Management Accounting and Capacity Management

– Some implications from cost management and measurement –

Junzo Wada

INTRODUCTION

Capacity cost is defined that fixed costs of being able to achieve a desired level of production or to provide a desired level of service while maintaining product or service attribute, such as quality\(^1\). Here are important keywords as fixed costs, production and service. Historically, capacity cost has been treated as meaningful territory in comparison to variable cost. Capacity cost is known as to maintain at suitable level of productive capacity. It is said that when organizations have unused capacity (of committed resources) they often attempt to get customers to shift their demands. The result of the excess costs attributable to idle or unused capacity is to increase the organization’s costs\(^2\). Here is clearly contained managerial handling for capacity cost. Also CAM–I (Consortium for Advanced Manufacturing–International) approaches that productive capacity is to provides value to the customer—it results in the delivery of good products or service to the market\(^3\). And it concludes that rated capacity means “idle capacity + nonproductive + productive”.

These development of capacity theories depicts the following points.

• Resource capability
• Baseline capacity measures
• Capacity utilization measures
• Time frame of analysis
• Organizational focus or strategy\(^4\)

Among these points capacity cost has some strong relations on ‘the baseline capacity measures’ and ‘capacity deployment’. Baseline capacity measures (see Figure 1) mean theoretical capacity, practical capacity, normal capacity, budgeted capacity and actual capacity.

Capacity deployment (see Figure 2) consists of excess capacity, planned idle capacity, unplanned idle capacity, planned nonproductive capacity and productive capacity. Traditionally, fixed cost mentioned above is an example of total capacity cost expressing capacity deployment. Productive capacity here adapts marketable

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2 Kaplan, R. S. et al. (1998), Advanced Management Accounting, 3rd ed.
3 McNair, C. J. et al. (1996), Measuring the Cost of Capacity, SMA 4Y.
4 McNair, C. J. et al. (1998), Total Capacity Management, FAR.
Theoretical capacity
Practical capacity
Normal capacity

Annual budgeted capacity 63%
Actual capacity utilization 58%

Figure 1 Baseline Definitions of Capacity

Excess capacity 10%
Productive capacity 28%
Planned idle capacity 20%
Unplanned nonproductive capacity 20%

Figure 2 Capacity Deployment

Historical background

Development of capacity costing has not passed so long time and has experienced critical debates. For over sixty years of capacity and capacity cost has been deemed as hidden resources. Emergence for managerial use on capacity cost would be beginning from the era of direct costing and business budget⁷. Making a clear realization for capacity cost on treatment product costing confined to the development of standard cost⁵.

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7 Tsuji Atsuo. (1971), *Kanrikaikei hattatsushiron*.
Product costing problem indeed has so fruitful accomplishments on managerial using of costing. Among others proper overhead distribution is the central idea of this era. These areas are summarized as follows.

• Overhead absorption methods (1875–1900):
  Association of overheads with jobs by the addition to each job’s prime costs of a flat percentage of its labor cost or prime cost. The percentage would be determined by the relationships between total overheads and total labor cost of the previous year.
  A crude form of machine hour rate was also in use in this period, but only to absorb expenses directly connected with the machine.
  Separate departmental rates might apply, but the idea of cost centers or production centers was not prevalent.

• Production centers
  Recognition of the factory or workshop as consisting of a number of production centers. From this idea was developed a more refined machine hour rate.

• Overhead analysis
  Recognition of the distinction between works overheads and general overheads, and the breakdown of works overheads into different classes.

• Relationship of overheads to capacity
  From this relationship was developed the idea of a normal cost in preference to an actual cost. The normal cost concept in turn prepared the way for that of the standard cost.

The final area listed above are focusing on capacity cost and its management. Standard cost has two aspects. One is exact product costing through proper distribution, and the other is the control device for productive work.

At this site, periodical cost estimate, in particular, budgeted production capacity. If these capacity estimates would not match with actual production volume, differences should be charged to either product or periodical revenue.

During the early periods of development, the most excellent works was established by Gantt and Church. Gantt’s theory on proper treatment of expense burden focuses to exclude idle capacity cost from product cost.

9 Hart, Harold. (1976), An Examination of Developments in Some Critical Areas of Management Accounting with Particular Reference to Overhead Costs.
Church has another opinion to treat idle capacity with control report which has conjunction to supplementary rate.

The subsequent period throughout the 1920s was characterized by debates on the difference between engineering and accounting standard. Mainly two groups make fierce arguments around normal concept at some annual meetings of the NACA (National Association of Cost Accountant). Normal concept means one of the baseline capacity measurement, interlevel between budgeted and actual one. Remained difference is charged directly to the profit and loss statement\textsuperscript{12}. Capacity management relies on the excess from potential performance of to actual performance. This phenomenon comes from the economic recession in the U.S. at those days. In other words, over capacity and excess productive power are identified as the cause.

Development of business budgeting\textsuperscript{11} has thrown light at peculiar aspects on capacity cost. Passing though the 1930s profit planning and control system have made advance in this area. Its object places at the reasonable adjustment among entire business components. Here is no control problem on productive capacity, however, involvement of every non–productive forces\textsuperscript{14}. Kobayashi(1981) says ‘The era of setting sun on debates for the capacity cost=fixed cost has begun from now’.

The Present State of Capacity Cost Management and Theory

McNair(1998) points that the reemergence and proliferation of capacity cost management models appear to be logical outgrowths of the renewed interest in cost models\textsuperscript{15}. And the CAM–I presents the diversity of issues and approaches that make up modern capacity cost management practice(see Table1, Table2). CAM–I and IMA (Institute of Management Accountants) make clear the following points.

- Capacity cost management appears to mean more than measuring and directing short–term capacity utilization.
- Estimated cost of capacity under different levels of utilization
- Capacity issues and objectives in the short, intermediate and long term
- Capacity issues and objectives at different organizational levels (i.e., process, unit, company, and total value chain)
- Analysis and choice of appropriate capacity cost management tools given the existing company strategy and core objectives
- Analysis and improvement in actual capacity utilization

\textsuperscript{11} Church, A. H. (1901), “The proper distribution of established charges,” The Engineering Magazine.
\textsuperscript{13} McKinsey, J. O. (1922), Budgetary Control Harrison, G. C. (1930), Standard Costs–Installation, operation and use.
\textsuperscript{14} Kobayashi Kengo. (1987), Yosankanri Hattatsuhi.
\textsuperscript{15} op. cit.
### Table 1. Capacity Cost Management Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Features</th>
<th>Primary Time Frame</th>
<th>Organizational Level</th>
<th>Capacity Baseline Emphasized</th>
<th>Suggested Treatment of Idle Capacity Costs</th>
<th>Primary Focus of Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gantt idleness charts</td>
<td></td>
<td>Short-term</td>
<td>Process</td>
<td>Practical</td>
<td>Charge to P&amp;L</td>
<td>Efficiency / utilization</td>
</tr>
<tr>
<td>Supplemental rate method</td>
<td></td>
<td>Short-term</td>
<td>Process / plant</td>
<td>Practical</td>
<td>Charge to product</td>
<td>Idle capacity costs</td>
</tr>
<tr>
<td>Normalized cost</td>
<td></td>
<td>Intermediate</td>
<td>Process / plant</td>
<td>Normal</td>
<td>Charge to P&amp;L</td>
<td>Decision costs</td>
</tr>
<tr>
<td>Theory of constraints</td>
<td></td>
<td>Short to intermediate</td>
<td>Process / plant / company</td>
<td>Practical (marketable)</td>
<td>None suggested</td>
<td>Throughput</td>
</tr>
<tr>
<td>Mix–adjusted model</td>
<td></td>
<td>Short-term</td>
<td>Process / plant</td>
<td>Theoretical</td>
<td>Charge to P&amp;L</td>
<td>Throughput</td>
</tr>
<tr>
<td>Resource effectiveness model</td>
<td></td>
<td>Short-to-long-term</td>
<td>Process / plant / company</td>
<td>Theoretical</td>
<td>Charge to P&amp;L</td>
<td>Resource utilization</td>
</tr>
<tr>
<td>Capacity utilization analysis</td>
<td></td>
<td>Short to intermediate</td>
<td>Process / plant / company</td>
<td>Theoretical</td>
<td>Charge to P&amp;L</td>
<td>Resource utilization</td>
</tr>
<tr>
<td>Capacity variance model</td>
<td></td>
<td>Short to intermediate</td>
<td>Process / plant</td>
<td>Theoretical</td>
<td>None suggested</td>
<td>Causality / analysis</td>
</tr>
<tr>
<td>Activity–based cost model</td>
<td></td>
<td>Short to intermediate</td>
<td>Process / plant / company</td>
<td>Normal</td>
<td>Charge to P&amp;L</td>
<td>Cost of resources used</td>
</tr>
<tr>
<td>CAM–I model</td>
<td></td>
<td>Short to long–term</td>
<td>All levels (potential)</td>
<td>Theoretical</td>
<td>Charge to P&amp;L</td>
<td>Communication</td>
</tr>
<tr>
<td>CUBES model</td>
<td></td>
<td>Short to intermediate</td>
<td>Process / plant / company</td>
<td>Theoretical</td>
<td>None suggested</td>
<td>Process utilization</td>
</tr>
<tr>
<td>Cost containment model</td>
<td></td>
<td>Intermediate</td>
<td>All levels (potential)</td>
<td>Implicit theoretical</td>
<td>None suggested</td>
<td>Total cost / resources</td>
</tr>
</tbody>
</table>

### Table 2. CAM–I Capacity Model

<table>
<thead>
<tr>
<th>Rated Capacity</th>
<th>Summary Model</th>
<th>Industry Specific Model</th>
<th>Strategy Specific Model</th>
<th>Traditional Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>idle</td>
<td></td>
<td>Not Marketable</td>
<td>Excess Not Usable</td>
<td>Theoretical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off Limits</td>
<td>Management Policy</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Contractual</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Legal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marketable</td>
<td>Idle But Usable</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Capacity</td>
<td></td>
<td>Stand by</td>
<td>Process Balance</td>
<td>Scheduled</td>
</tr>
<tr>
<td>Non–productive</td>
<td></td>
<td></td>
<td>Variability</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Waste</td>
<td>Scrap</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Rework</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintenance</td>
<td>Scheduled</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Unscheduled</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Setups</td>
<td>Time</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Volume</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Change–Over</td>
<td></td>
</tr>
<tr>
<td>Productive</td>
<td></td>
<td>Process Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Product Development</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Good Products</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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16 Ibid.
17 Ibid.
These are reflected in some changing aspect of company resources and its use. Priority of issues should be placed upon value-creation management beyond mere measurement of capacity utilization.

**ABC model**

ABC (Activity Based Costing) had its completion by the work of R. S. Kaplan and R. Cooper in the 1990s. ABC model has a simple equation that is activity availability = activity usage + unused capacity. Unused Capacity means the gap between what could have been done and the work actually accomplished, stated in financial terms. The basic structure (see Figure 3) of ABC consists from two concepts, Resource and Cost Driver. They do identify the differences between value-creating consumption and non-value-consumption of resources. Traditional capacity costing and measurement have denoted multiple cost drivers and clear distinction on profitable consumption of capacity.

ABC model is typically the technique of many allocation methods on overhead, however, its information implies which optimal capacity decision which is needed. Especially, ABM (Activity Based Management) can be installed with ABC makes more useful capacity management information for management.

**JIT Model and Kaizen Costing**

JIT (Just In Time) from Japanese management has acquired its explosive acceptance through the 1970s and 80s. JIT works with TQM (Total Quality Management), which has concentrated on eliminating errors and defects from the workflow, and which has focused on eliminating move and queue from operations. JIT model

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18 Ibid.
20 Kaplan, R. S. and Cooper, R. (1997), *Cost & Effect*.
(see Table 3) incorporates some unique aspects against traditional manufacturing process. Measurement of capacity utilization with JIT is similar in structure to ABC system (see Table 4). In JIT system many indirect costs are converted to direct one. From the capacity management view, it’s more easier to analyze on utilization that the specific product / service has the conversion into direct costs from indirect one. And flexibility in the production can be estimated in advance.

Kaizen Costing has derived from JIT model, is the term for continuous improvement during manufacturing. Kaizen costing may allow the firm to achieve target cost over the product’s life\textsuperscript{23}. JIT model also provides a yardstick for performance measurement. These information may mitigate to handle with complicated cost figures. (see Table 5)

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23 Ibid.
TOC and Backflush costing

TOC (Theory of Constraints)\(^2\) advocates strongly exclusions of any capacity costs from products. Three factors, which are throughput, operating expense and inventory, play important roles. TOC measures profit = throughput − operating expenses. Also throughput measures the difference between revenues and cost of raw materials. In the TOC, capacity cost should be used to create customer value. If all the company resources are not matched with the throughput the company creates, inefficient use of the capacity in the various business processes can mean low or nonexistent profits. In that meaning, TOC may target its profit as added value.

Backflush costing is a costing system that omits recording some or all of the journal entries relating to the cycle from purchase of direct materials to the sale of finished goods. The type of backflush costing can treat profit from the sale of finishing goods\(^2\).

<table>
<thead>
<tr>
<th>Table 5. Performance Measures—Traditional versus JIT(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional</strong></td>
</tr>
<tr>
<td>Direct labor efficiency</td>
</tr>
<tr>
<td>Direct labor utilization</td>
</tr>
<tr>
<td>Direct labor productivity</td>
</tr>
<tr>
<td>Machine utilization</td>
</tr>
<tr>
<td><strong>JIT</strong></td>
</tr>
<tr>
<td>Total head count productivity</td>
</tr>
<tr>
<td>Return on assets</td>
</tr>
<tr>
<td>Days of inventory</td>
</tr>
<tr>
<td>Group incentives</td>
</tr>
<tr>
<td>Lead time by product</td>
</tr>
<tr>
<td>Response time to customer feedback</td>
</tr>
<tr>
<td>Number of customer complaints</td>
</tr>
<tr>
<td>Cost of quality</td>
</tr>
<tr>
<td>Setup reduction</td>
</tr>
</tbody>
</table>

Conclusion

The development of capacity cost management has long history. The first commitment to the capacity is costing idle or excess capacity. Proper allocation of indirect cost on products indeed was focused to prepare profit and loss report. Although A.H. Church discovered efficiency standard of capacity utilization as supplementary rate for managerial use, dominant opinions and practices were directed to solution for overhead allocation. Solutions for capacity costing problem still remained at result−based approach.

The development of standard costing and budgeting is the second one for the capacity costs. Importance of capacity utilization has discovered as the great consequence to determinate product cost and business profit. There was no theoretical distinction between productive and non−productive consumption of capacity, however the object for analysis was changing from physical to both of physical and non−physical asset.

Capacity−related resources are acquired and paid for in advance when the work is done. The transition from

\(^{25}\) Shim (1997).
cost assignment to cost control for capacity has been seemed to be seamless. Three issues remains. The first is to
measure utilization of existing capacity as service potentials, the second is the conversion to value–based
approach and the third is managerial treatment of nonphysical capacity. ABC, TOC and JIT models might give
some alternative suggestions for constructing useful framework for management accounting.

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— Some implications from cost management and measurement —

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Capacity management has one of the most important issues for management accounting and cost management. It has huge accumulation of theoretical and empirical research through the 20th century. In other words, there remain many inextricable disputes on capacity management. Turning to the real business world, we must solve a variety of challenges from strategic mixture of company resources and measurement for their components. Now, capacity is the value-creating ability of an organization. Its ability comes from proper shapes of capacity and cost management system.

This paper shows that measurement concept and techniques for capacity costing from historical background are mainly focusing on physical asset. Adding to that, central issue has been around the distribution of unused capacity cost to products. Today’s view of capacity cost management is reinforced to notify forward-looking not retrospective. In this meaning, this paper addresses that capacity cost management should provide supportive instruments in current and future utilization of capacity including nonphysical asset.