluate them by DEA for selecting some of them as best times for changing layouts. Since classic DLP model was explained before, the proposed method is explained in details for next stages.

A. Alternatives and criteria

Suppose that solving a classic DLP model for a planning horizon of P periods, leads to P layouts (each layout belongs to one period) which can be the same or different from each other. In this stage all considering criteria must be calculated for each of these P layouts. As mentioned before our proposed method doesn't require any special software because it is an optimization problem and can be solved by any optimization software like Lingo, GAMS, etc.

Noting that in DEA, positive criteria are considered as outputs and negative criteria play inputs role. But it is desirable to examine layouts changing not layouts themselves. So we define changing between each pair of layouts as our alternatives (DMU_s). In other words changing layout i to layout j is considered as DMU_{ij} (i=1, …, P-1 and j=2,…,P and j>i). Figure 2 shows this concept better. So DMU_{ij} means that the first change after layout$_i$ is at the beginning of the period including layout$_j$. Therefore if we have P layouts, there will be $\binom{P}{2}$ DMU$_{ij}$. For example having 3 layouts for 3 periods (layout$_0$, layout$_1$, layout$_2$) leads to have 3 DMUs including: DMU$_{01}$, DMU$_{02}$, DMU$_{12}$. In this example, DMU$_{02}$ means that there is just one layout changing at the beginning of period 2. In other words if this change is accepted, there will be a sub layout plan as layout$_0$, layout$_0$ and layout$_1$ respectively for periods 0, 1 and 2.

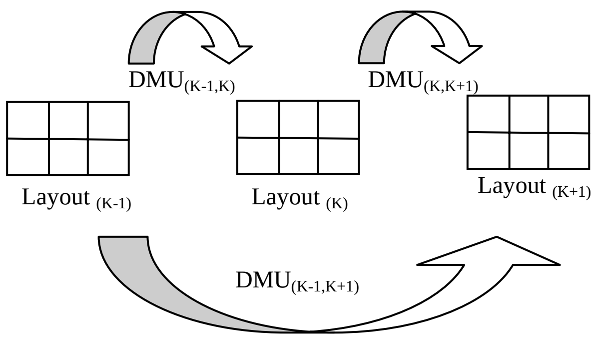

Fig2. Determining DMUs

After defining DMUs, it is required to determine their inputs and outputs. To simplicity we consider 4 criteria (cost, adjacency score, shape ratio and flexibility) for produced layouts from [24]. These four criteria are labeled as C_k^j means criteria k for layout$_j$. The first two criteria are negative and the second two ones are positive. For each DMUij we consider the average of C_k^j for all layouts in layout sub-plan resultant from that DMU. If C_k^j is a negative criterion, result of this averaging will be an input for that DMU. Otherwise it will be an output.

B. Combined DLP-DEA model

After defining DMUs and their inputs and outputs, we propose following DLP-DEA model based on Klimberg and Ratick's model , to select best times for changing layouts. Z_{ij} is a binary variable which will be equal to 1 if there is a change from layout$_i$ to layout$_j$. If this change happens, DMU$_{ij}$ will be considered in DEA calculations. d_{ij} indicates the inefficiency of DMU$_{ij}$. This model is a mixed integer linear programming. The first objective function (19) is to maximize sum of DMUs' efficiencies simultaneously. All considered criteria are optimized through this efficiency maximization. Supposing that A$_{ij}$ shows the cost of changing layout i to layout j, the second objective function (20) is to minimize sum of changing cost. Constraint set (21) requires having layout changing in planning horizon. Constraints (22) say that for each current layout, it's just possible to have one change. This is also the same for destination of each change which is placed in constraints (23). Constraints (24) show that having a change from an original layout (i) to a destination layout (j) makes it impossible to have any other changes between i and j. Constraints (25) means that the essential condition for $Z_{ij} = 1$ is the existence of layout i. Constraints (26), (27) and (28) is similar to (9), (10) and (11) in SDEA model. When $Z_{ij} = 1$, constraints (26) and (27) is entered to DEA calculations. Against when $Z_{ij} = 0$, constraints (29) and (30) require input/output weights to be nonnegative and then constraints (26) and (31) force them to be zero. Under this condition $d_{ij} = 0$ and it results in adding $Z_{ij} - d_{ij} = 0$ to the first objective function. This paper use GC method to solve this two objectives problem.

Our proposed method suggests a solution which is not totally worse than classic solution (because of maximizing sum of efficiencies), but it is not necessarily true for each criterion separately. In cases that proposed solution is worse than classic solution in some criteria except cost, decision maker will have authority to select classic solution or our solution.

IV. NUMERICAL EXAMPLE

In this section, a hypothetical example for proposed DLP–DAE model is presented. This example considers a planning horizon of 4 periods, 3 departments and 3 locations. The 4 criteria said before are considered for each layout produced from classic DLP solution. Tables 1 and 2 show C$_{tijkm}$ and A$_{tijm}$ (required parameters for classic DLP). It should be reminded that A$_{tijm}$ is cost of moving department i from j to m at the beginning of period t.

$$\max \sum_{i=1}^{m-1} \sum_{j=i+1}^{m} (Z_{ij} - d_{ij}) \tag{19}$$

$$\min \sum_{i=1}^{m-1} \sum_{j=i+1}^{m} A_{ij} Z_{ij} \tag{20}$$

$s.t:$

$$\sum_{i} \sum_{j} Z_{ij} >= 1 \qquad \text{for all } i, j \tag{21}$$

$$\sum_{j=i+1}^{m} Z_{ij} \le 1 \qquad \forall i = 1,\ldots, m-1 \tag{22}$$

$$\sum_{i=1}^{m-1} Z_{ij} \le 1 \qquad \forall j = i+1,\ldots, m \tag{23}$$

$$Z_{ij} + Z_{hq} \le 1 \qquad h > i, q > h, q < j \tag{24}$$

$$\sum_{p=1}^{i-1} Z_{pi} \ge Z_{ij} \qquad \forall i, j \tag{25}$$

$$\sum_{r=1}^{I+O} v_r^{ij} x_r^{\,ij} = Z_{ij} \tag{26}$$

$$\sum_{s=1}^{I+O} u_s^{ij} y_s^{ij} + d_{ij} = Z_{ij} \tag{27}$$

$$\sum_{s=1}^{I+O} u_s^{ij} y_s^{hq} - \sum_{r=1}^{I+O} v_r^{ij} x_r^{\,hq} \le 0 \tag{28}$$

$$u_s^{ij} \ge \varepsilon Z_{ij} \tag{29}$$

$$v_r^{ij} \ge \varepsilon Z_{ij} \tag{30}$$

$$u_s^{ij} y_s^{ij} \le Z_{ij} \tag{31}$$

$$Z_{ij} = 0,1 \tag{32}$$

Table 2: A_{tijm} values (must be multiplied by 1000)

	t				t				t		
	2	**3**	**4**		**2**	**3**	**4**		**2**	**3**	**4**
$\mathbf{A_{t112}}$	4	6	5	$\mathbf{A_{t121}}$	2	8	2	$\mathbf{A_{t131}}$	5	10	5
$\mathbf{A_{t212}}$	5	7	5	$\mathbf{A_{t221}}$	6	8	6	$\mathbf{A_{t231}}$	10	3	7
$\mathbf{A_{t312}}$	9	4	9	$\mathbf{A_{t321}}$	6	7	1	$\mathbf{A_{t331}}$	2	5	12
$\mathbf{A_{t113}}$	7	4	1	$\mathbf{A_{t123}}$	6	5	3	$\mathbf{A_{t132}}$	3	9	4
$\mathbf{A_{t213}}$	4	10	7	$\mathbf{A_{t223}}$	5	2	5	$\mathbf{A_{t232}}$	4	6	8
$\mathbf{A_{t313}}$	7	3	10	$\mathbf{A_{t323}}$	8	5	2	$\mathbf{A_{t332}}$	7	4	4

This given data is applied to solve classic DLP. Fig. 3 shows the classic solution (layout plan).

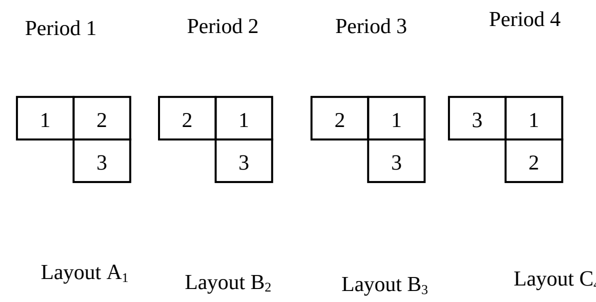

Fig3. Classic DLP solution

Next step is calculating all considered criteria for these produced layouts which are shown in table 3.

Table 3: Calculated positive and negative criteria

layout	**cost**	**adjacency score**	**shape ratio**	**flexibility**
A_1	10000	3500	0.065	0.5
B_2	18000	4200	0.054	0.7
B_3	16000	4200	0.054	0.7
C_4	28000	6500	0.025	0.15

After defining DMUs, their inputs and outputs can be determined as below.

Table 4: DMUs and their inputs and outputs

DMU	$\mathbf{IN_1}$	$\mathbf{IN_2}$	$\mathbf{OUT_1}$	$\mathbf{OUT_2}$
A_1B_2	14000	3850	0.0595	0.6
A_1B_3	20000	3734	0.0613	0.567
A_1C_4	32000	4250	0.055	0.4125
B_2B_3	17000	4200	0.054	0.7
B_2C_4	20670	4967	0.044	0.517
B_3C_4	22000	5350	0.0395	0.425

Now using these DMUs and their inputs and outputs (table 4) DLP-DEA model is written and run in lingo software. Using GC method by weights of 0.9 and 0.1 for the first and the second objective functions respectively, results in optimal solution as below:

$$Z_{A_1B_2} = Z_{B_2B_3} = 1$$

This means that it is not efficient to have layout C_4. So the layout plan showed in Fig. 4 is proposed for this example.

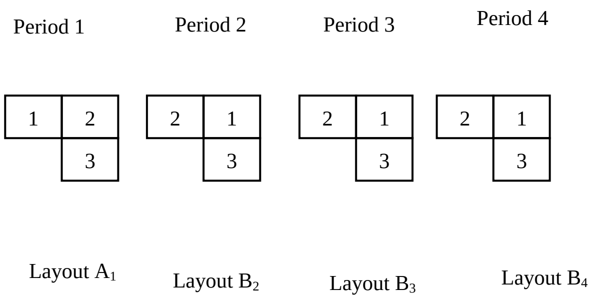

Fig4. Efficient DLP solution

To be assured that this layout plan is more efficient than the classic dynamic layout plan, a comparison should be made between them. To calculate criteria for a layout plan, we add up each positive and negative criterion for layouts presented in that layout plan. So our alternatives and criteria for comparing classic dynamic layout plan and obtained solution from our proposed method for this example are shown in table 5:

Table 5: Comparing proposed solution with classic DLP solution

Alternative	**cost**	**adjacency score**	**shape ratio**	**flexibilit y**
classic DLP solution	74900	18400	0.198	2.05
proposed method solution	93000	16100	0.227	2.6

Table 1: C_{tijkm} values (must be multiplied by 1000) for example

	t					t					t					t			
	1	***2***	***3***	***4***		***1***	***2***	***3***	***4***		***1***	***2***	***3***	***4***		***1***	***2***	***3***	***4***
C_{t1122}	3	8	12	4	C_{t1123}	4	2	9	5	C_{t1132}	2	5	1	8	C_{t1133}	1	6	11	4
C_{t1221}	5	2	4	8	C_{t1223}	13	5	1	4	C_{t1231}	8	5	10	2	C_{t1233}	7	5	3	10
C_{t1321}	4	5	3	9	C_{t1322}	4	3	7	2	C_{t1331}	3	5	7	14	C_{t1332}	5	4	10	8
C_{t2112}	5	2	4	8	C_{t2113}	4	5	3	9	C_{t2132}	6	4	7	11	C_{t2133}	9	2	1	6
C_{t2211}	3	8	12	4	C_{t2213}	4	3	7	2	C_{t2231}	6	2	7	5	C_{t2233}	1	3	5	7
C_{t2311}	4	2	9	5	C_{t2312}	13	5	1	4	C_{t2331}	10	2	4	8	C_{t2332}	2	3	10	6
C_{t3112}	8	5	10	2	C_{t3113}	3	5	7	14	C_{t3122}	6	2	7	5	C_{t3123}	10	2	4	8
C_{t3211}	2	5	1	8	C_{t3213}	5	4	10	8	C_{t3221}	6	4	7	11	C_{t3223}	2	3	10	6
C_{t3311}	1	6	11	4	C_{t3312}	7	5	3	10	C_{t3321}	9	2	1	6	C_{t3322}	1	3	5	7

V. CONCLUSION

Designing a good layout has a significant impact on firms' performance. To determine a good layout researchers usually considered material handling cost. But some of them realized that it is better to consider more criteria to design a proper layout. This point isn't considered in dynamic layout problem generally. This paper paid attention to this point and considered other criteria except than cost using a 3 stages solution procedure. This leads to design an optimal layout plan from different criteria point of view. The proposed method is explained in a hypothetical example. Our proposed method suggests another layout plan for this example that is more efficient than classic DLP solution.

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