P³R– A study of effectiveness of the system in real life situations through evaluation of moving annual turnover

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Abstract: -Operations management in pharmaceutical industry play a significant role in maintaining the supply chain. Shortage of drugs have profound impact on the death of the society, and how well we can save lives, just merely by providing timely healthcare facilities and medicines. P³ system (Production, Planning & Procurement System- A novel inventory management tool) was developed to address specific needs of the pharmaceutical industry and allied industries, especially for products that can be classified as perishable and essential. Being perishable, over stocking can have financial implication, being essential products their shortage means loss of sale and patient moving to another brand. Over the years, with dynamic market environment, there was a need to revisit the P³ system. A refined approach is now envisioned in form of P³R system, which promises to have filled the gaps identified in the P³ system. This paper evaluates the performance of P³R system as compared to the P³ system, and experiences of the actual users with the new system. The statistical evaluation shows overwhelmingly positive results.

Key Words: P³ system, P³R system, Operations Management, Pharmaceutical inventory management, Moving Annual Turnover, Track Team

Abbreviations & Notations: The following are the abbreviations and notations most frequently used in the article:

Abbreviations: Most commonly used abbreviations are as follows.

(1) SCM: Supply Chain Management
(2) MAT: Moving Annual Turnover

Notations: Some standard notations which we have been using in this the article is as follows.

(1) P³ System: As designed, Production, Planning, and Procurement System
(2) P³R: Revised P³ system

INTRODUCTION

P³R system is refined inventory management tool based on market driven dynamic integration of operations with three key aspects of SCM- Production, Planning and Procurement. It was based on study to update the P³ system in line with recent developments. Market study was done to have overview and comparison of the various aspects of business. It rests on **(1) Bias free reflexive model and (2) Track Team**.**Bias free reflexive model** is executed by a team of four to five members and constitutionally two members are from patron customers and the rest are, one from each zone,-- Planning, Production, and Procurement.**Track Team** is based on a technical & marketing groups of people which are devoted to (1) research and development of new drugs which are superior to the regular ones in

all respects (2) Keeping analytical track of drugs manufactured by leader pharma companies and (3) New avenues and scopes which can be availed and (4) Market survey for review of the stock position, sales performance and profits of competing companies and products**.** A study on our preliminary experiences of P^{3R} was done and published in my paper "Time travels-We revise what we justified once" and has clearly shown that the operations management through P^{3R} have distinct advantages over the operations through P^3 system.

Subsequent to the success of P^{3R}, we decided to track the experiences of more and more users with the revised system, in order to understand the system better and to reassure the efficiency of the P^{3R}.

2. Marker of performance- Moving Annual Turnover

Moving annual turnover is the sum of turnover of the last 12 months, and is a direct indicator of the overall changes in revenue. It has been extensively used in pharmaceutical industry by ORG MARG, AIOCD AWACS, IQVIA and all other leading market survey agencies globally for the industry performance. Monthly statistics published by these agencies track the changes in MAT to understand how the industry performs in various therapeutic segments and in various regional segments As a result, Moving annual turnover, denoted as MAT, was selected as the marker for the performance evaluation.

The aim was to understand the efficacy of the inventory and operations management system in growth of the organization. Under the P3R we have introduced a concept of Track teams and new product introduction through those teams. These track teams dynamically interact with the market for identifying the new products to be introduced, and amends in existing ones. These teams further integrate with the internal wings of the organization, and thereby creating a response to the market information gathered by the track teams. The published statistical data have clearly evidenced the new product introductions to be the key for growth in this segment, and our assessment has revealed the gap in handling the new product introduction through P^3 system. If the P^{3R} works, as it is expected to, MAT would show a positive result. On the contrary, if the system isn't working efficiently, we have seen that companies working with P^3 have been struggling to grow in new product segments. In such case, the MAT would either be stagnant or may turn negative, or at least the growth would not be statistically significant.

3. Record of Moving Annual Turnovers of different companies

About 30pharmaceutical companies were consulted who had implemented the P^{3R} system. Each of these had a history of having adopted P^3 system earlier. Most of these companies had participated through this study in identifying the gaps in P^3 system.

Data was collected for period of at least 6 months prior to implementation of the P^{3R} system and at least 6 months subsequent to the implementation of the P^{3R}system. The data was anonymised. The data was collected and tabulated in MS Excel for calculation of changes in moving annual turnover.

Month	Sale in Million- Rs	MAT	Change	Month	Sale in Million - Rs	MAT	Change
Apr-18	100	1200	4.68%	Apr-19	119	1278	6.50%
May-18	102	1223	3.96%	May-19	121	1297	6.05%
Jun-18	103	1240	4.11%	Jun-19	120	1314	5.97%
Jul-18	105	1270	3.58%	Jul-19	121	1330	4.72%
Aug-18	102	1240	1.23%	**Aug-19**	**136**	**1364**	10.00%
Sep-18	100	1275	2.12%	Sep-19	138	1402	9.96%
Oct-18	98	1280	3.11%	Oct-19	102	1406	9.84%
Nov-18	105	1290	3.01%	Nov-19	110	1411	9.38%
Dec-18	104	1295	0.05%	Dec-19	130	1437	10.97%
Jan-19	108	1302	3.10%	Jan-20	128	1457	11.90%

Feb-19	112	1301	2.90%	Feb-20	119	1464	12.53%
Mar-19	120	1259	1.60%	Mar-20	125	1469	16.68%
Annual	**1259**				**1469**		

Table 3.1: Tabulation of MAT

Period	Average MAT	Remarks
Feb 19 to July 19	4.62%	(Before adoption of P^{3R} system)
Aug 19 to Jan 20	10.34%	(After adoption of P^{3R} system)

Table 3.2: Calculation of MAT

4. Testing of Hypothesis

4.1 Assumptions

a) Distributors and buyers can freely exchange information on markets trends, status of the present stock, future projections, and financial matter related to their business with the vendor.

b) Maintenance and replenishment of a reasonable stock level at buyers' and distributor's ends are important commitment of the vendor

c) There are no changes in prices during the launch phase

4.2 Sales Revenue

Sales revenue is a direct result of the sales and marketing efforts. The study has revealed that new product launches have greatly enhanced the sales revenues. Hence, successful new launches will lead to elevation in sales revenue. This can be captured through change in sales revenue over a given period when the launch is executed.

4.3 Setting up of Hypothesis and testing

The Market study of research team suggested the gap in new product launch. Subsequently, we have defined the revised and a more refined and versatile version of the P^3 system that we call P^{3R} system. Upon discussing the results of our research and the proposed new system, many users agreed to upgrade from the current system of P^3 to the newly emerging P^{3R} (Modified P^3 system) system as in order to push the sales revenue. This could be reflected by change in rate of sales revenue. For example a company having 2% increase in sale revenue is to check whether the new system will help them to grow more than 2% or not. We collected data from such 26 users who agreed for the upgradation in the first trial phase.

With the help of the statistician the data of sales revenue was collected and tested to verify the hypothesis.

Null Hypothesis H_0: That there is no difference in the sales revenue before adoption and after adoption of P^{3R} system.

Alternative Hypothesis: H_1: After adoption of P^{3R} system revenue has increased.

Level of Significance: $0.05 = \alpha$

The data collected on 26 companies and is summarized as follows: We have 26 companies on the list who were adopted P^3 system and were ready to now switch to the newly modified P^{3R} system. The following table shows change in sales revenue growth % during adoption of P^3 but before adopting P^{3R} system and after adopting P^{3R} system.

Sr. No.	Before adoption of P^{3R}	After adoption of P^{3R}	Sr. No.	Before adoption of P^{3R}	After adoption of P^{3R}
(a)	(b)	(c)	14	6.78	8.23
1	4.62	10.34	15	3.23	6.04
2	3.27	9.87	16	2.9	6.12
3	4.45	6.56	17	6.44	8.3
4	3.72	4.33	18	1.45	6.98
5	6.12	8.87	19	4.6	5.9
6	2.4	2.4	20	5.6	9
7	8.5	8.5	21	2.3	7.83

8	1.45	2.33	22	-0.2	8.8
9	2.92	3.33	23	6	8.8
10	4.45	7.66	24	0.9	0.98
11	8.22	8.66	25	2.3	6.45
12	4.44	6.98	26	1.8	10.2
13	4.55	9.4			

Table 4.1: Table showing revenue growth %

The above data was statistically evaluated on a paired t-test as follows:

Sr. No	Before adoption of P^{3R}	After adoption of P^{3R}	d=c-b	d^2
(a)	(b)	(c)	(d)	(e)
1	4.62	10.34	5.720	32.718
2	3.27	9.87	6.600	43.560
3	4.45	6.56	2.110	4.452
4	3.72	4.33	0.610	0.372
5	6.12	8.87	2.750	7.562
6	2.4	2.4	2.650	7.023
7	8.5	8.5	-	-
8	1.45	2.33	0.880	0.774
9	2.92	3.33	0.410	0.168
10	4.45	7.66	3.210	10.304
11	8.22	8.66	0.440	0.194
12	4.44	6.98	2.540	6.452
13	4.55	9.4	4.850	23.523
14	6.78	8.23	1.450	2.103
15	3.23	6.04	2.810	7.896
16	2.9	6.12	3.220	10.368
17	6.44	8.3	1.860	3.460
18	1.45	6.98	5.530	30.581
19	4.6	5.9	1.300	1.690
20	5.6	9	3.400	11.560
21	2.3	7.83	5.530	30.581
22	-0.2	8.8	9.000	81.000
23	6	8.8	2.800	7.840
24	0.9	6.98	6.080	36.966
25	2.3	6.45	4.150	17.223
26	1.8	10.2	8.400	70.560

Table 4.2: Statistical evaluation of Change in sales growth

Test Statistics: From the given data, we have

$\sum d = 88.30$ n = 26   and so $\overline{d}$ = 3.9696

$\sum d^2 = 448.9292$

$S^2 = \{448.929/25 - (3.9696)^2\} = 2.20$

$S^2/(n-1) = 0.09$

We apply 't' test;

$$t = \frac{\overline{d}}{\left(\frac{s^2}{n-1}\right)^{1/2}} \quad ....(4.1)$$

t = 3.9696 / (0.09)^{1/2} = 13.3836

A study of 26 companies who migrated from their existing systems of P^3 inventory management to the P^{3R} system showed changes in sales, reflected by change in % sales revenue as per Table -1. The Table-2 shows the Sales

revenue growth before adoption and that after the adoption of the P^{3R} system for a specific company, while the Table-3 shows the Sales revenue growth before adoption and that after the adoption of the P^{3R} system for all the 26 companies selected for the study.The data was computed to calculation of 't' value as per the paired t-test.

5. Result and Discussion

Table value for one sided table at 25 degree of freedom at 0.05 level of significance = 1.708. Calculated value is greater than the table value and hence calculated value of 't' falls in rejection region. We reject the null hypothesis and accept the alternate hypothesis H_1.

H_1: After adoption of P^{3R} system sales growth has increased. It is thereby validated and concluded that the novel P^{3R} system isa significant improvement over the P^3 system, and is now accepted for release to the companies for their operations and supply chain management. Based on the gaps identified by the operations research team upon review of performance, a novel P^{3R} system is evolved by introducing periodic market review and operational aspects of new product launch in the existing P^3 system.

This study shows evolution of a new add-on to the P^3 system, now revised and coined as P^{3R} system. This study also shows the statistical evaluation of the application of the new system. The study has proved that the adoption of the new model, P^{3R} system, leads to increase in sales growth of organizations.

6. Conclusion

The P^{3R} system has evolved as an improved version of the P^3 system. The P^{3R} model has shown that it is capable to block the gaps that emerged in the P^3 system over time. With new all new P^{3R} now in place, the operational management and inventory management decisions can now lead to a significant growth in revenues. The P^{3R} thus fuels growth. The track teams, work as an integrator for the market and facilitator for the organization. In future the composition of these teams can be further broadened in order to keep this activity dynamic and market driven.

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