

APIS Visualization Components

(WIP DRAFT)

Conventions in this document

The visual representation of charts deliberately abstracts away concrete color schemes. Thus charts use only monochrome visuals and descriptions make reference to characteristics of color schemes to be used, at best.

Statements in a (grammatically) indicative mode denote strong requirements while subjunctive mood (“may”, “might”, “should”, “optional”) is used where features are to be implemented “in a second step”. This does not mean they will not be implemented.

Italics (*like this*) are used in two cases:

1. Non-standard terms that have a fixed meaning (quasi-technical terms within the scope of this document). They are explained in section “Terms used in this paper” at the end of the document
2. Non-English words and terms (which can be identified within the context where used).

Growth-share matrix

The growth-share matrix is based on the infamous Boston-Consulting-Group matrix (BCG matrix). Technically, it is a scatter plot visually relating two (sometimes three) measurements for a set of items simultaneously in a single chart. In the original BCG matrix those measures are market share and growth rate of business units, product lines etc. In the context of APIS, similar measures are used (growth and relative share of turnover) and the items are the cargo types handled.

An item is defined by the values for the two measures and forms a data point (e.g., [“liquid bulk”, 4%, 32%]). The growth-share matrix allows comparing several of those data points in a single space. *Comparative measures* for both coordinates provide for a benchmark in the two measures. This is, e.g., the market share of the port in general and its turnover growth rate compared to other ports in the area.

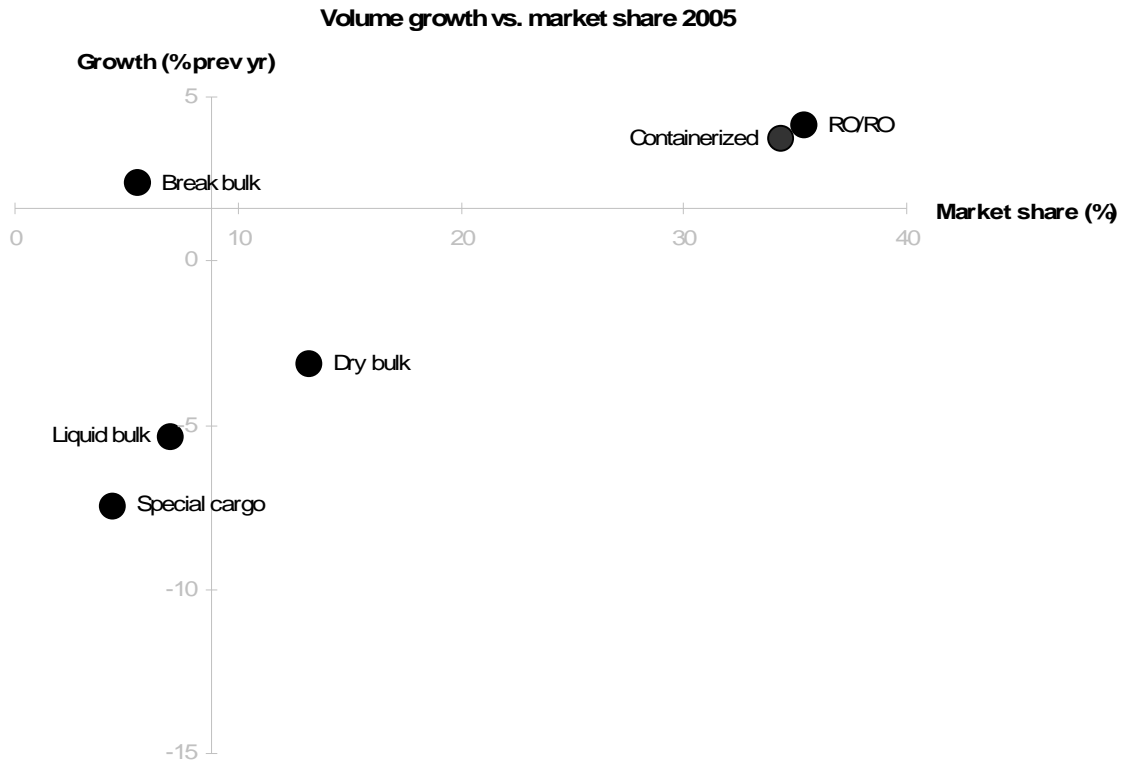


Diagram elements

The growth-share matrix consists of four primary components:

- A caption or text label
- Two orthogonal linear axes with generally quantitative continuous scales
- Markers which encode an item and the values of measurements
- (Optional) Lines connecting the markers for same items at different points in time

Diagram element: Caption/label

The caption/label shows the variable names of the measures (name of variables on the horizontal and vertical axes, markers and time with its granularity).

Diagram element: Axes

The chart consists of two perpendicular axes which represent the domains of the measure variables: one horizontal and one vertical axis. As such they have typically quantitative/continuous, linear scales. Tick marks along the scale occur at the values for the respective data points [i.e. not in regular spacings as shown in the figure → fix that] with two additional marks at the beginnings and ends of the visible axes (typically, minimum and maximum values of data points in the respective dimension).

Axes are drawn with less stroke weight than the other elements to reduce clutter in the chart. The axes are labeled with respective variable names and their units. The labels appear horizontally centered above the vertical axis and vertically centered next to the horizontal line.

One axis crosses the other at the *comparative measure* value for that variable. For instance, the growth axis (ordinate) crosses the market share axis at a “reference value” of approx 8.5% percent which represents the market share of the port in a particular trade area. Vice versa, abscissa intersects the growth axis at 1.5% which is overall port growth. This divides the

diagram into four quadrants: cargo categories with low market shares but high growth rates, better than average in both variables, etc., which serve as categories for management policy responses.

Diagram element: Markers

The actual data points in the coordinate system are encoded by markers. For clarity, these markers shall be circular areas filled with a strong color. Different colors to underline the distinctness of items are discouraged. Instead markers shall be of same color and labeled with category names.

Markers may be used to code a third measure (e.g. [avg.] time to customer market). In this case values are encoded as marker color and color shade shall be chosen going from light to dark for values low to high.

Diagram element: Data point trajectories in time [optional]

In order to add time (and thus the evolution of data points over time) to the display, data points in each category may be sub-classified by at time dimension. In this case (“current” or “latest” point)

Measures and dimensions represented

Measures

Performance indicators 2 “growth in bulk throughput” and 3 “growth in container throughput” combined are the measures for the horizontal axis. The ordinate axis typically represents performance indicators 11 “market share” or, alternatively, 12 “growth in market share”.

Measures to be encoded by marker size are performance indicators include primarily 14 “time to customer market” and 13 “distance/Destination to customer market”.

In general, a variety of other measures seem to be accessible to growth-share analyses, these include “passengers handled”, “growth in passengers handled”, 14 “time to customer market”, 13 “distance/destination to customer market”, etc.

Dimensions

The dimensions used to distinguish different items (represented by markers in the chart) are classifications like “cargo category”, “commodity”. In order to represent time, they may be classified according to temporal dimensions (cf. diagram element “data point trajectories in time”).

Other dimensions are of spatial nature like ports, origins or destinations.

Bullet graph

A bullet graph supports comparison of a single quantitative measure to a set of *comparative measures*. The actual measure is represented by a bar whose length is read off along a parallel axis scaled linearly. A mark for ticks off the value for *comparison measure*

A bullet graph consists of five primary components:

- A text label
- A linear continuous quantitative scale
- The primary measure
- A target value (as a *comparative measure*)
- A series of three to five ranges which classify the actual (and target measure) into qualitative categories

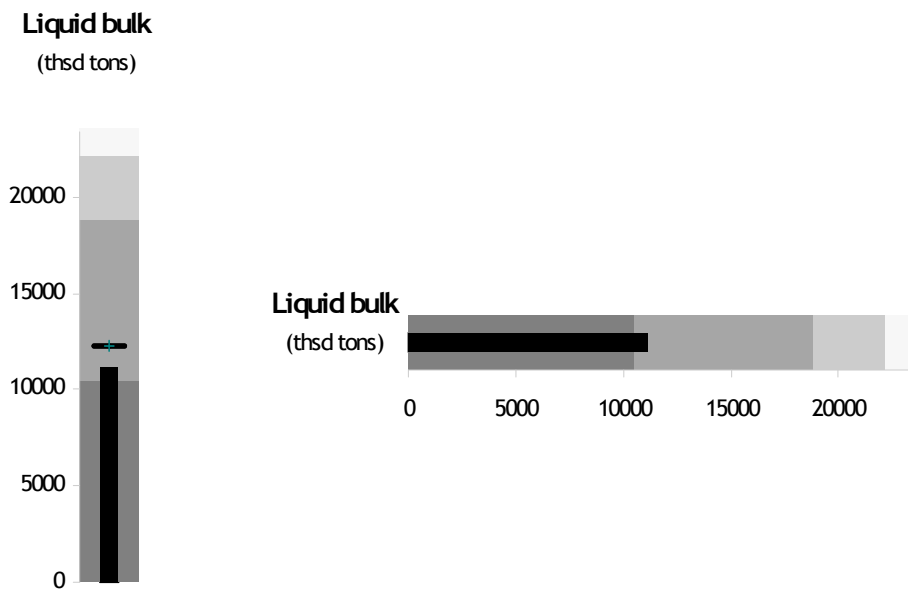


Diagram elements

Diagram element: Text label

The label identifies the measured quantity. It shows the measure variable name and its units. It is placed to the left of a vertically oriented graph or vertically centered above.

Diagram element: Axis

The chart has an axis which represents the domain of the primary measure variable. As such it is quantitatively/continuously, linear scaled. Tick marks along the scale occur at the values for the respective data points: the values for the primary and target measure as well as the range limits for the categories [i.e. not in regular spacings as shown in the figure → fix that]. The Axis is drawn with less stroke weight than the other elements to reduce clutter in the chart and appears to the left of the graph for vertically oriented graphs and below a horizontal one.

Diagram element: Primary measure

A prominent vertical marker along the direction of the graph orientation, typically represented by a bar as in a bar chart, encodes the primary measure. It is drawn centered in the graph area with a prominent stroke weight and an equally prominent color (dark, usually black). In the case of the axis scale starting at a value greater than zero, the marker is encoded as a dot, square or solid and prominent line perpendicular to the graph (and thus bar) orientation.

Diagram element: Comparative measure

A short line orthogonal to the (covering slightly more than the stroke width of the primary measure bar) encodes the comparative measure of the bullet graph. This can be a target value for the primary measure or a forecast. The value is an actual *comparative measure* as it is defined by the user (directly or indirectly).

Diagram element: Qualitative ranges

These ranges qualify the primary measure along intervals defined by several comparative measures. These can be simple classifications based on experience (like intervals for “good”,

“ok”, “bad”) or systematically calculated as, e.g., multiples of standard deviations from a historic mean, etc. The number of ranges should be limited to at most five, ideally three. Categories are encoded by colored fields which make up the “background” of the plot area. The use of distinct colors is discouraged. Instead the ranges have distinct color intensities from dark to light. As a rule of thumb:

Number of ranges	Two	Three	Four	Five
Color intensities	35 and 10%	40, 25 and 10%	50, 35, 20 and 10%	50, 35, 20, 10 and 3%

Measures and dimensions represented

Measures

There is no specific restriction to any quantitative measure in the performance indicators.

Dimensions

There is no specific restriction to any dimension for performance indicators. All those are of course *external*.

Sparklines

Terms used in this paper

Comparative measure. A value that a measure is compared to (e.g., a target value).

Comparative measures are “exogenously” defined, i.e. either directly by the user or by means of the APIS “Read & write interface to econometric and statistics tools” (see APIS architecture document).

External quantity. Several other dimensions are apt for classifying. These are