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Performance Evaluation of a Micro-Irrigation Company Using the APC model

Mohan Rao
Texas A&M University-Corpus Christi
Email: mohan.rao@tamucc.edu

Rishi Chhabria
Texas A&M University-Corpus Christi
Email: Rishi.Chhabria16@gmail.com

ABSTRACT

This article discusses the importance of micro irrigation and focuses on a business in this industry in India. Specifically, the competition it is facing and its efforts to improve its financial performance. To evaluate its performance, a spreadsheet-based application was developed using the APC model. The results are analyzed for possible corrective actions for improvement. This paper would be of interest to researchers and business executives for measuring and evaluating performance in terms of productivity, price recovery and profitability.

KEYWORDS: Decision support systems, Micro irrigation, Multi-factor productivity, Performance measurement, Productivity

INTRODUCTION

With world population growing, there is a need for increased supply of food. Consequently, increased on water resources (De Fraiture et al., 2014). Although more than 70% of the earth is covered with water, less than 1% is accessible for irrigation, drinking and household purposes, which indicates an acute scarcity of water (Whitmee et al., 2015). 83% of this water is used for agriculture. Most of the irrigation uses the surface irrigation or the conventional method of irrigation, which causes a lot of waste due to evaporation, interception and conveyance. Micro irrigation is much more efficient and is gaining popularity. With micro irrigation, the waste of water would be reduced by nearly 56% to 76% (Jagermeyr et al., 2015a). “Drip irrigation is the most efficient method of irrigation, with efficiencies ranging between 90%-95%. The global micro irrigation systems market is one of the fastest growing segments of agriculture industry” (PR Newswire US, 2013).

“Approximately 1.1 billion people in the world live on less than US$1 per day, 800 million of whom are smallholder farmers relying on subsistence agriculture for their livelihood” (Andrezejewski, 2014). India is the second most populous country in the world. The “pressure of survival and the need for additional food are necessitating a rapid expansion of irrigation” in India. Water scarcity is very high making irrigation the largest water consuming sector (Narayanamoorthy, 2009). There is a tremendous opportunity for growth in micro-irrigation in India. A 2012 research study carried out under the partnership of the International Water Management Institute (IWMI) and Sir Ratan Tata Trust (SRTT) found that “only 12.2 percent of potential drip irrigation area and 7.8 percent of potential sprinkler area is covered in the country” (Palanisami and Raman, 2012). That is, about 90% of the potential area is not covered by micro irrigation.

There are more than 150 manufacturers of drip and sprinkler irrigation systems in India. One of the top three companies is Finolex Plasson Industries Pvt. Ltd. Finolex has an ambition to move up from the third place. The focus of this paper is Finolex organization and its performance. Finolex has a joint venture with an Israeli company and is known for its quality products and services. According to Finolex, it has the latest technology (pulse irrigation through pressure-compensated non-drain dripline) with automation. These components are manufactured in India.

The primary focus of this paper is to evaluate the performance of Finolex. Performance measurement is a very broad area with a number of measurement models. They include single factor productivity measures and multi-factor productivity measures (Hannula, 2002; Rao, 2006). Within multi-factor models, there are profit-linked models (Miller and Rao, 1989) that use basic accounting data and provide results in dollars instead of ratios or indexes. One of these models is called the APC model. It "was developed by the American Productivity and Quality Center" (Miller and Rao, 1989). It links productivity to the bottom line profitability. It is used for evaluating the performance of three measures – profitability, productivity and price recovery. Applications of this model have been developed in other industries (Rao, 2006; Rao, 2007; Rao and Phusavat, 2013). This is an appropriate model to measure performance at an organization level.

In this paper a spreadsheet-based performance measurement system is developed using the APC model to evaluate the performance of Finolex. Based on the results and the trend charts, the areas for improvement are identified. This would lead to developing strategies. The remainder of the paper is organized as follows: (a) application development; (b) analysis of results; and (c) summary and conclusion.

APPLICATION DEVELOPMENT

In order to develop the APC application in a spreadsheet, eight quarters (2 years) of data was collected from the organization. A sample data setup for the first two quarters is shown in the Table 1. It is organized into three sections - quantity, price and value - for both inputs and the outputs. The outputs include extrusion, molded items, PVC pipes and other traded items. Inputs are classified into categories such as material, energy, repairs and maintenance, employees, supplies, operating expenses, and sales and distribution. The values (i.e., revenues and expenses) are in lakhs of Indian Rupees (INR). Ten lakhs are equal to one million and 10 million is equal to one crore.

Table 1. Quantities, Prices and Values

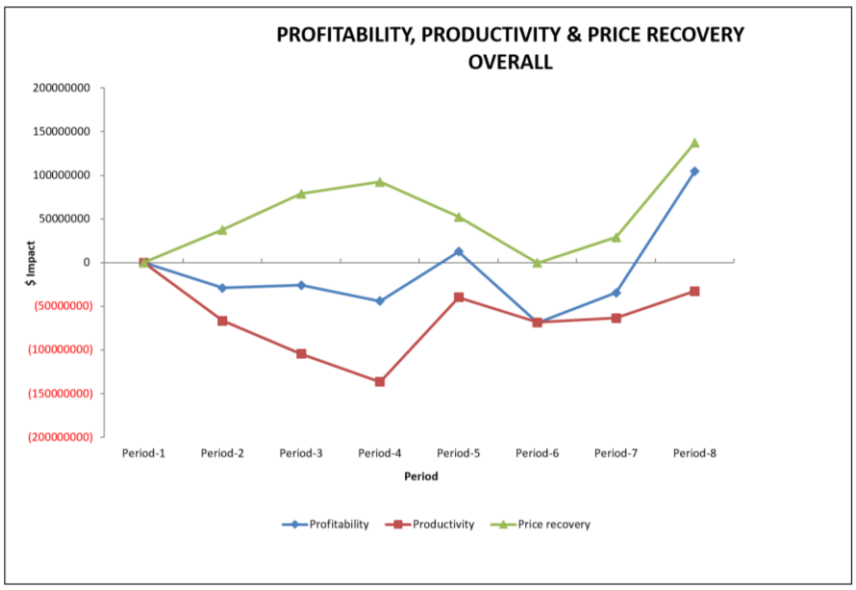
	A	B	C	J	K	R	S
1	**Finolex: APC Method for a Multi-period Performance Evaluation (2013-2015)**						
2		**QUANTITY**		**PRICE**		**VALUE**	
3		Period-1	Period-2	Period-1	Period-2	Period-1	Period-2
4		Qty-1	Qty-2	P1	P2	V1	V2
7	PVC Pipes (Mtrs)	1,409,238	636,684	63.40	54.17	89,347,067	34,487,374
8	Other Traded Items (nos)	3,195,033	3,069,526	27.51	28.44	87,891,874	87,290,827
9	**TOTAL PRODUCT**					**638,449,480**	**445,470,124**
10	Polyethylene (kgs)	2,043,602	1,570,500	117.37	113.36	239,856,269	178,029,176
11	PVC Pipes (mtrs)	1,409,238	636,684	65.43	55.07	92,206,173	35,064,400
12	Other Traded Items (nos)	3,195,033	3,069,526	24.11	27.49	77,029,016	84,376,841
13	**Material**					409,091,458	297,470,417
14	Electricity charges (Units consumed in KWH)	1,559,020	1,598,360	8.33	7.92	12,989,309	12,665,942
15	Water charges (Kilo Litres consumed)	1,020	930	126.95	128.83	129,490	119,810
16	**Energy**					13,118,799	12,785,752
17	Buildings (No of buildigs)	2	3	7486.00	11427.67	14,972	34,283
18	Machinery (no of machines)	8	9	448865.50	261174.78	3,590,924	2,350,573
19	Others (Value of Fixed Asset -Rs lakhs)	5,641	5,771	155.69	26.74	878,241	154,331
20	**Repair and Maintenance**					4,484,137	2,539,187
21	Security charges (No of places)	7	7	157554.00	169967.00	1,102,878	1,189,769
22	Communication costs (Total employees on payroll)	637	641	1320.82	1867.40	841,363	1,197,004
23	Printing and stationery (per lak Rs of sales)	6,384	4,455	220.23	122.75	1,406,065	546,809
24	Travelling and conveyance (Total employees on payroll)	637	641	14046.60	9058.33	8,947,687	5,806,392
25	**Supplies**					12,297,993	8,739,974
26	Managers (grade wise employees)	85	86	199335.99	200958.38	16,943,559	17,282,421
27	Staff (grade wise employees)	484	490	42678.96	42999.49	20,656,616	21,069,748
28	Workers (grade wise employees)	68	65	34400.98	34216.97	2,339,267	2,224,103
29	Welfare Expenses (Total employees)	637	641	5557.39	5843.17	3,540,058	3,745,471
30	Contract labor (Number of employees on contract basis)	150	145	49574.19	48491.83	7,436,129	7,031,316
31	Contract labor at branches (Number of employees on contr	74	64	35074.58	32683.84	2,595,519	2,091,766
32	**Employees**					53,511,148	53,444,825
33	Rent (No of offices/godowns)	46	46	33397.15	39941.15	1,536,269	1,837,293
34	Rates and taxes (Production -lakh mtrs)	561	557	3303.83	3128.51	1,853,449	1,742,578
35	Insurance (Value of Fixed Asset - Rs in lakhs)	5,641	5,771	77.37	176.22	436,458	1,016,985
36	Legal and professional fees (number of consultants)	20	20	155677.65	190521.45	3,113,553	3,810,429
37	Miscellaneous expenses (Per lakhs Rs ofSales)	6,384	4,455	203.41	267.93	1,298,695	1,193,541
38	**Operating Expenses**					8,238,424	9,600,826
39	Freight outward (Per lakhs Rs of Sales)	6,384	4,455	3503.38	3141.10	22,367,318	13,992,679
40	Advertisement, publicity and sales promotion (Per lakhs R	6,384	4,455	1171.23	1388.40	7,477,710	6,184,885
41	Sales commission (Per lakhs Rs of Sales)	6,384	4,455	5005.26	1981.53	31,956,026	8,827,137
42	Installation charges(Per lakhs Rs of Sales)	6,384	4,455	393.06	201.66	2,509,510	898,325
43	**Sales and Distribution**					64,310,564	29,903,026
44	Finance costs (Receivables -Rs lakhs)	7,129	5,684	1384.53	2091.72	9,870,301	11,889,326
45	Depreciation (Value of Fixed Asset -Rs lakhs)	5,641	5,771	1899.61	1967.55	10,715,707	11,354,732
46	**Capital**					20,586,008	23,244,058
47	**OVERALL**					**585,638,531**	**437,728,065**
48	**PROFIT/LOSS**					**52,810,950**	**7,742,059**

Once the data is setup, the productivity, price recovery and profitability contributions of each factor and each category are determined. The steps include the following: First, deflated values are calculated by multiplying current period quantities by base-period prices. Second, change ratios are calculated for quantities, prices and values in each period. Third, "performance indexes of productivity, price recovery and profitability are calculated" (Rao, 2006; Rao, 2007) from the change ratios. Finally, the "productivity, price recovery and profitability contributions in dollars are calculated as follows" (Rao and Phusavat, 2013). These contributions from the top level, down to the resource level are plotted so that the trends are easily identified and the problem areas are determined.

ANALYSIS OF RESULTS

The management can begin analyzing the results at the top level. The top-level performance chart is shown in Figure 1. The overall performance chart shows very positive results in price recovery. According to the management, there was a change in state governments where Finolex competes. Those governments relaxed price controls. Finolex also promoted sales in areas with higher margins. These actions have resulted in very positive contributions in price recovery and profitability. The chart also shows that there is a serious problem with productivity. It has been negative through all eight periods although it has an upward trend in recent periods. This upward trend seems to be the effect of investments in automation in recent periods. Overall, this chart indicates that the management at Finolex should be focusing on productivity. In particular, the productivity contributions of the categories and resources should be pinpointed.

Figure 1. Overall Profitability, Productivity and Price Recovery



Similar charts for all categories are drawn for visual inspection of trends. Through visual inspection of the category-level charts, it was clear that one Material category stood out from the rest for significant productivity problems.

SUMMARY AND CONCLUSION

Water conservation is very important, and micro irrigation plays an important role. This paper focused on the performance evaluation of a micro-irrigation company using the APC model. A spreadsheet application of the model was developed for this company. Performance charts were drawn and analyzed. Through a top-down approach, it was shown how one could pinpoint the significant problem area in the company.

This paper should be of interest to researchers in the area of micro irrigation, water conservation and in the areas of performance measurement, spreadsheet modeling and decision support systems. Further research includes applications using other models for performance measurement. Further extensions could lead to applications in predictive analytics and prescriptive analytics.

REFERENCES

References available upon request.