



RAILWAY CORPORATE STRATEGY
CLOSE CORPORATION

OPERATIONAL DEFINITIONS FOR VARIABLES IN THE GLOBAL LINE HAUL RAILWAY CORPORATE CITIZENSHIP DATABASE

1 Competitiveness group

1.1 Research and development level

Variable 1.1: *Research and Development Level* describes how a country allocates resources to acquire or develop railway genetic technologies. It is measurable on an interval scale, operationally defined as follows:

Industry leadership means possessing world-class research and development facilities and personnel that demonstrate leading-edge achievements (Level 4).

In-house research and development means approaching problems competently from first principles to develop well-grounded solutions (Level 3).

Acquisition from external specialists means understanding performance requirements, but acquiring solutions and/or technology from consultants or equipment suppliers (Level 2).

Reliance on base technology means addressing current problems with operational personnel, without dedicated facilities (Level 1) (Default).

Sources: Content analysis of trade periodicals and Internet research.

1.2 Genetic technology leverage level

Variable 1.2: *Technology Exploitation Level* describes the extent to which railways leverage the genetic railway technologies *Bearing*, *Guiding*, and *Coupling*. They are measured as Variable 1.2.1, Variable 1.2.2, and Variable 1.2.3 respectively.

Variable 1.2.1, *Relative Maximum Axle Load* describes the extent to which a country exploits known heavy axle load technology. It is measured on a dimensionless ratio scale, operationally defined as:

(Maximum axle load in country) divided by (Highest axle load implemented commercially anywhere in the world) = decimal number.

Variable 1.2.2, *Relative Maximum Speed*, describes the extent to which a country exploits known high speed technology. It is measured on a dimensionless ratio scale, operationally defined as:

(Maximum speed in country) divided by (Highest speed implemented commercially anywhere in the world) = decimal number.

Variable 1.2.3: ***Distributed Power Presence*** describes whether a country exploits known long, heavy, train technology. It is measurable on a dichotomous interval scale, operationally defined as follows:

Distributed power in operation (Level 1).

Distributed power absent (Level 0) (Default).

Sources for Variable 1.2.1, Variable 1.2.2, and Variable 1.2.3: Perusal of trade periodicals, International Heavy Haul Association proceedings, *Jane's World Railways*, and Internet research.

1.3 Presence of railway growth market spaces

Variable 1.3 describes whether a country exploits one or more of the three natural *Railway Growth Market Spaces*. It is measured as Variable 1.3.1, Variable 1.3.2, and Variable 1.3.3.

Variable 1.3.1: ***Heavy Haul Presence*** describes the presence of heavy haul operations, per International Heavy Haul Association thresholds. The latter stipulate achieving any two of the following minima: Aspiration to 27 tonnes/axle; conveying 20 million tonnes per year on a line segment of at least 150km; and operating 5000-tonne trains. It is measurable on a dichotomous interval scale, operationally defined as follows:

Heavy haul present (Level 1).

Heavy haul absent (Level 0) (Default).

Variable 1.3.2: ***High-speed Intercity Presence*** describes the presence of high-speed intercity passenger operations with maximum speed of 200km/h or higher. It is measurable on a dichotomous interval scale, operationally defined as follows:

High-speed intercity present (Level 1).

High-speed intercity absent (Level 0) (Default).

Note that, to ensure consistency with previous research, a threshold of 200km/h has been retained, which is less than the 250km/h threshold currently stated by the European Rail Agency.

Variable 1.3.3: ***Heavy Intermodal Presence*** describes the presence of heavy intermodal, or double stack, operations. It is measurable on a dichotomous interval scale, operationally defined as follows:

Heavy intermodal present (Level 1).

Heavy intermodal absent (Level 0) (Default).

Sources for Variable 1.3.1, Variable 1.3.2, and Variable 1.3.3: Content analysis of trade periodicals, International Heavy Haul Association proceedings, and Internet research.

1.4 Motive power type

Variable 1.4: *Motive Power Type* describes the type of motive power deployed. It is measured as Variable 1.4.1 and Variable 1.4.2.

Variable 1.4.1: *Diesel Traction* describes the presence of diesel traction. It is measurable on a dichotomous interval scale, operationally defined as follows:

Diesel traction present (Level 1).

Diesel traction absent (Level 0).

Variable 1.4.2: *Electric Traction* describes the presence of electric traction. It is measurable on a dichotomous interval scale, operationally defined as follows:

Electric traction present (Level 1).

Electric traction absent (Level 0).

Source for Variable 1.4.1 and Variable 1.4.2: *Railway Directory*.

1.5 Attitude to competition

Variable 1.5: *Attitude to Competition* describes the attitude of a country to competition among railway infrastructure and/or train operators environment. It is measurable on an interval scale, operationally defined as follows:

Government encourages competition through enabling legislation (Level 1).

Government is neutral with respect to competition (Level 0) (Default).

Government discourages competition through protective regulation (Level -1).

Source for Variable 1.5: Content analysis of trade periodicals.

2 Networkability group

2.1 Own network

Variable 2.1: *Own Network* describes the railway network within a country in terms of the track gauges present. It is measured as Variable 2.1.1, Variable 2.1.2, and Variable 2.1.3.

Variable 2.1.1: *Narrow Gauge* describes the presence of narrow gauge (<1435mm) track. It is measurable on a ratio scale, operationally defined as:

Route kilometers of narrow gauge track (number).

Variable 2.1.2: *Standard Gauge* describes the presence of standard gauge (1435mm) track. It is measurable on a ratio scale, operationally defined as:

Route kilometers of standard gauge track (number).

Variable 2.1.3: *Broad Gauge* describes the presence of broad gauge (>1435mm) track. It is measurable on a ratio scale, operationally defined as:

Route kilometers of broad gauge track (number).

Source for Variable 2.1.1, Variable 2.1.2, and Variable 2.1.3: *Railway Directory*.

2.2 Contiguous network

Variable 2.2: *Networkability* describes the opportunities for operators to envision interoperability beyond their own country. It is measurable on a ratio scale, operationally defined as:

The sum of all contiguous same-gauge route kilometers (number).

Source: *Railway Directory*.

2.3 Strategic horizon

Variable 2.3: *Strategic Horizon* describes the extent of the domain in which a country's railways assert themselves. It is measurable on an interval scale, operationally defined as follows:

Global means that a country's railway strategic horizon stretches beyond the constraints of its continent to contiguous continents or beyond to distant continents (Level 4).

Continental means that a country's railway strategic horizon stretches to the full extent of its continent (Level 3)

Regional means that a country constrains its railway strategic horizon to railways in contiguous- or surrounding countries (Level 2).

National means that national boundaries constrain a country's railway strategic horizon (Level 1) (Default).

Source: Content analysis of trade periodicals.

3 Business group

3.1 Infrastructure operator diversity

Variable 3.1: *Infrastructure Operator Diversity* describes the origin-destination railway infrastructure operator options available to consignors, logisticians, or shippers. It is measurable on a dichotomous interval scale, operationally defined as follows:

Competitive, parallel, infrastructure operators exist (Level 1).

Only a single infrastructure operator, or end-to-end linkage of single infrastructure operators, exists (Level 0) (Default).

Source: *Railway Directory*.

3.2 Train operator diversity

Variable 3.2: *Train Operator Diversity* describes availability of competitive origin-destination train operator options for consignors, logisticians, or shippers. It is measurable on an interval scale, operationally defined as follows:

Multiple open-access operators offer competitive service on shared infrastructure (Level 2).

Infrastructure and operations are vertically separated (Level 1).

A monolithic railway offers monopolistic service (Level 0) (Default).

Source: *Railway Directory*.

3.3 Information technology leverage

Variable 3.3: *Information Technology Leverage* describes the extent to which railways deploy information technology to leverage their offering. It is measurable by proxy on an interval scale, operationally defined as follows:

Online business support, or private access by registered customers, provided in English language (Level 4).

Online business support, or private access by registered customers, provided in local language only (Level 3).

Website maintained in English language (Level 2).

Website maintained in local language only (Level 1).

No Internet presence (Level 0) (Default).

Source: URLs in *Railway Directory*, inspection of the websites listed, and Google searches for websites where none were listed.

3.4 Road competition

Variable 3.4, *Road competition*, describes a country's competitive milieu with respect to road transport. It is measured as Variable 3.5.1, Variable 3.5.2, and Variable 3.5.3.

Variable 3.4.1: *Total Road Network* describes the length of the road network. It is measurable on a ratio scale operationally defined as:

Kilometers of road (number).

Variable 3.4.2: *Motorways* describes the length of roads, specifically designed and built for motor traffic, which does not serve properties bordering on it. It is measurable on a ratio scale, operationally defined as:

Kilometers of motorways as a percentage of Variable 3.4.1.

Variable 3.4.3: *Paved Roads* describes the length of roads that are surfaced. It is measurable on a ratio scale operationally defined as:

Kilometers of paved roads as a percentage of Variable 3.4.1.

Source for Variable 3.4.1, Variable 3.4.2, and Variable 3.4.3: International Road Federation *World Road Statistics* [CD-ROM].

4 Ownership group

4.1 Infrastructure-operations separation

Variable 4.1: *Infrastructure-operations Separation* describes the extent of separation between infrastructure operations and train operations. It is measurable on a dichotomous interval scale, operationally defined as follows:

Vertically separated means that infrastructure operations and train operations are managed and accounted for in separate organizational structures and systems (Level 1).

Vertically integrated means that infrastructure operations and train operations are managed and accounted for in a unitary organizational structure and system (Level 0) (Default).

Source: Content analysis of trade periodicals, and *Railway Directory*.

4.2 Ownership locus

Variable 4.2: *Ownership Locus* describes a railway's owner on a private-public continuum. It is measured as Variable 4.2.1 and Variable 4.2.2.

Variable 4.2.1: ***Infrastructure Ownership Locus*** describes the presence of private ownership of infrastructure. It is measurable on an interval scale, operationally defined as follows:

Privately owned means that railway infrastructure owners have no relation or obligation to the state (Level 2).

Public-private partnership means that infrastructure is partly publicly-owned and partly privately owned, or concessioned to a private operator for a long term (Level 1).

Publicly owned means that government owns all infrastructure, either directly as a state department or -enterprise, or by proxy through an agency (Level 0) (Default).

Variable 4.2.2: ***Rolling Stock Ownership Locus*** describes the presence of private ownership of rolling stock. It is measurable on an interval scale, operationally defined as follows:

Privately owned means that railway rolling stock owners have no relation or obligation to the state (Level 2).

Public-private partnership means that risk of rolling stock ownership is shared between public owners and private owners (Level 1).

Publicly owned means that government owns all rolling stock, either directly as a state department or -enterprise, or by proxy through an agency (Level 0) (Default).

Source for Variable 4.2.1 and Variable 4.2.2: Content analysis of trade periodicals, and *Railway Directory*.

4.3 Commitment horizon

Variable 4.3: *Commitment Horizon* describes the economic life implicit in key industry decisions, such as major capital projects, or public-private partnerships. It is measured as Variable 4.3.1 and Variable 4.3.2.

Variable 4.3.1: ***Infrastructure Commitment Horizon*** describes the economic life implicit in major infrastructure decisions. It is measurable on a ratio scale, operationally defined as:

Economic life in years (number).

Variable 4.3.2: ***Rolling Stock Commitment Horizon*** describes the economic life implicit in major rolling stock decisions. It is measurable on a ratio scale, operationally defined as:

Economic life in years (number).

Source for Variable 4.3.1 and Variable 4.3.2: Content analysis of trade periodicals, and *Railway Directory*. A default value of 30 years was used for Commitment Horizon.

5 Contribution group

5.1 Network coverage

Variable 5.1: *Network Coverage* describes the coverage of the rail network. It is measurable on a ratio scale, operationally defined as:

Route kilometers of network, all track gauges (number).

Source: *Railway Directory*.

5.2 Transport task

Variable 5.2: *Traffic Volume* describes contribution to the transport task. It is measured as Variable 5.2.1 and Variable 5.2.2.

Variable 5.2.1: *Traffic Volume (Freight)* describes the quantity of freight traffic moved. It is measurable on a ratio scale, operationally defined as:

Freight loaded (million tonnes per year).

Variable 5.2.2: *Traffic Volume (Passenger)* describes the quantity of passenger traffic moved. It is measurable on a ratio scale, operationally defined as:

Passengers conveyed (million journeys per year).

Source for Variable 5.2.1 and Variable 5.2.2: *Railway Directory*.

5.3 Employment creation

Variable 5.3: *Employee Count* describes the total number of employees in a country, for both railway infrastructure- and train operators. It is measurable on a ratio scale, operationally defined as:

Employees in service (number).

Source: *Railway Directory*.

5.4 Initiative source

Variable 5.4: *Initiative Source* describes the direction and strength of an initiative. It is measurable on a directional interval scale, operationally defined as follows:

Extraordinary organisation initiative means that reporters attributed extraordinary initiative to the railway industry (Level 2).

Evolutionary organisation initiative means that the railway industry exercised the initiative that reporters reasonably expected (Level 1).

Neutral means that railway industry-environment interaction was evenly balanced (Level 0) (Default).

Evolutionary environment initiative means that society exercised the initiative that reporters reasonably expected (Level -1).

Extraordinary environment initiative means that reporters attributed extraordinary initiative to society or to its organs (Level -2).

Source: Content analysis of trade periodicals.

6 Society group

6.1 Country economic freedom

Variable 6.1: *Country Economic Freedom* describes the prevailing freedom to make economic decisions in a country. It is measurable on a ratio scale operationally defined as.

The Heritage Foundation's Index of Economic Freedom.

Source: <http://www.heritage.org> .

6.2 Country population

Variable 6.2: *Country Population* describes the size of the population in a country. It is measurable on a ratio scale, operationally defined as.

Population.

Source: <http://devdata.worldbank.org> .

6.3 Country income

Variable 6.3: *Country Income* describes the per capita income of a country. It is measurable on a ratio scale, operationally defined as:

Gross National Income per capita, Atlas method (current US\$).

Source: <http://devdata.worldbank.org> .

6.4 Country physical size

Variable 6.4: *Country Physical Size* describes the size of a country. It is measurable on a ratio scale, operationally defined as:

Surface area, km².

Source: <http://www.geohive.com> .

6.5 Determinism

Variable 6.5: *Determinism* describes the direction and strength of determinism a country applies to its railways. It is measurable on an arbitrary, directional interval scale, operationally defined as follows:

Authoritarian means that government and/or other significant stakeholders (such as a labour union) do not entertain non-compliance (Level 1).

Ambivalent means that although government and/or other significant stakeholders entertain representations, they respond indistinctly (Level 0) (Default).

Laissez faire means that government and/or other significant stakeholders abstain from interfering in the positioning of railways (Level -1).

Source: Content analysis of trade periodicals.

6.6 Climate-change Position

Variable 6.6: *Climate-change Position* describes a country's response to the Kyoto Protocol to the United Nations Framework Convention on Climate Change. It is measurable on an interval scale, operationally defined as follows:

Signed and ratified (Level 3).

Signed but not ratified (Level 2).

Signed but not intending to ratify (Level 1).

Not signed and not ratified (Level 0).

Source: <http://en.wikipedia.org> .

7 Sustainability group

7.1 Asset investment capacity

Variable 7.1: *Asset Investment Capacity* describes the capacity of railways to renew or to expand their asset base. It is measured as Variable 7.1.1 and Variable 7.1.2.

Variable 7.1.1: *Infrastructure Investment Capacity* describes the ability to invest in infrastructure from time to time. It is measurable on an interval scale, operationally defined as follows:

Evidence of expansion exists (Level 2)

Evidence of renewal exists (Level 1).

No evidence of change (Level 0) (Default).

Evidence of deterioration exists (Level -1).

Evidence of withdrawal or abandonment exists (Level -2).

Variable 7.1.2: *Rolling Stock Investment Capacity* describes the ability to invest in rolling stock from time to time. It is measurable on an interval scale, operationally defined as follows:

Evidence of expansion exists (Level 2)

Evidence of renewal exists (Level 1).

No evidence of change (Level 0) (Default).

Evidence of deterioration exists (Level -1).

Evidence of withdrawal or abandonment exists (Level -2).

Source for Variable 7.1.1 and Variable 7.1.2: Content analysis of trade periodicals.

7.2 Stakeholder satisfaction

Variable 7.2: *Stakeholder Satisfaction Level* describes the extent to which a country's railway service providers satisfy aggregate external stakeholder expectations. It is measurable on an interval scale, operationally defined as follows:

Broad satisfaction means that external stakeholders express encouragement (Level 2).

Moderate satisfaction means that external stakeholders express positive appreciation (Level 1).

Adequate satisfaction means that external stakeholders express neither positive nor negative sentiments (Level 0) (Default).

Marginal satisfaction means that external stakeholders express constructive criticism (Level –1).

No satisfaction means that external stakeholders do not perceive railways to render meaningful returns (Level –2).

Source: Content analysis of trade periodicals.

7.3 Service reputation

Variable 7.3: *Service Reputation* is operationally defined as relevant comments in the trade press. It is measurable on an interval scale as follows:

Positive comments (Level 1).

No comments (Level 0) (Default).

Negative comments (Level –1).

Source: Content analysis of trade periodicals.

7.4 Safety reputation

Variable 7.4: *Safety Reputation* is operationally defined as relevant comments in the press. It is measurable on an interval scale as follows:

Positive comments (Level 1).

No comments (Level 0) (Default).

Negative comments (Level –1).

Source: Content analysis of trade periodicals.

7.5 Subsidy influence

Variable 7.5: *Subsidy Influence* describes the provision of government funding to make up a capital- or operating cost shortfall to sustain railways, whether privately- or publicly owned, and thereby to influence the railways. It is measurable on an interval scale, operationally defined as follows:

A subsidy is provided, and government uses it to influence the beneficiary (concessionaire, operator, etc.) (Level 1).

No subsidy is present (Level 0) (Default).

A subsidy is provided, and the beneficiary (concessionaire, operator, etc.) uses it to influence government (Level –1).

Source: Content analysis of trade periodicals.

8 Time group

8.1 Calendar Year

Variable 8.1: *Calendar Year* defines the year in which data originated. It is measurable on a ratio scale, operationally defined as the serial number of the year AD.

Notes

Default values

Content analysis needs to address situations where trade publications carried no articles that enabled measurement of any or all variables for each country during the review period. The scales are constructed to provide a default value in cases where no published data were available, and are so indicated against relevant variables.

Global railway population

Scope

Only line haul railways, as listed in the *Railway/Train Operators* section of *Railway Directory* are included. Urban (or City) railways are excluded from this database, but are included in the separate Railway Corporate Strategy CC Urban Railway Database at www.railcorpstrat.com.

Track gauge

The population was operationally defined as railways with track gauge equal to or greater than yard, meter, or 3'-6". Railways with track gauge narrower than the range mentioned were excluded.

Precedence

Where more than one level of a particular variable is present in a country, for example an incumbent national railway operator coexists with open access operators, the highest level was given precedence.

Trade periodicals

Content analysis data were extracted from *International Railway Journal* and *Railway Gazette International* for the six complete years January 2002 to December 2007.