Chapter 2
Measuring Educational Quality by Means of Indicators

Abstract In this chapter the input-process-outcomes-context framework, introduced in Chapter 1 is used for categorising and describing input indicators, process indicators, outcome indicators and context indicators. The chapter starts out with a review and further illustration of this framework and follows up with a discussion of the various types of indicators that are generated from it. As such the chapter defines an exhaustive set of education indicators, categorized according to the input, context, process, output framework and recognizing the hierarchical nature of education systems (distinguishing a national system, school, classroom and individual student level). Specific attention is given to outcome indicators. Outcome indicators are further differentiated as output, outcome and impact indicators. Output indicators are seen as the more direct outcomes of schooling, often measured by means of standardized achievement tests. Outcome indicators, also described as "attainment indicators", are summary statistics of participation and graduation rates. Impact indicators refer to the social status of students having reached certain levels of schooling.

Keywords Output, outcome and impact indicators · Context indicators · Process indicators · Input indicators · Achievement and attainment indicators

In this chapter the input–process–outcome–context framework, introduced in Chap. 1, is used for categorising and describing input indicators, process indicators, outcome indicators and context indicators. The chapter consists in a revision and further illustration of the framework and a discussion of the various types of indicators that can be generated from it.

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2.1 A Brief Revision of the Framework

Perspectives on education quality can be clarified on the basis of a conceptual framework that describes education. The most frequently used method is to depict education as a productive system, in which inputs are transferred into outcomes. Steps in elaborating this basic scheme consist in:

(a) including a context dimension that functions as a source of inputs and constraints but also as a generator of the required outputs that should be produced;
(b) differentiating outcomes into direct outputs, longer-term outcomes and ultimate societal impact;
(c) recognising the hierarchical nature of conditions and processes, which comes down to considering the functioning of public education as just another example of "multilevel governance".

The model depicted in Fig. 2.1, also shown in Chap. 1, shows the basic ingredients of this framework.

In the schematic presentation of the framework in Fig. 2.1 there are various options for choosing at which level the central "black-box" is described. When analysing the impact of policy measures at the national level, one might choose the education system in a country as the central black box. In applications where the quality of schools is the centre of attention one would choose the school as the level where the transformation of inputs to outputs is studied. A perhaps more interesting option, however, is to distinguish several levels in the central black box, for example, the national educational system, the school level and the level of the group where the teaching and learning at school takes place, traditionally, the classroom level. But other options are possible: the students could explicitly be incorporated as a separate level and one might wish to include local community as a level as well. Finally, one or more controlling levels could be placed in the context.

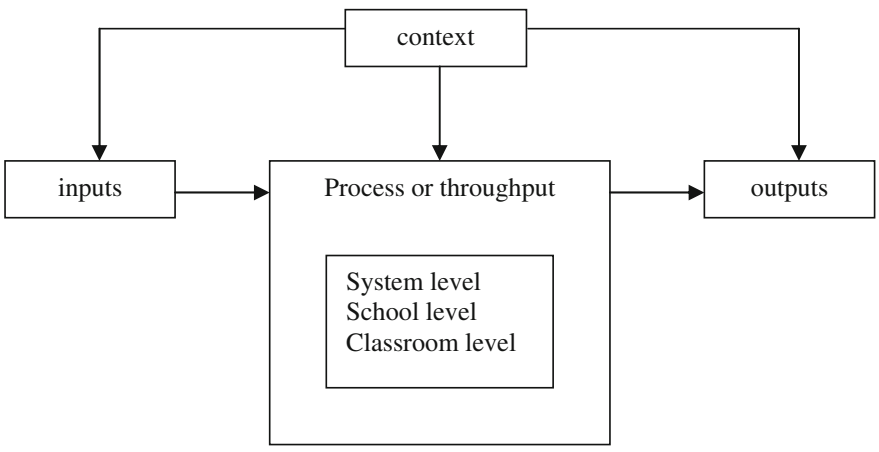


Fig. 2.1 A basic systems model on the functioning of education

It is worth underlining that the incorporation of a context dimension adds considerably to the flexibility and broadness of applicability of the framework. As already indicated, the context can be seen as a generator of inputs, as a level that determines or co-determines the definition of desired outcomes that should be generated and as a level that judges quality and provides feedback. In more practical terms, the context-dimension gives room for situational adaptation to local conditions.

A final analytical distinction to qualify the impact of "context" is the one between malleable conditions and "given" environmental constraints, sometimes also indicated as "antecedent" conditions. Malleable conditions are in the hands of actors on the scene, like national policy planners, local constituencies, school managers and teachers. Antecedent conditions already "exist". Background characteristics of students, such as cognitive aptitude or socio-economic status of their home background, are examples of "given" factors. At higher levels, the school or system level, the distinction becomes more arbitrary. For example, school size could be seen as a given condition, but also, perhaps in a longer-term perspective, as a variable that is subject to change in national policies concerning the desired scale of educational provisions.

Another example is the composition of the student population of a school in terms of, for example, average socio-economic status. This variable is usually treated as a "given" condition, out of reach of policies aimed at improvement of the primary process of teaching and learning. However, a school might have explicit recruitment, selection and admission policies, in order to control student composition.

Having clarified the basic "working" of the input–process–output–context framework, it can be concluded that the framework is quite general and flexible for describing the functioning of education.

The rest of this chapter consists in a discussion of the following categories of indicators:

- outcome indicators, differentiated as output, outcome and impact indicators
- process indicators, differentiated at three aggregation levels, national system, school and classroom level teaching
- input indicators, differentiated between national system, school and teaching levels
- context indicators, differentiated between national system level indicators and the school community

2.2 Measuring Educational Outcomes

Outcome indicators are central in productivity and effectiveness interpretations of educational quality but also play an indispensable role in assessing the equity, efficiency and responsiveness of schooling. A distinction is made between output, outcome and impact indicators. Output indicators are seen as the more direct outcomes of schooling and are most likely measured by means of a form of student assessment, like a standardised achievement test. Attainment indicators, as for

- outcomes as measured by tests included in textbooks
- outcomes as measured by implemented school curricula (teacher developed)
- outcomes as measured by tests based on the intended national curriculum
- outcomes as measured by international tests covering the common core of a range of national curricula, e.g., TIMSS
- "literacy" tests, aimed at measuring basic skills in reading, mathematical and scientific reasoning, e.g., PISA
- competencies as multi-facetted dispositions of individuals, including cognitive, motivational and possibly other components
- personality traits, like internally or externally determined locus of control, independence, general intelligence

Fig. 2.2 A continuum of educational outcomes, running from highly content-bound to personality dependent

example the number of students that complete a certain period of schooling without delay, are of a more administrative nature. Impact indicators are indicators of the social status of students that have reached certain levels of educational attainment.

One of the dimensions on which output and outcome indicators can be differentiated is the degree to which outcome measures are tied to educational content or are relatively content free. Competencies can be placed on a continuum of types of educational outcome that run from specifically content-oriented to "content-free" personality traits. Discrete positions on this continuum are presented in Fig. 2.2.

In Table 2.1, an overview is given of the different categories of outcome indicators that could be used to monitor quality aspects related to the productivity, effectiveness and equity of education.

2.3 Process Indicators

Although indicators on educational processes can be used in a "stand-alone" way, according to what was described in Chap. 1 as a disjointed application of indicators, it makes more sense to see them as part of indicator *systems,* in combination with outcome, input and context indicators. In this section process indicators will be considered within the framework of macro-level, i.e., national level, indicator systems and secondly, as part of multi-level indicator systems, where transformation processes at school level are central.

2.3.1 System Level Indicator Systems

The OECD Education Indicators project (INES—see the Education at a Glance publications) uses the following categorisation, which is evident from the table of contents in the Education at a Glance Publications (OECD 1998).

Table 2.1 Overview of educational outcome indicators

Main categories of outcome indicators	Sub-categories	Technical issues
Output indicators	Achievement measures Subject matter based Literacy (reading, mathematical, scientific) Competencies (e.g., learning to learn)	Value-added effect measures; growth curves Assessment methodology (ranging from multiple choice tests to authentic assessment) Criterion versus norm-referenced testing
Outcome/ attainment indicators	Attainment measures Graduation rates Proportion of students graduated without delay Drop-out rates Class repetition rates	Controlling for selection-oriented school policies
Impact indicators	Social participation rates (For each attainment level: % of employed at a certain job level) % of unemployed (For lower school levels: % enrolled in follow-up education) Degree of social participation (social capital) Adult literacy rates Average income, for each attainment level; earning differentials Skills shortages and surpluses	Availability of national educational and labour market statistics Appropriate measures of social capital and adult literacy

The main categories are:

(A) The demographic, social and economic context of education (e.g., literacy skills of the adult population)
(B) Financial and human resources invested in education (e.g., educational expenditure per student)
(C) Access to education, participation and progression (e.g., overall participation in formal education)
(D) The transition from school to work (e.g., youth unemployment and employment by level of educational attainment)
(E) The learning environment and the organisation of schools (e.g., total intended instruction time for pupils in lower secondary education)
(F) Student achievement and the social and labour-market outcomes of education (e.g., mathematics achievement of students in 4th and 8th grades and earnings and educational attainment)

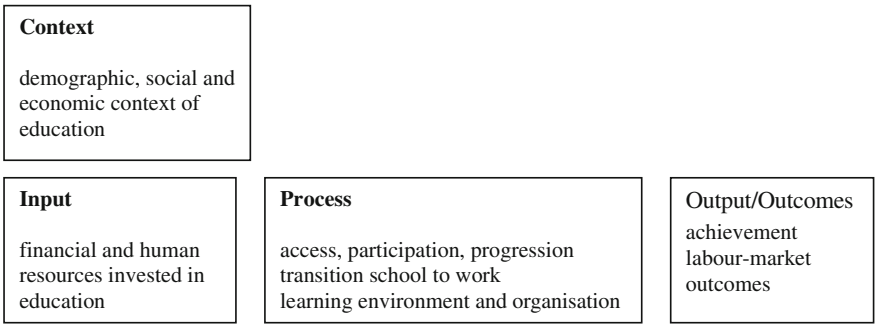


Fig. 2.3 Ordering of the OECD-INES education indicator set, according to a context–input, process and outcome scheme

These six categories can be classified in various ways. The context–input–process–outcome scheme, as used throughout this chapter, is the most likely way to do so. Accordingly, category A is in the context domain, category B refers to inputs, categories C, D and E refer to different interpretations of the process dimension and category F to an output/outcome dimension (see Fig. 2.3).

In Fig. 2.3, arrows between the boxes have been omitted since these categories are expected to be linked in a causal way only in a very loose sense. In fact, each category is used in a descriptive sense and interrelationships between indicators have hardly been analysed so far.

Examples of system level process indicators are given in Table 2.2.

Table 2.2 Examples of system level process indicators

Teaching time per subject
Total hours of instruction per year, for specific grade levels in primary and secondary education
Opportunity to learn, in terms of expert ratings of test curriculum overlap
The locus of decision-making in education, by education level (This indicator shows at which administrative level decisions in sub-domains of education—curriculum, personnel management—instruction, resources—are made with a certain degree of autonomy)
School autonomy (this indicator is actually included in the concept of locus of decision making)
Education standards by level (e.g., targets like increased completion rates, percentage of students scoring at or above a particular achievement level)
Whether or not formal examinations are taken at the end of each school category
The degree of categorisation and formal streaming at secondary level
The evaluation capacity of the system (defined as a quantification of the occurrence and intensity of various evaluation forms, such as national assessment programmes, examinations, school inspection, an educational management information system, etc.)
The magnitude and diversification of an educational support structure in the country (possibly comprising a curriculum development unit, IT services, school counselling, an educational assessment and testing unit, etc.)
The division of private, government dependent and public schools
Incentive-based policies to stimulate school performance
The degree to which school choice is free

2.3.2 Comprehensive Indicator Systems Including Process Indicators of School Functioning

Educational systems have a hierarchical structure in which administrative levels are "nested". Indicator systems may ignore this hierarchical structure by using statistics that are defined at national level or formal characteristics of the system. Examples are: pupil teacher ratio computed as the ratio of all pupils and all teachers in a country and teacher salaries defined on the basis of nationally determined salary scales.

Even when considering the use of indicators at national level only, there are two main advantages to using data at lower aggregation levels:

- disaggregated data allow the examination of variation between units, e.g., the variance between schools in success rates for examinations;
- disaggregated data allow for better adjustments and more valid causal inferences; the best example in education is the use of so-called "value-added" performance indicators based on achievement test scores adjusted for prior achievement and/or other relevant pupil background characteristics.

When it is the intention to relate, for example, school organizational characteristics to pupil achievement, disaggregate data at pupil level are required to carry out appropriate multi-level analyses.

Particularly when indicators are used for programme evaluation purposes, the above-mentioned advantages of disaggregated data are important because they provide firmer ground to answer causal questions about programme effectiveness.

A final added advantage is that the relevance of indicator systems for lower administrative levels (e.g., school districts and individual schools) grows when disaggregated data are available.

Overviews of process indicators at school and classroom level are provided in Tables 2.3 and 2.4.

2.4 Input Indicators

According to our basic input–process–outcome–context framework, *inputs* provide the material and immaterial pre-conditions for the core transformation processes in organisations. In the case of education and taking the school as the level where teaching and learning as the primary transformation process take place, the following main categories of input can be discerned:

- financial and material resources
- human resources
- background conditions of the students

Table 2.3 Overview of examples of process indicators of school functioning

Process indicators defined at school level
Community involvement
The degree of actual involvement of parents in various school activities (the teaching and learning process, extra-curricular and supporting activities)
The percentage of the total annual school budget that is obtained from the local community
The amount of discretion local school boards have in the conditions of labour of teachers (possible operationalisations in EDUCO project—El Salvador)
School financial and human resources
Average years of teachers' experience per school
School level pupil teacher ratio
Average class size per school
Proportion of formally qualified teachers per school
School managerial "overhead" (principal and deputy-principal fte per 1000 students)
Achievement-oriented policy
Whether or not schools set achievement standards
The degree to which schools follow the (education) careers of pupils after they have left the school
Whether or not schools report achievement/attainment outcomes to local constituencies
Educational leadership
The amount of time principals spend on educational matters compared to administrative and other tasks
Whether or not principal's appraise the performance of teachers
The amount of time dedicated to instructional issues during staff meetings
Continuity and consensus among teachers
The number of changes in staff over a certain period
The presence or absence of school subject-related working groups or departments (secondary schools)
Frequency and duration of formal and informal staff meetings
Orderly and safe climate
Statistics on absenteeism and delinquency
Ratings of school discipline by principals, teachers and pupils
Efficient use of time
Total instruction time and time per subject matter area
Average loss of time per teaching hour (due to organisation, moving to different rooms, locations, disturbances)
Percentage of lessons "not given", on an annual basis
Opportunity to learn
Teacher or student ratings of whether each item of an achievement test was taught or not
Evaluation of pupils' progress
The frequency of use of curriculum-specific tests at each grade level
The frequency of use of standardised achievement tests
The actual use teachers make of test results
Ratings of teaching quality
Quality of instruction as rated by peers (other teachers)
Quality of instruction as rated by students

Table 2.4 Overview of effective teaching and learning variables

Effective teaching variables
Main teaching factors
Opportunity to learn
Structuring and scaffolding (cognitive structuring)
Stimulating engagement (motivational structuring)
Climate aspects
Task orientation
Mutual respect
Orderliness, safety
Monitoring and questioning
Feedback and reinforcement
Modelling learning and self-regulation strategies
"Authentic" applications
Adaptive teaching
Learning strategies of students
Overt
Engaged learning time
Student use of resources
Cooperative learning
Covert
Self-regulatory capacity
Auto-control
Meta-cognitive "actions"
Learning styles

2.4.1 Financial and Material Resources

Financial and material resources indicators can be defined at system and school levels. Financial indicators are predominant at system level, while material resources indicators make more sense formulated at the level of schools. In Table 2.5, examples of financial and material resources indicators, defined at system and at school level, are given.

2.4.2 Human Resources

A well-qualified and motivated teaching force is to be seen as one of the most vital assets for educational quality. Indicators on teachers as individuals or of the total stock of teachers in a country can be categorised in various ways.

In Table 2.6 a distinction is made between descriptive background characteristics of teachers, knowledge and skills, attitudes and morale relative to general working conditions and attitudes with respect to the work situation at school and student staff ratios.

Only part of these indicators is likely to be available on the basis of national statistics and would depend on the availability of school or teacher surveys.

Table 2.5 System level financial and material resources indicators

System level financial and material resources indicators
Proportion of Gross Domestic Product spent on education
Educational expenditure per student
Proportion of public and private investments in education
Public investment in educational research and development
Total expenditure on programmes and special facilities for disadvantaged students
State provision of ancillary services
Household expenditure and public subsidies to parents
Percentage of spending on salaries for administrative personnel
Percentage of spending on pensions for educational personnel
Percentage of spending on salaries for teachers
School level financial and material resources
Proportion of the school's budget that is acquired through other than public funding
School building facilities
Classroom equipment (furniture, computers, etc.)
School supplies like pencil and paper, chalk board, flipchart
Availability of textbooks on the major school subjects
Basic services like separate toilets for girls and boys, water, electricity, heating, telephone, provision of ancillary services, regarding nutrition, health and transportation

Table 2.6 Categorisation of teacher indicators

Teacher background characteristics
Age, sex, and ethnicity distribution
Full-time/part-time distribution
Certification/license status
Formal qualifications
Year of experience
Language
Health, specifically HIV
In-service training history
Teacher professional knowledge and skills
General knowledge
Content knowledge
Knowledge about pedagogical and didactic strategies
Knowledge about students
Beliefs and attitudes about teaching
Flexibility in adapting teaching repertoire
Teacher working conditions
Salaries (relative to other professionals)
Working time
Average class size
Merit-based incentives
Other incentive policies
Career structures
Teacher training/certification requirements

(continued)

Table 2.6 (continued)

Teacher autonomy
Standards-based teacher appraisal
Secondary working conditions (e.g., vacations)
Exposure to external inspection
Teacher morale and status
Opinions about career and job mobility
Teacher morale
Perception about being needed by society
Perceived status as a teacher
Appreciation of general working conditions
Appreciation of the work situation at school of current employment
Job mobility
Sense of political efficacy
Staff to student ratios
System level student teacher ratio
School level student teacher ratio
Support staff student ratio (system and school level)
School managerial "overhead" relative to the number of students

2.4.2.1 Student Background Characteristics

To some, perceiving students as the "raw material of the education production process" may seem to stretch the economic metaphor a bit too far. More psychologically inclined analysts might maintain that students are the main producers of learning and the attainment of learning results. For analytical purposes it nevertheless makes sense to recognise that the home background and intellectual capacities of students make a lot of difference. When effectiveness and productivity interpretations of quality are at stake, it is usually considered relevant to construct value-added outcome indicators, that is, indicators that show the effect of malleable conditions of schooling over and above the impact of background conditions. For equity interpretations of quality, student background characteristics function as categorisation criteria, to contrast groups with one another, for example, boys and girls, schools with a relatively small and a large proportion of students from minority groups, etc. Table 2.7 provides an overview of relevant student background characteristics.

2.5 Contextual Issues and Context Indicators

Within the input–process–outcome–context framework, specifying what is meant by the *context* depends on the level at which the central transformation process is defined. Throughout this chapter two interpretations have been used. Most of the time transformation processes at school level have been concentrated on. When

Table 2.7 Student background characteristics

General student background characteristics
General intelligence or scholastic aptitude
Socio-economic status
Mother's level of educational attainment
Gender
Ethnicity
Student background characteristics associated with specific situational constraints
Discrepancy between language spoken at home and language at school
Distance a student has to walk to school
The amount of out of school time a student has to spent on labour
Whether the students has had a meal when arriving at school
Place to study at home
Number of books in the home
Malnutrition
Ill health/HIV

Table 2.8 Types of societal conditions particularly relevant to education

Contextual conditions of education systems
Demographic developments
The labour market, e.g., shortages and surpluses in certain sectors
The general state of the economy
Relevant cultural aspects
The institutional infrastructure
The general health situation in a country
Disasters of nature and wars

transformation processes at school are further differentiated to distinguish primary teaching processes at classroom level and secondary, supporting management and organisation processes at school level, a multi-level model results, in which everything "outside" the school is defined as the context. In this kind of conceptualisation "context" could be further subdivided in the direct environment, local community and local/regional administration on the one hand and the national context on the other. The second model interpretation is the one where education is considered at one level only, the national system level. According to this interpretation the context is defined as the relevant environment of the "education province" as a whole. As such, the general affluence of a country, demographic tendencies, cultural aspects that impinge on values that are important in education and the institutional infrastructure of a nation could be seen as the context of education. Overviews of different types of context indicators are given in Table 2.8.

Some of the societal dimensions mentioned in Table 2.8 have specific translations to conditions within the educational system. An overview of areas relevant for description and indicator development is given in Tables 2.9 and 2.10.

Table 2.9 Antecedent conditions within the educational system

Demographics
The supply and demand of teachers in a country
The proportion of teachers over 50 years old
The gender composition of the teacher force per school level
Percentage of students in school outside the age ranges for grade levels
Cultural aspects
The status of teachers as perceived by the general public
Appreciation of education and being educated
Expectations about pedagogical functions of the school (e.g., educating for good citizenship, moral education, teaching democracy)
Culturally embedded interpretations relative to authority and educational leadership
Institutional infrastructure
Degree of formalisation of teacher working conditions
Formalisation of teacher, student and parent rights (e.g., free school choice)
Formal monitoring and inspection of schools
Rules and enforcement of rules with respect to teacher absenteeism
Regulations with respect to private tuition by teachers in public service
Anti-corruption measures in education
Framework for delivering and assessing the curriculum

Table 2.10 The organisational infrastructure of the local community

The organisational infrastructure of the local community
The existence of a school board in which the local community is represented
The availability of a local or regional educational resources centre (which, among other things, might offer IT facilities to schools in the community)
The "openness" of local companies and industry to working with schools and offering students opportunities for site visits or specific training
The role of the community in financing the school; in-kind support

Cultural aspects that are manifest in the local community are likely to reflect regional, national or even "world cultural" traditions. It is therefore somewhat arbitrary to deal with these conditions at national or local levels. The reason for doing so here is that the local level is the one closest to the school and the aspects to be dealt with are seen primarily as contextual constraints on the functioning of schools. Fuller and Clarke (1994) have distinguished different types of cultural constraints relative to the effective functioning of schools (Table 2.11).

In our quality framework "context" has been interpreted as "provider of direct influence and control", as a "provider of inputs" and as a source of more general "constraints" that interfere and interact with more direct control measures. In all of these interpretations the direction of influence is from the context to the

Table 2.11 Overview of local cultural conditions as examples of given local contextual conditions

Local cultural conditions
Parents' values concerning school participation of their children
Discrepancy between indigenous knowledge and "school knowledge"
Discrepancy between local perspectives on authority and ideas on active participation of students during lessons
Culturally constructed meaning of school inputs

Table 2.12 Areas of responsiveness to context at system and school level

Areas for describing responsiveness to context at system level
The availability of an institutional infrastructure for curriculum development
Enforcement mechanisms that monitor curriculum development and implementation
Liaison functions of educational authorities and societal organisations
Analysis and research units that try to predict the demands of the labour market
Dual systems in vocational education
Areas for describing responsiveness of the school towards the local community
External contacts of school management
"School marketing policies"
Active role of the school in acquiring parental involvement
"Authentic" teaching examples involving representatives from the local community

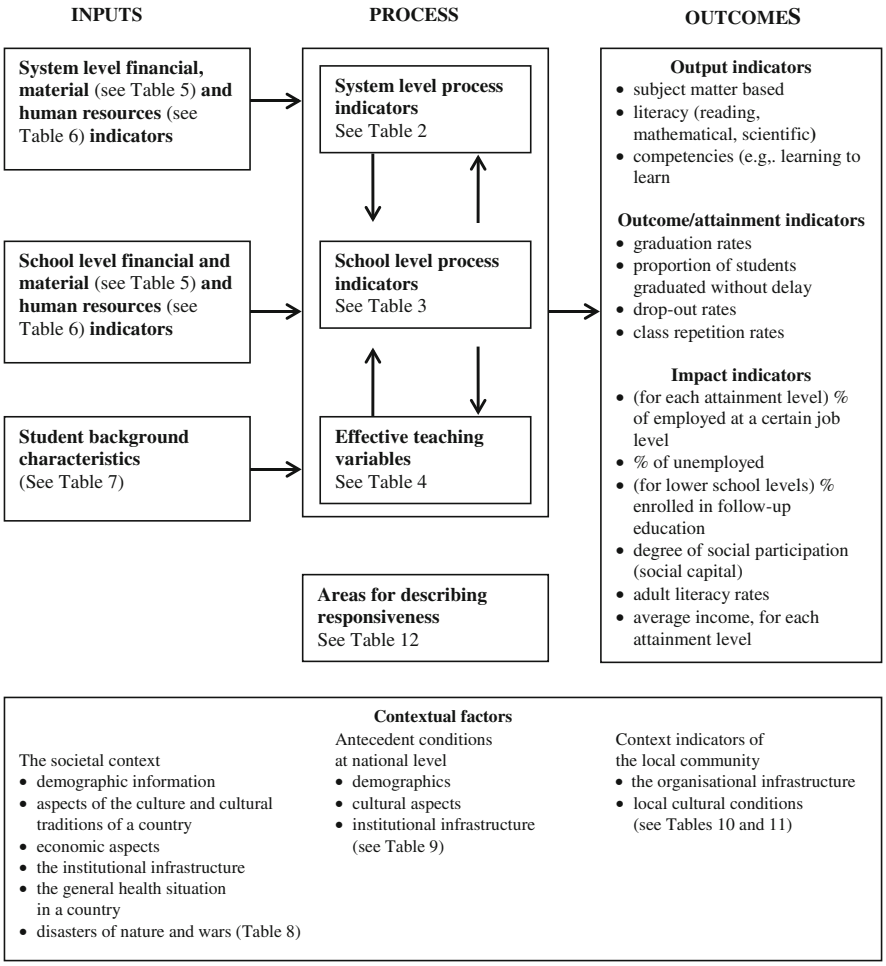
educational level, be it the school or the national educational system, that is being described or analysed for its quality. However, in one of the quality perspectives that was described in the chapter, the direction is the other way around. According to the adaptation or *responsiveness perspective*, schools or national educational systems attempt to meet the demands of the relevant context, the local community or society at large. This generally means two things, first, that the intended outcomes or the *goals* and *objectives* are in line with external expectations and second, that these goals are also actually being realised. The latter issue is the effectiveness issue, while the former more properly addresses the question of the responsiveness of educational organisations. The key question in the responsiveness interpretation of educational quality is therefore whether the "right" goals are chosen as a first step to delivering what is externally required. For our purposes, the main question is whether an educational system has an infrastructure and established mechanisms to deal with responsiveness issues. Not only with respect to the demands of the labour market, but also with respect to other kinds of societal demands on education, for example developing good citizenship.

Areas for describing "responsiveness to context" at system and school levels are summarised in Table 2.12.

2.6 Summary and Conclusion

In this chapter the well-known input–process–outcome–context framework was used to define different perspectives on educational quality: productivity, effectiveness, efficiency, equity, responsiveness and a more eclectic use of the quality indicators input, process, outcome and context education that were further described and specified in the remaining part of the chapter. The indicator set has been summarised in Table 2.13.

Table 2.13 Synthetic overview of educational input, process, outcome and context indicators



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