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The Business End of Maintenance



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About the Author

Deryk Anderson has had 18 years experience in maintenance across asset intensive industries. He currently lectures in maintenance management at Australia's Central Queensland University and has run his own maintenance management consulting business for more than 9 years.

SUMMARY

Many organizations fail to see the Maintenance function as part of their competitive advantage. Maintenance is more often regarded as a mystery to many decision makers and is frequently seen as an easy target for budget cuts. Often the cause of a poor corporate view of maintenance lies in the difference between executive and technical stakeholder views. This paper explores the relationship between maintenance and business outcomes and the contribution of the maintenance function to the business “bottom line”.

Keywords: Maintenance, Strategy, Business, Financial Performance, Return on Assets, Return on Equity, Asset Intensive, Organizations

INTRODUCTION

Asset intensive organizations in both the private and public sectors rely on assets to provide products and services. The ability of these organizations to provide desired service levels, function safely (with regard to personnel, public and the environment), and economically or profitably is dependent on the effective maintenance of these assets. Effective maintenance requires planning, organization and control, in other words management, of the maintenance function.

The maintenance function of organizations has an essential purpose directly related to the assurance of asset capability [1] and the achievement of organizational objectives. Greater understanding of the relationship between maintenance objectives and organizational goals and objectives will enable the maintenance practitioner to deliver new levels of service to the organization.

The challenge for maintenance is to quantify its value to the business in a measure of organizational management effectiveness. Moderate improvements in maintenance performance can have a significant impact on the “bottom line” results of business. This paper explores the impact of maintenance improvement initiatives on the Return on Assets and Return on Equity of business.

OBJECTIVES OF BUSINESS

In fundamental terms, the purpose of business is to return a profit to owners and investors. The conclusion that business is focused only on making money to the exclusion of all other concerns is not popularly supported. Kay [ii] observes:

“... this view of business as necessarily selfish, narrow and instrumental, is, as it always has been, nonsense. Business which is selfish in motivation, narrow in outlook, and instrumental in behavior is rarely successful business.”

Hutton [iii] reports an excerpt from Shell’s annual report from Sir Mark Moody-Stuart:

“Profits are an important part of our ability to contribute to society. Shell companies also accept that their responsibility is to help deliver the economic, social and environmental requirements of sustainable development. Being trusted to meet societal expectations is essential for long term profitability.”

Most businesses declare their purpose and objectives in a number of published statements that are available to employees, shareholders and the public. These may include:

- A statement of the purpose, vision and values of an organization (e.g. Mission Statement);
- A statement of the functional objectives of an organization, which contains more distinct goals that may have performance criteria associated with them.

There are similar common objectives identified in the statements of asset intensive businesses:

- To operate profitably or economically;
- To provide desired or agreed levels of service;
- To operate safely in terms of consumers, the public and employees;
- To operate safely with regard to the environment.

These objectives can be seen in the following statement by Rio Tinto [iv]:

“Rio Tinto is a world leader in finding, mining and processing the earth’s mineral resources. In order to deliver superior returns to our shareholders over many years, we take a long term and responsible approach to exploring for first class orebodies and developing large, efficient operations capable of sustaining competitive advantage. In this way, we help to meet the global need for minerals and metals which contribute to essential improvements in living standards as well as making a direct contribution to economic development and employment in those countries in which we invest. Wherever we operate, we aim to work closely with our hosts, and strive to respect laws and customs, minimize adverse impacts, and ensure transfer of benefits and enhancement of opportunities. We believe that our competitiveness and future success depend not only on the unrivalled quality and diversity of our assets but also on our record as good neighbors and partners around the world. Accordingly, we set ourselves high environmental and community standards. Our commitment to health, safety and the enhancement of the skills and capabilities of our employees is second to none in mining. We seek to make lasting contributions to local communities and to be sensitive to their culture and way of life.”

Asset intensive organizations rely on assets (plant and equipment) to achieve their outcomes. These assets are designed to achieve levels of safety, output and economy. As the capability of assets deteriorates, these outcomes are put at risk. Assets may behave in a way that is unsafe or uneconomical.

The effectiveness of the performance of assets in asset intensive organizations impacts on the ability of these organizations to meet their objectives. The loss of asset capability through degradation or failure can impact significantly on the ability to meet these objectives. Maintenance contributes, in particular to the organizational objectives of profitability (economy of operation), agreed levels of service, and safety of consumers, the public, employees and the environment.

OBJECTIVES OF MAINTENANCE

Thomas [v] reports that maintenance accounts for up to 40% of an organization's costs; this means that maintenance is a significant consumer of human and financial resources in business. As maintenance is intended to assure asset capability, the purpose of maintenance can be generally described as to assure the safety and profitability (or economy) of the host business. The role of maintenance in preventing the consequences associated with asset failure, means that maintenance should be considered a vital function within the business.

The objectives of the maintenance function must be complimentary to the objectives of the host business. For this reason, maintenance objectives often emphasise attention to:

- Maintaining assets to a functional standard of performance such that they will achieve their desired capacity and availability (assures required service levels and economy / profitability of operation);
- Safety of consumers, public, personnel and the environment;
- Meeting objectives of safety and capacity at a minimum total resource cost.

MEASURING BUSINESS PERFORMANCE

The outputs of business management are demonstrated in the model of Figure 1, derived from [vi]. This model shows business management responding to a set of operational and environmental constraints to produce performance in terms of profit, risk and cash flow. These outputs are considered to be both tangible and intangible. The financial performance of a business is considered to be much easier to measure, while risk is less quantifiable.

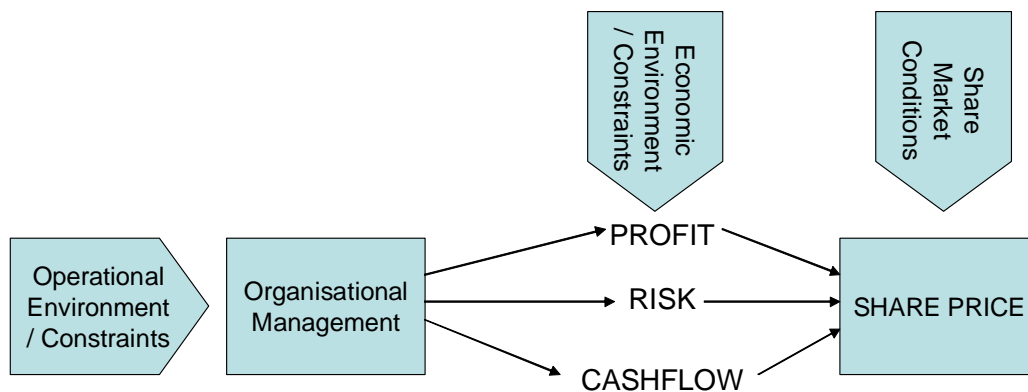


Figure 1 - Influence of Organisational Management on Share Price

A more detailed appraisal of business performance can be seen in the following list derived from work by Freibert [vii]. This list considers business performance in terms of managerial performance and financial performance.

Managerial Performance

- Strategic Direction;
- Management Team;
- Leadership;
- Succession Planning;
- Employee Relations;
- Innovation;
- Board Relations;
- Investor Relations;
- Community Relations;
- Regulatory (statutory) Compliance;
- Risk Management.

Financial Performance

- Return on Assets (ROA);
- Return on Equity (ROE);
- Capital Provision;
- Stock Price Performance;
- Book Value Performance;
- Dividend Payout;
- Market Share.

It is argued that the managerial performance measures relate to risk, and are ultimately reflected in the financial performance of the business. Risk management is part of the social responsibility of organizations, but is ultimately measured by the viability and profitability of the business. Financial performance is a tangible outcome that reflects the true performance of business and one against which the contribution of maintenance can be easily measured. Primary measures of financial performance for asset intensive business are Return on Assets and Return on Equity. Calculations of these measures vary between sources. For the purposes of this paper, these measures are defined as follows:

Return on Assets (ROA) - A ratio of the net income a business is able to earn with its total assets. ROA is calculated by dividing operating profit by total assets.

Return on Equity (ROE) - A ratio of the net income a business is able to earn with its total shareholders' equity. ROE is calculated by dividing operating profit by shareholders equity.

The calculation of ROA and ROE is demonstrated in the model of Figure 2, derived from Higgs [viii].

The model of Figure 2 shows the relationship between finances and ROA and ROE. The financial categories of Figure 2 are defined as follows:

- **Current Assets** are assets of a business that are expected to be converted to cash, sold, or consumed during the normal operating cycle of the business (normally one year) and include cash, receivables, and inventory including maintenance spares.
- **Fixed Assets** are assets such as plant and equipment, machinery and furniture and fittings.
- **Total Assets** are the entire assets of an organization and are calculated by the sum of Current Assets and Fixed Assets.
- **Total Liabilities** are what a business owes to others and includes wages and salaries payable, taxes payable, bank loans, etc.
- **Shareholders Equity** is the capital invested from shareholders and from retained profits and is equivalent to Total Assets minus Total Liabilities.
- **Sales Revenue** is the income from all sales.
- **Operating Cost** is the sum of all costs associated with sales and includes raw materials, labor including maintenance labor and materials.
- **Operating Profit** is profit before tax and is calculated by the difference between Sales Revenue and Operating Cost.

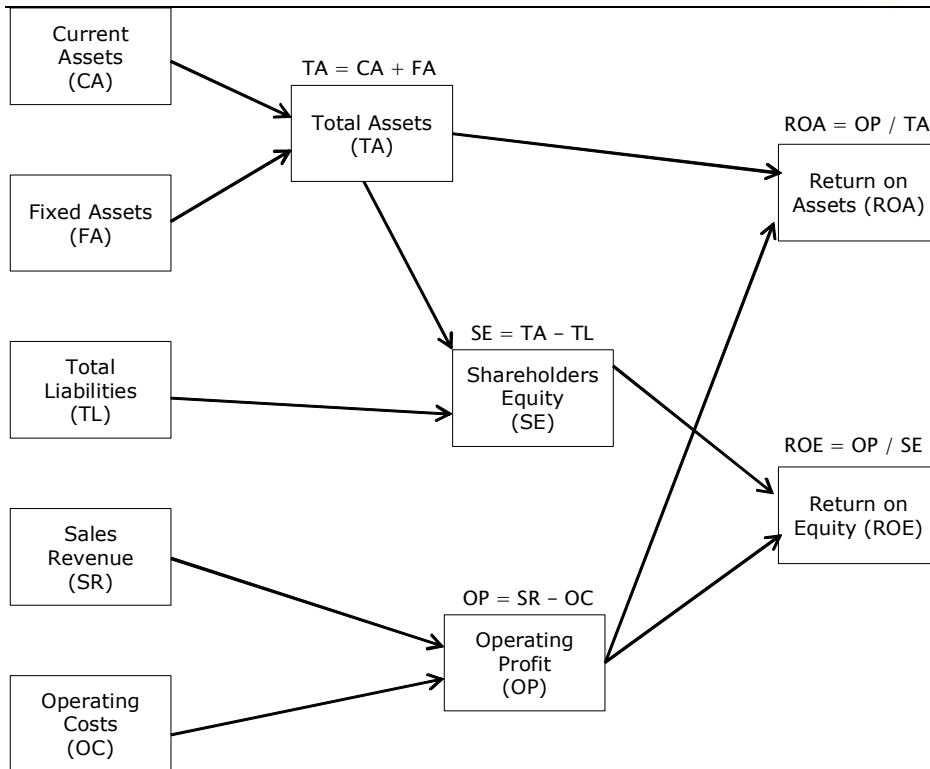


Figure 2 - Calculation of ROA and ROE

The financial performance of a medium sized manufacturing business is shown in the following example. The relevant financial figures for the business are shown in Table 1. These figures are derived from the annual report of the business.

Category	
Current Assets	\$ 167,988,152
Fixed Assets	\$ 476,610,000
Total Assets	\$ 644,598,152
Total Liabilities	\$ 215,241,494
Shareholder Equity	\$ 429,356,658
Sales Revenue	\$ 428,250,643
Operating Costs	\$ 406,728,737
Operating Profit	\$ 144,867,123

Table 1 - Financial Figures

The application of these figures to the model of Figure 2 is shown in Figure 3. This indicates current financial performance of the business with an ROA of 3.34% and an ROE of 5.01%.

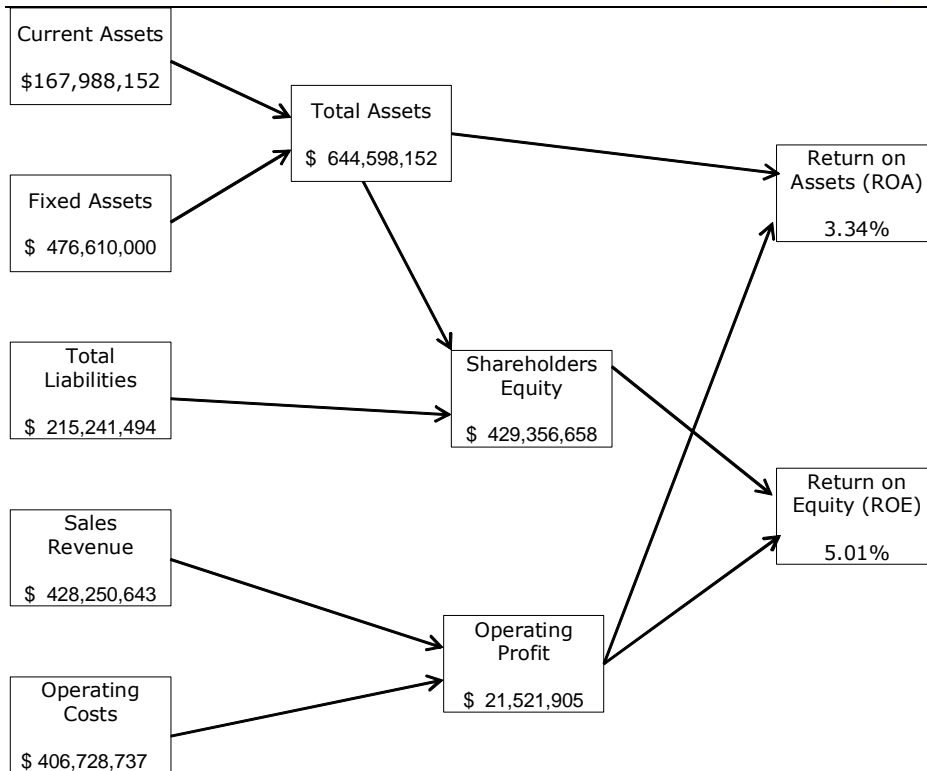


Figure 3 - Example Calculation of ROA and ROE

THE CONTRIBUTION OF MAINTENANCE

The cost and performance of maintenance contributes to the ROA and ROE. The degree of contribution of the maintenance function to ROA and ROE can be explored by considering the influence of improvement in maintenance performance on ROA and ROE.

The model of Figure 4 shows how maintenance improvement initiatives can impact on ROA and ROE. This model shows the following Operational and Financial benefits of maintenance improvement:

- Lower maintenance costs, reduce operating costs, and increase operating profit, ultimately increasing ROA and ROE. Every dollar that is not spent on maintenance has a direct impact on increasing company profitability.
- Lower inventory costs decrease operating costs AND decrease assets increasing ROA and ROE. Every dollar reduction in inventory has a multiple impact on increasing business profitability.
- Increased equipment uptime can lead to increased revenue, increasing gross profit and profit after tax.
- Reducing the incidents of undesirable equipment failure consequences and increasing inventory service levels can reduce risk and lower insurance premiums (either external coverage or self insurance).

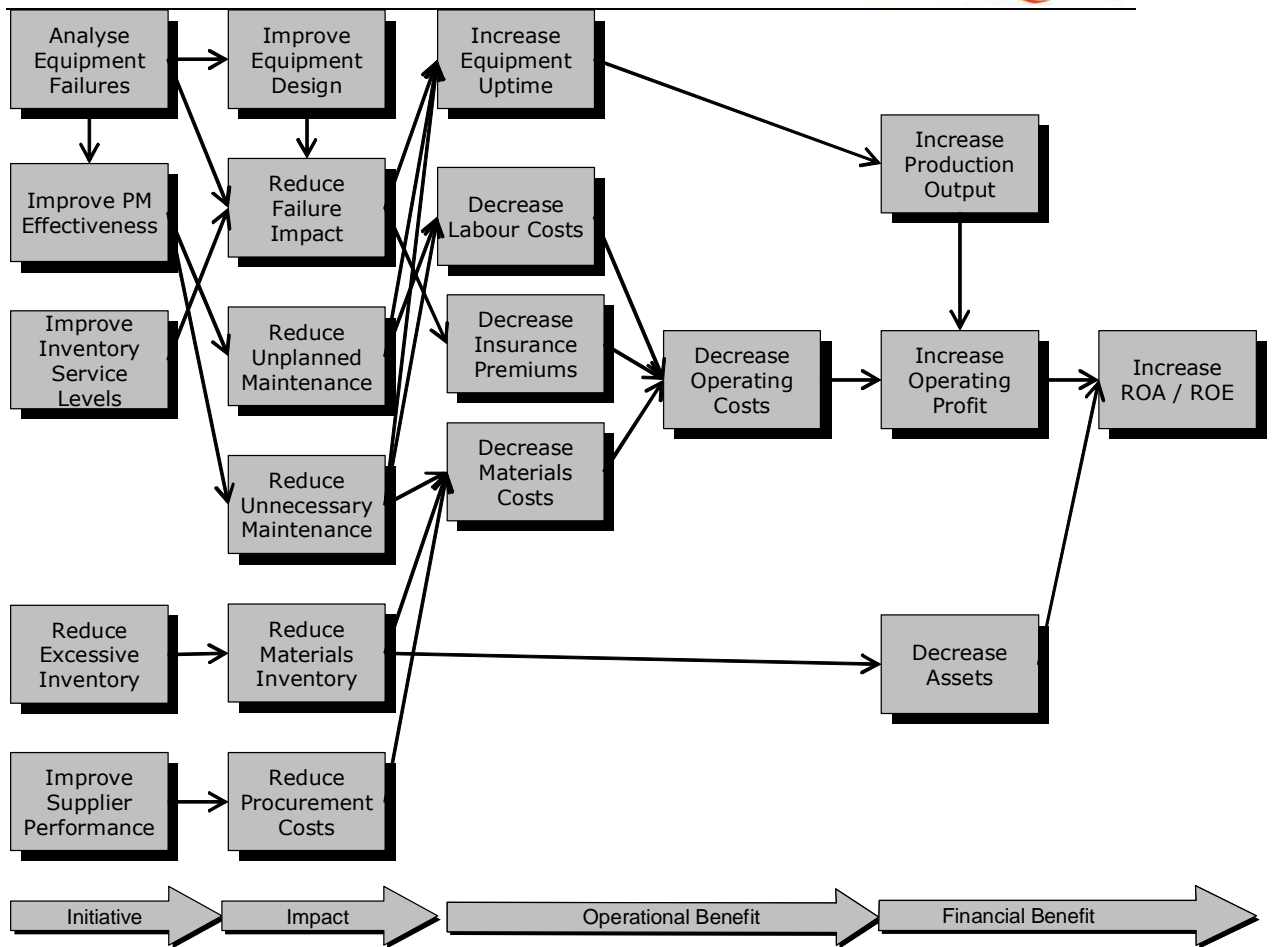


Figure 4 - Impact of Maintenance Improvement Initiatives on ROA and ROE

The quantification of maintenance improvement is considered in the following example. Moderate improvements in maintenance performance are arbitrarily applied to the categories of Figure 4 in Table 2. The financial impact of these improvements is summarized in Table 3.

The figures from Table 3 are applied to the existing figures in Figure 3 on the following basis:

- Increased production is added to sales revenue;
- Labor cost reductions are deducted from operating costs;
- Material cost reductions are deducted from operating costs;
- Inventory reduction is deducted from current assets.

The results of these alterations are shown in the model of Figure 5. This shows a net increase of 24% and 25% in ROA and ROE respectively. These figures represent a significant improvement in the business “bottom line”. To achieve equivalent improvements through sales would require a 24% increase in sales (\$104,046,875).



Operating Uptime	Annual Cost / Income	Recoverable Loss	Annual Savings
Losses due to downtime, quality and rate	\$428,250,643	1.00%	\$ 4,282,506
Labor Resource			
Excessive Labor Resource Cost	\$ 8,266,670	10.00%	\$ 826,667
Overtime	\$ 827,000	10.00%	\$ 82,700
Material Resources			
Excessive Maintenance Inventory	\$ 4,133,330	5.00%	\$ 206,667
Excessive Purchasing Transactions	\$ 125,000	4.00%	\$ 5,000
Reduce Number of Invoices	\$ 50,000	4.00%	\$ 2,000
Reduce Number of Payments	\$ 50,000	3.00%	\$ 1,500
Reduce Expediting Costs	\$ 25,000	25.00%	\$ 6,250
Overheads			
Annual Budget Over / Under Run	\$ 13,227,000	0.00%	\$ 0

Table 2 - Moderate Improvement in Maintenance Performance

Category	Savings
Improved Uptime / Rate / Quality	\$ 4,282,506
Labor Cost Reductions	\$ 909,367
Materials Cost Reductions (15% Holding Costs)	\$ 45,750
Inventory Reduction	\$ 206,667
Overhead Reductions	\$ 0

Table 3 - Summary of Maintenance Improvement Initiatives

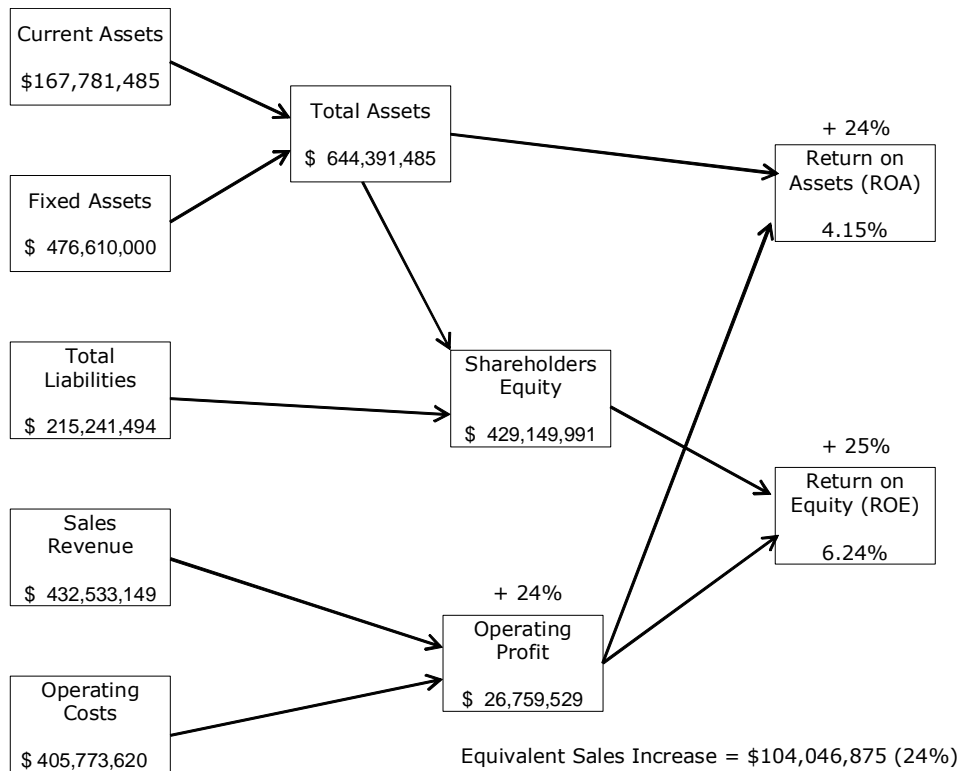


Figure 5 - Changes to ROA and ROE after maintenance improvement

CONCLUSION

The outputs of the maintenance function have a direct impact on the objectives of private and public organizations. Maintenance particularly impacts the following objectives of asset intensive organizations:

- To operate profitably or economically;
- To provide desired or agreed levels of service;
- To operate safely in terms of consumers, the public and employees;
- To operate safely with regard to the environment.

The quantification of benefit to the business provided by maintenance can be considered to include tangible and intangible measures. When tangible, financial measures of business performance are considered, moderate improvements in maintenance effectiveness can be shown to impact significantly on the business "bottom line". Quantifying maintenance improvement in terms of business measures is an effective tool for demonstrating the power of maintenance improvement and the cost effectiveness of investment in the maintenance function.

AUTHOR'S NOTE

Portions of the content of this paper are extracted from Central Queensland University (CQU) course notes "Establishing the Maintenance Strategy" written by the Author. Permission of CQU to reproduce this portion in this paper is acknowledged.

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