

A 'GPS' for Engineering Economics Students (An Answer to: What Business Am I In?)

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Abstract

The purpose of this paper is to increase motivation for students to learn economics by showing them a 'global positioning system' that describes their current or potential, economic work unit categories. By knowing where they fit into the overall economic scheme, the student may feel more connected to their economic area, as well as its 'parent' and 'children' units, satisfying the engineering desire to see where they are in the 'big picture'.

The mechanism to do this 'positioning' is given by NAICS, the North American Industrial Classification System. First introduced in 1997, NAICS uses a 6-digit classification system developed by the United States, Mexico, and Canada to consistently and comprehensively cover *all* of the economic units within these three countries. Using NAICS, a student can 'drill-down' from the highest level, consisting of 20 economic *sectors*, all the way down to a national industry business unit, 5 'levels' down. Given any 6-digit NAICS code, a wealth of statistical and economic information concerning industry standards, trends, and historical data is then available.

Classifying All Economic Units in North America

The purpose of these notes is to bring to your attention the results of a massive effort to classify and categorize *all* economic production in the U.S., Mexico, and Canada, using a single approach for all three countries. Knowing this really big picture allows us to look at a particular industry, such as *Automobiles*, and see where it fits in the overall economic production world. For this industry, we could find its 'parent' industries and its 'child' industries. Looking in the NAICS manual we see that it is in *sector*: Manufacturing, *subsector*: Transportation Equipment Manufacturing, *Industry Group*: Motor Vehicle Manufacturing, *NAICS group*: Automobile & Light Duty Motor Vehicle Manufacturing and finally *U.S. Industry*: Automobile Manufacturing.

Statistics Canada, Mexico's Instituto Nacional de Estadística, Geografía e Informática (INEGI), and the Economic Classification Policy Committee (ECPC) of the US created this common classification system to describe all of the economic production of these three North American NAFTA trading partners.

The resulting classification system sets up a single framework within which to collect, classify, analyze, inter-compare, and publish information on both inputs and outputs within and between these North American countries. This is a new classification system that supersedes the older Standard Industry Classification (SIC) of the 1980's. The new classification is based on a common conceptual framework of economic units (called *establishments*) that have similar *production processes*. Economic units that have similar production processes are classified in the same

industry and the boundaries of each unit of classification are drawn with differences in production processes in mind.

Wherever you work, whether for yourself or with someone else, if you produce or provide a service, it falls within one of these classifications. Knowing this big picture, allows you to contribute at your own local level by supplying information or extracting it. (Knowing some of these details will make you look good in your organization as well!).

What Does The Classification Look Like?

NAICS (2002) is *process* based. The classification of industries is based on how they *process* their source entities into final goods and services. It is hierarchical, like its predecessor, the Standard Industry Classification (SIC), but has been updated to show the new industries that have emerged in the last part of the 20th century and the very first part of the 21st. Additionally, shifting perspectives that have changed some classification categories since the 1997 version was first issued. NAICS uses a 6-digit coding system to identify particular industries and position them in the classification hierarchy. The classification system is as follows, with each digit or pair of digits having specific meaning. Note: I have introduced the term “level” as an additional perspective on the depth of partitioning represented by the digit code, this term isn’t used in the manual.:

Table 1: NAICS Digit Meanings

Digit Positions	Classification Level
one and two	sector (the broadest category, level 1)
three	subsector (level 2)
four	industry group (level 3)
five	the NAICS industry (a common designation between the three nations, level 4)
six	the national industry that may or may not be common between countries (level 5)

The Sector Breakdown

NAICS initially classifies all economic activities into 20 general sectors. Below is a short description of each sector. Notice that there is a *Name*, which is a *structural* description and refers to generally recognizable external features, and a *process* description which describes how source entities are transformed (processed) into goods and services, either final or intermediate. I have also included the total industries in each sector, at the 6-digit breakdown. For example, for the

Agriculture, Forestry, Fishing and Hunting (11) sector, there are a total of 64 categories of industry among the three countries at the lowest classification level.

Table 2: NAICS 2-Digit Sector Codes with Totals

Sect or Cod e	Name (Structural Description)	Process Description	Number of 6-digit Categories
11	Agriculture, Forestry, Fishing, Hunting	grow crops, raise animals, harvest timber, fish and animals from farms, ranches, or natural habitats	64
21	Mining	extracting naturally occurring mineral solids such as coal and ore; liquid minerals such as crude petroleum; and gases such as natural gas. Other preparations associated with the mining activity at the mine site or as part of mining activity. This includes: crushing, washing, screening, and flotation.	29
22	Utilities	generate, transmit and/or distribute electricity, gas, steam, water and removing sewage through a permanent infrastructure of lines, mains, and pipes.	10
23	Construction	erect building and structures (including additions), heavy construction other than buildings; alterations, reconstruction, installations, and maintenance and repairs.	31
31-33	Manufacturing	mechanical, physical, or chemical transformation of materials, substances, or components into new products	473
42	Wholesale Trade	selling or arrange for purchase or sale of goods for resale; capital or durable non-consumer goods; and raw and intermediate materials and supplies used in production, and providing services incidental to the sale of the merchandise.	71
44-45	Retail Trade	retailing merchandise generally in small quantities to the general public and providing services incidental to the sale of the merchandise.	75
48-49	Transportation and Warehousing	provide transportation of passengers and cargo, warehousing and storing goods, scenic and sightseeing transportation, and supporting these activities	57
51	Information	distributing information and cultural products, provide means to transmit or distribute these products as data or communications, and processing data	36
52	Finance and Insurance	creation, liquidation, or change in ownership of financial assets (financial transactions) and/or facilitating financial transactions	42
Sect or Cod e	Structural Description	Process Description	Number of 6-digit Categories

Table 2: NAICS 2-Digit Sector Codes with Totals

Sect or Cod e	Name (Structural Description)	Process Description	Number of 6-digit Categories
53	Real Estate and Rental and Leasing	renting, leasing, or otherwise allowing the use of tangible or intangible assets (except copyrighted works) and providing related services	24
54	Professional Scientific and Technical Services	perform professional, technical, and scientific services for the operations of other organizations	47
55	Management of Companies and Enterprises	holding of securities of companies and enterprises for the purpose of owning controlling influence or influencing their management decisions, or administering, overseeing, and managing other establishments of the same company or enterprise and normally undertaking the strategic or organizational planning and decision making of the company or enterprise.	3
56	Administrative and Support and Waste Management and Remediation Services	perform routine support activities for the day-to-day operations of other organizations	43
61	Educational Services	provide instruction and training in a wide variety of subjects	17
62	Health Care and Social Assistance	provide health care and social assistance for individuals	
71	Arts Entertainment and Recreation	operate or provide services to meet varied cultural, entertainment, and recreational interests of their patrons	25
72	Accommodation and Food Services	provide customers with lodging and/or preparing meals, snacks, beverages for immediate consumption	15
81	Other Services (Except Public Administration)	provide services not elsewhere specified, including repairs, religious activities, grant-making, advocacy, laundry, personal care, death care, and other personal services	49
Sect or Cod e	Structural Description	Process Description	Number of 6-digit Categories

Table 2: NAICS 2-Digit Sector Codes with Totals

Sect or Cod e	Name (Structural Description)	Process Description	Number of 6-digit Categories
91- 93	Public Admin- istration	administration, management, and oversight of public programs by Fed- eral, State, and local governments.	29
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Sect or Cod e	Structural Description	Process Description	Number of 6-digit Categories

Drilling Down Into Various Industrial Sectors

Next, I would like to show a few ‘drill-downs’ from some of the sectors above. These entries are from the NAICS manual but are only a tiny selection since there are 1179 6-digit classifications encompassed. What I have done is simply select a few entries from some of the sectors and followed their sub-classifications down to their logical end-points.

An Example Discussion of Sector 11, Agriculture, Forestry, Fishing & Hunting

Recall that this is the sector characterized by the *processes* of growing crops, raising animals, and harvesting timber, fish and animals from farms, ranches, or natural habitats.

The first display below shows four levels of nested economic units, ending with 11111 Soybean Farming. (See “NAICS Digit Meanings” on page 2 for the meanings of the digits.)

The interpretation is that Soybean Farming is a *NAICS industry* and has the same meaning between all three nations: U.S., Canada, and Mexico. Notice that the classification stops with 5 digits, reflecting a decision to end sub-classification. However, if some new important variant of Soybean Farming, perhaps related to genetic engineering, were to emerge as an economically important industry, an additional digit is available. We see that Soybean Farming is within the *industry group* Oilseed & Grain Farming, which is again a common designation among the trading partners. Oilseed and Grain Farming is within the *subsector* Crop Production. Finally, Crop Production is positioned with the *sector* Agriculture, Forestry, Fishing and Hunting.

11 Agriculture, Forestry, Fishing & Hunting

11 Agriculture, Forestry, Fishing & Hunting

 111 Crop Production

 1111 Oilseed & Grain Farming

 11111 Soybean Farming

An Example Discussion of Sector 22, Utilities

Notice in this case that there is no 3-digit code. This means that the 3-digit and 4-digit codes are the same. When we get down to the 6-digit codes, there is a possibility that the industry designations will differ between the three nations. (See “NAICS Digit Meanings” on page 2 for a defini-

tion of the meaning of the digits.). In fact, the 6th digit is designed to absorb this inevitable variety of designations among the three nations.

22 Utilities

22 Utilities

- 2211 Electric Power Generation, Transmission, and Distribution

 - 22111 Electric Power Generation

 - 221111 Hydroelectric Power Generation

 - 221112 Fossil Fuel Electric Power Generation

 - 221113 Nuclear Electric Power

- 2212 Natural Gas Distribution

 - 22121 Natural Gas Distribution

Further Examples of NAICS Positioning

Notice that manufacturing encompasses three sector codes thus allowing for current and future expansion. Manufacturing includes 473 (6-digit) subcategories and below is just one of very many!

31-33 Manufacturing

31 Manufacturing

- 313 Textile Mills

 - 31311 Fiber, Yarn & Thread Mills

 - 3131112 Yarn Texturing, Throwing & Twisting Mills

42 Wholesale Trade

42 Wholesale Trade

- 421 Wholesale Trade Durable Goods

 - 4211 Motor Vehicle/Motor Vehicle Parts & Supply Wholesale

 - 42114 Motor Vehicle Parts (Used) Wholesale

44-45 Retail Trade

44-45 Retail Trade

- 442 Furniture & Home Furnishing Stores

 - 4422 Home Furnishing Stores

 - 44221 Floor Covering Stores

61 Educational Services

61 Educational Services

- 6113 Colleges, Universities & Professional Schools

- 6116 Other Schools and Instruction

- 61169 All Other Schools and Instruction

 - 611692 Automobile Driving Schools

62 Health Care and Social Assistance

62 Health Care and Social Assistance

- 621 Ambulatory Health Care Services

- 6214 Outpatient Care Centers
 - 62142 Outpatient Mental Health /Substance Abuse Centers
- 624 Social Assistance
 - 6242 Community/Emergency & Other Relief Services
 - 62422 Community Housing Services
 - 624221 Temporary Shelters

71 Arts, Entertainment & Recreation

- 71 Arts, Entertainment & Recreation
 - 713 Amusement, Gambling & Recreation Industries
 - 7139 Other Amusement & Recreation Sports Centers
 - 71394 Fitness & Recreational Sports Centers

92 Public Administration

- 92 Public Administration
 - 922 Justice, Public Order & Safety Activities
 - 9221 Justice, Public Order & Safety Activities
 - 92216 Fire Protection
 - 926 Administration of Economic Programs
 - 9261 Administration of Economic Programs
 - 92613 Regulation & Administration of Utilities

Summary

This article introduces the North American Industrial Classification System (NAICS) that assigns a 6-digit code to all the categories of economic production establishments in the U.S., Mexico, and Canada. The purpose is to give students a view of the kinds of industries that are “out there” and what relations they bear to their ‘parent’ and ‘children’ industries. The NAICS sector table, showing the 20 highest level industrial subdivisions is shown together with a number of example to the descriptions possible using these classifications.

References

North American Industry Classification System (NAISC), Executive Office of the President, Office of Management and Budget, 2002, ISBN 0-934213-86-0, NTIS Order# PB2002-101430.