Figure 2.5.: The hierarchical Structure of the Goal Question Metric Model (from [4]).

the form of metrics on the third level, called quantitative level.

The GQM approach proceeds top-down and starts with the identification of metrics for the defined goals. In the next step the bottom-up proceeding is performed, where the results, that are obtained by the measurement, are validated, analyzed and interpreted [4].

2.5. Dashboard

A Dashboard (or also cockpit, control and management cockpit) is a general term for a software tool, which is employed for visualization, monitoring, analysis and evaluation of information needs. The information needs displayed on the dashboard are the different predefined metrics represented as text and graphics [11].

In the previous chapter metrics were defined as a tool to support management decisions, that allows to predict the development process. In reality, the different numerical values of metrics can be hard to interpret and analyze. A dashboard combines and illustrates the collected data values in an appropriate form, which allows to find critical or important information and to achieve objectivity. Moreover, the data represented as a graphic or an image in the dashboard are more "powerful" for the human awareness and can be better understood and quicker processed than numbers [12].

Classification of Dashboards

Different types of business or software engineering activities can be illustrated by using dashboards. As a consequence, there are a lot of aspects for dashboard classifications. For instance, the type of data, the type of metric or the update frequency etc. [11] Stephen Few classified dashboards according to their role in business activities. According to this categorization, dashboards are divided into three groups:

- **Strategic Dashboards**. Strategic dashboards are used for long-term strategic planing management. They display different *static* metrics from the different business areas during a long period of time and therefor help managers to monitor and to define a strategy for the future business development.

  An example for a strategic dashboard is a metric dashboard for the manufacturing department of a company, which illustrates product rate changing during several months [6].

- **Analytical Dashboards**. Analytical dashboards are commonly used if it is necessary to perform analysis on artifacts and to find the source of their changing. As strategic dashboards, analytical dashboards visualize static metrics, which can have arbitrary complexity and present information from different business areas.

  An example for an analytical dashboard is a dashboard for analyzing customer satisfaction of an automobile sales company, which displays, for instance, unit sales per month, the average first year defects, the average purchase price, service satisfaction and new vehicle quality.

- **Operational Dashboards**. Operational dashboards support dynamic processes that are needed to be monitored permanently. Operational dashboards facilitate indications of critical events and enable their immediate processing.

  A dashboard performed network server, which allows to indicate network congestion, can be an example for an operational dashboard.