

'Product Name'
Document Number: 'Document Number'

Software Productivity Metrics for 'Component Name'

Version: 'Version Number'

'Organization'

'Date'

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4 Relationships

This section demonstrates many types of relationships, using the primitives defined in earlier sections. These relationships are presented as examples of the way that output and input primitives are combined. It is left to the SMEs to decide which combinations of primitives are most useful to them.

4.1 Productivity Ratios

Productivity is the ratio of the defined output to the defined input effort that produced it. For example, the productivity ($Productivity_a$) for Producta is computed by dividing the output (O_a) by the effort spent on it (E_a).

$$Productivity_a = \frac{O_a}{E_a}$$

4.1.1 Incremental Productivity Ratios

This relationship can be used during development and accumulated to assess the productivity as it progresses to the end of the project. This is done to show fluctuations in productivity and trend patterns. These trend patterns can help derive project estimates for other projects.

The periodic sampling of productivity is referred as incremental productivity ratios and is computed by

$$Incremental\ Productivity = \frac{(O_{tm} - O_{tm-1})}{(E_{tm} - E_{tm-1})}$$

Where,

O_{tm} is the selected output primitive and E_{tm} is the effort expended for the output through the time t_m

and,

O_{tm-1} and E_{tm-1} are the output and effort through the previous time t_{m-1} .

4.1.2 Source Statement Productivity Ratios

Source statement productivity ratios are calculated using the output primitives:

1. Delivered New SS
2. Delivered Reused SS
3. Nondelivered New SS
4. Nondelivered Reused SS
5. Nondelivered Deleted SS

Where, SS stands for logical source statements or physical source statements for 'component name'.

The input primitives used in the productivity relationships are:

1. Direct Delivered Staff Hour
2. Direct NonDelivered Staff Hour

So,

$$\text{Productivity}_{\text{newSS}} = \text{Delivered}_{\text{newSS}} / \text{DirectDelivered}_{\text{staffHour}}$$

$$\text{Productivity}_{\text{reusedSS}} = \text{Delivered}_{\text{reusedSS}} / \text{DirectDelivered}_{\text{staffHour}}$$

and,

$$\text{Productivity}_{\text{newSS}} = \text{NonDelivered}_{\text{newSS}} / \text{DirectNonDelivered}_{\text{staffHour}}$$

$$\text{Productivity}_{\text{reusedSS}} = \text{NonDelivered}_{\text{reusedSS}} / \text{DirectNonDelivered}_{\text{staffHour}}$$

4.1.3 Function Point Productivity Ratios

The function point productivity ratios are optional, but are useful in determining the productivity of 'component name' from a functionality aspect. The function point output primitive is the number of function points. The input primitives used for analyzing productivity relationships can be one of the following parameters:

1. Direct Delivered Staff Hour
2. Direct Nondelivered Staff Hour
3. Support Staff Hour

Three different productivity ratios are provided when dividing the output primitive by each of the above input primitives.

4.1.4 Documentation Productivity Ratios

Documentation productivity ratios provide a measurement to evaluate the documentation. The document output primitives are:

1. Document Page Count or Screen Count
2. Number of Words
3. Number of ideograms
4. Graphics

The document input primitives are:

1. Direct Delivered Staff Hour
2. Direct Nondelivered Staff Hour
3. Support Staff Hour

So the productivity based on the number of pages in the software requirements specification for 'component name',

$$\text{Productivitysrrpgs} = \frac{\text{DocPgCntsrrpgs}}{\text{DirectDeliveredstaffHour}}$$

The other productivity ratios are computed in the same manner.

4.2 Output-to-Output Ratios

Out-put-to-output ratios provide useful insight into the development process of 'component name'. The following sections describe the ratios for source statements, function points, and documentation.

4.2.1 Source Statement

The source statement output-to-output ratios measure the development of the source code for 'component name'. The computed ratios are:

1. The proportion of delivered source statements to the total number of source statements developed for 'component name'
2. The proportion of reuse in the component
3. The proportion of delivered source statements that are new
4. The proportion of delivered source statements that are reused

5. The proportion of nondelivered source statements that are reused
6. The executable logical source statements to the total number of logical source statements for 'component name'.
7. The ratio of comments to the total number of physical source statements

4.2.2 Function Point

Output-to-output ratios are not calculated if the function point count is a single number. If that is not the case, ratios are derived in the same manner for source code.

4.2.3 Documentation

Document content ratios are computed to describe the density of the documentation for 'component name'. These ratios help to distinguish high density documents from low density ones. The computed ratios are similar to the source statement ratios:

1. The proportion of delivered pages to the total number of pages output
2. The proportion of reuse in the document
3. The proportion of delivered pages that are new
4. The proportion of delivered pages that are reused

4.2.4 Mixed Output Ratios

Ratios comparing output primitives of different types may provide insight into the software development process. Two possible combinations are:

$$\frac{\text{Function Points}}{\text{Total Source Statements}}$$

Or,

$$\frac{\text{Document Pages}}{\text{Total Source Statements}}$$

4.3 Input-to-Input Ratios

Ratios of input primitives to input effort primitives provide insights about the effort expended. The input primitives are:

1. Direct Delivered Staff-Hours = A
2. Direct Nondelivered Staff-Hours = B
3. Support Staff-Hours = C

Meaningful combinations used to evaluate the production of 'component name' are:

$$\begin{aligned}\text{Total Effort} &= A + B + C \\ \text{Total Direct Effort} &= A + B\end{aligned}$$

The ratio of Direct Effort to Total Effort:

$$\frac{\text{Total Direct Effort}}{\text{Total Effort}} = \frac{A + B}{A + B + C}$$

The ratio of Support Effort to Total Direct Effort:

$$\frac{\text{Support Effort}}{\text{Total Direct Effort}} = \frac{C}{A + B}$$

The ratio of Direct Delivered to Direct Nondelivered Effort:

$$\frac{\text{Direct Delivered Effort}}{\text{Direct Nondelivered Effort}} = \frac{A}{B}$$