2-3) DEVELOPMENT AND QUALITY OF LIFE

Objective: This data gathering exercise allows you to compare economic and political factors that affect quality of life and resource consumption in a wide range of countries. Most of all, it provides a sense of perspective as to where your country stands in relation to other countries with regard to these issues.

Introduction: How do we comprehensively measure the well-being of human society? What questions need to be asked? Pakistani economist Mahbub ul Haq (1934-1998) developed the "Human Development Index" (HDI) with this goal in mind. The HDI incorporates data on health, knowledge, income, poverty, gender inequality, human security, and environmental sustainability into one number that ranges from 0 to 1 (*1*).

In the 2010 report that included 169 countries, the U.S. ranked 4th and Norway ranked 1st with scores of 0.902 and 0.938, respectively. Zimbabwe ranked last with a score of 0.140. In 1990, this African nation ranked near the middle, with 40% of the evaluated countries scoring lower than Zimbabwe. Its sharp decline over the last two decades can be attributed in large part to corrupt land redistribution policies that devastated Zimbabwe's agricultural output during the 1990s.

Many of the models for improving societal welfare today have their origin in the Industrial Revolution. By today's standards, factory conditions were dismal. Nonetheless, it was the wealth of choice brought about by mass production that may have given people reason to believe that a society that maximized human well-being was within reach.

Based on his observations of people living in pre-industrial societies, naturalist Alfred Russell Wallace (1823-1913) came to regard the human brain not as a product of natural selection but as "an organ that seems prepared in advance, only to be fully utilized as [humanity] progresses in civilization" (*2*). Given that most educated Englishmen of the Victorian era took for granted the prominence of the British Empire as evidence of "white" supremacy, this was an extraordinary statement for its time.

The late Dr. Haq stated that people are the true wealth of nations. In an era in which policy makers hesitate to discuss the root causes of underdevelopment that touch upon deeply held cultural beliefs, it helps to recall how Alfred Russell Wallace was able to discern objectively the positive and negative roles of culture, with observations that were not tainted by the racial hubris of his times or the political correctness of our times. Only when policy makers are capable of circumventing such fallacies can surveys such as the HDI serve as an actual means for improving human welfare.

CIA Factbook Data Collection and Arrangement of Two Categories:

1) Go to the "CIA World Factbook" website:
https://www.cia.gov/library/publications/the-world-factbook/

Go to "**Select Country or Location**"; then choose any country and click on "**People and Society**."

2) Under "**birth rate**", click on "**country comparison to the world**." This will give you a list of countries in order of number of births per 1000 population. Click on "**download data**" (on the upper right hand) to download the data in simple text form.

3) Open a blank Microsoft® Office Excel®, spreadsheet, then copy and paste the downloaded data to the first three columns of your spreadsheet. The top portion of your first three rows may look like this:

◊	A	B	C
1	1	Niger	46.12
2	2	Mali	45.53
3	3	Uganda	44.17

4) Delete the first column (the column with the ranking numbers) and arrange the data into alphabetical order. To do this, highlight these two columns and go to the "Data" option on excel. Under this option choose "Sort" and type in the letter corresponding to the column with the names of the countries. Your first three rows should now look like this:

◊	A	B
1	Afghanistan	38.84
2	Albania	12.73
3	Algeria	23.99

5) Go back to the website under "**People and Society**," scroll to "**Infant mortality per 1000 live births**", then click on "**country comparison to the world**." Download the data and copy them to the next three columns on your spreadsheet:

◊	A	B	C	D	E
1	Afghanistan	38.84	1	Afghanistan	117.23
2	Albania	12.73	2	Mali	104.34
3	Algeria	23.99	3	Somalia	100.14

6) Delete the number ranking column and use the "Sort" function as you did previously to put it in alphabetical order:

◊	A	B	C	D
1	Afghanistan	38.84	Afghanistan	117.23
2	Albania	12.73	Albania	13.19
3	Algeria	23.99	Algeria	21.76

7) As you look down the column you will notice that many of the countries do not line up. In the example below the Faroe Islands did not provide birth rate data:

◊	A	B	C	D
67	Fiji	19.86	Faroe Islands	5.71
68	Finland	10.35	Fiji	10.2
69	France	12.49	Finland	3.36

This problem is addressed by deleting this country and its corresponding data (cells C67 and D67) so that the next countries will line up:

◊	A	B	C	D
67	Fiji	19.86	Fiji	10.2
68	Finland	10.35	Finland	3.36
69	France	12.49	France	3.31

8) Go down the entire column to make sure that all of countries line up, taking great care to examine each pair to make sure that no countries or their data are mismatched. Never assume that just because countries at the bottom of your list (such as Zimbabwe) line up that every country above it is also paired correctly. Check the entire list!

9) Highlight the values corresponding to "birth rate" and "infant mortality", then make a scatter plot the data. If all the data have been entered into the correct cells your data points should indicate a fairly straight line with few outliers. Give your graph a title and a caption describing the trend (positive or negative correlation, straight or curved line) and the reason for this relationship between x and y. Below is a sample graph and partial caption:

Birth Rate vs. Infant Mortality Rate
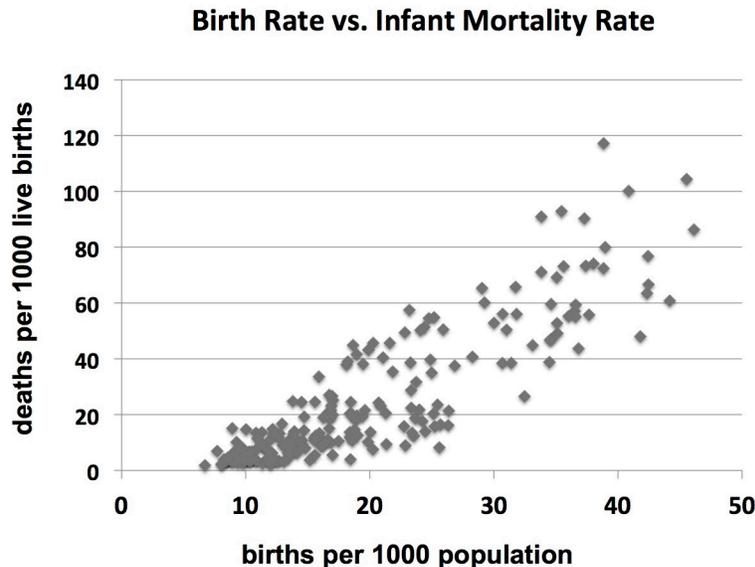
As birth rate increase, infant mortality increases. This relationship is expected because ...

10) Open the completed spreadsheet supplied by your instructor and skip to the "Graphing" section near the end of the procedure.

Advanced Study: Creating the Complete Spreadsheet:

11) Return to "**People and Society**" and follow the same procedure for gathering data for the following two data set one by one:

 "**Population" and "Life expectancy at birth**."

12) Click on "**Economy**" to gather the following four data sets one by one:

 "**GDP per capita, electricity consumption, oil consumption, and oil production**."

Follow the same procedure for collecting and lining up all the data.

13) Finally, click under "**Communications**" to gather the following data set:

 "**Telephones-main lines in use**."

14) After you have gathered all the data and made sure all of the countries line up, label the columns (using abbreviations to save space) and re-order them so that population is in column B. Your spreadsheet should now look like this:

	A	B	C	D	E	F	G	H	I	J
	Country	Pop'n	Infant mort.	Life exp.	Birth rate	GDP/ capita	Electr. use	Oil use	Oil-prod.	Teleph. lines
	Afghan- istan	2.8E+07	153	44	38	800	1.0E+09	5.0E+03	0	4.6E+05
	Albania	3.6E+06	19	78	12	6200	3.6E+09	3.4E+04	5.9E+03	3.2E+05
	Algeria	3.4E+07	28	74	17	7100	2.8E+10	3.0E+05	2.2E+06	3.3E+06

Column A: country name
Column B: total population
Column C: infant mortality rate (deaths per 1000 live births)
Column D: life expectancy at birth
Column E: fertility rate (estimated average number of children born per woman)
Column F: annual GDP per capita (in US $)
Column G: annual electricity consumption (kWh generated plus imports minus exports)
Column H: annual oil consumption (in barrels per day)
Column I: annual oil production (in barrels per day)
Column J: main telephone lines in use

Inserting Spreadsheet Functions:

1) **Column K** corresponds to electricity consumption in kilowatt-hours per capita per day. This is obtained by dividing the amount of kilowatt-hours per year by the total population and further dividing by 365. Label the column and use cell K2 to write out the following formula:

$$= (G2/B2)/365$$

2) **Column L** corresponds to oil consumption in barrels per capita per year. Label the column and use the cell L2 to write out the following formula:

$$= (365*H2)/B2$$

3) **Column M** corresponds to oil production per capita per year. Label the column and use the cell M2 to write out the following formula:

$$= (365*I2)/B2$$

4) **Column N** corresponds to telephone lines per capita. Label the column and use the cell N2 to write out the following formula:

$$= J2/B2$$

Data Collection from the Heritage Foundation:

1) Go to the "**Index of Economic Freedom**" for the Heritage Foundation: http://www.heritage.org/index/
2) Click on "**Download**" at the top of the website, then click on the tab that says "**Download Raw Data**".

3) Since data is already in the Excel® format, all you need to do is copy and paste the columns that correspond to the name of the country and the score and organize them the same as you organized the previous data from the CIA factbook.

Data Collection from the Transparency International:

1) Go to the "**Corruption Perceptions Index**" at the "Transparency International" website: http://cpi.transparency.org

2) Click on "**Results**" then download the "**CPI information package**". This will give you a folder with many files. Open the Excel file titled Regional "**Scores and Ranks**".

3) Copy and paste the columns that correspond to the name of the country and the CPI score, then organize them in the same way as you organized the previous data from the CIA factbook.

Data Collection from the Human Development Reports:

1) Go to the United Nations Human Development Index Report: http://hdr.undp.org/en/statistics/hdi

2) Click on "**Table 1: Human Development Index and its Components**", then click on the tab for exporting the data and choose "**XLS**".

3) Copy and paste the columns that correspond to the name of the country, the HDI and gender inequality scores, then organize them the same as you organized the previous data from the CIA factbook.

Graphing:

Use the extended completed spreadsheet to test numerous relationships. Whenever possible, use the y-axis for the dependent variable and the x-axis for the independent variable. In some cases this will be hard to know, because both x and y may be dependent on a third factor. For example, both infant mortality and life expectancy are strongly influenced by infrastructure, GDP per capita, and quality of medical care. Make six graphs from among the following 13 categories:

1. Quality of Life vs. Quality of Life (example: Infant mortality vs. Life expectancy)
2. Energy Use vs. Energy Use (example: Electricity use per capita vs. Oil use per capita)
3. Policy vs. Policy (example: Economic freedom vs. Corruption)
4. Quality of Life vs. Demographics (example: Infant mortality vs. Birth rate)
5. Economics vs. Demographics (example: GDP per capita vs. Birth rate)
6. Economics vs. Quality of Life (example: GDP per capita vs. Infant mortality)
7. Economics vs. Energy Consumption (example: GDP per capita vs. Oil use per capita)
8. Economics vs. Infrastructure (example: GDP per capita vs. Telephone lines per capita)
9. Policy vs. Economics (example: Economic freedom or Corruption vs. GDP per capita)
10. Natural Resources vs. Economics (example: Oil production per capita vs. GDP per capita)
11. Policy vs. Quality of Life (example: Corruption vs. Infant mortality or Life expectancy)
12. Infrastructure vs. Quality of Life (example: Telephone lines per capita vs. Infant mortality)
13. Energy Use vs. Quality of Life (example: Oil use per capita vs. Infant mortality)

Discussion / Questions:

Note the strength of the correlation between the x and y axis in each graph. Is there a pattern or just a random distribution of points? If there is a pattern, note the shape of the line that is indicated by the clustering of the points. Is it straight or curved? Which points are outliers? For each of your graphs write a caption that describes this relationship between x and y. Pick at least one graph among the six that contains an outlier (a point that does not follow the line) and comment on the reason why this country is an outlier for these parameters. Be sure to include credible references in your caption to support your view as to why this country is an outlier.

Literature Cited:

1. *Reflections on Human Development* Oxford University Press, 1st edition, 1996; 288 pages, ISBN 0-19-510193-6. 2nd edition, 1999; 324 pages, ISBN 0-19-564598-7.

2. Wallace, A.R. *The Limits of Natural Selection as Applied to Man*. In *Contributions to the Theory of Natural Selection: A Series of Essays*, pp. 332—71. Macmillan, London, 1870.

2-3) **INSTRUCTOR'S GUIDE TO DEVELOPMENT AND QUALITY OF LIFE**

Overview: The completed spreadsheet is contained the "Instructor's Guide" disk. The quickest and easiest way to complete this activity is skip steps 1-9 and give students the completed spreadsheet from the start (step 10), but the 30-40 minutes needed for them to visit the website and gather data from the source (steps 1-9) is well worth the experience. In this case, you should not provide the completed spreadsheet to the students until they have completed steps 1-9 (assuming they are not doing the "Advanced Study" which requires them to create the entire spreadsheet from scratch). You also need to remind students that correlation cannot always be attributed to cause and effect. Some students may not be good at discerning correlation, so it is best for them to produce all their graphs in class so you can make sure they are not producing meaningless graphs (such as "total population" vs. "per capita GDP"). Some extreme values will make it hard to discern the overall pattern. You can exclude these values by choosing an upper limit on the axis scale. In the example below the oil consumption in the graph on the right is limited to 50 barrels per capita per year. This makes the overall pattern much more evident:
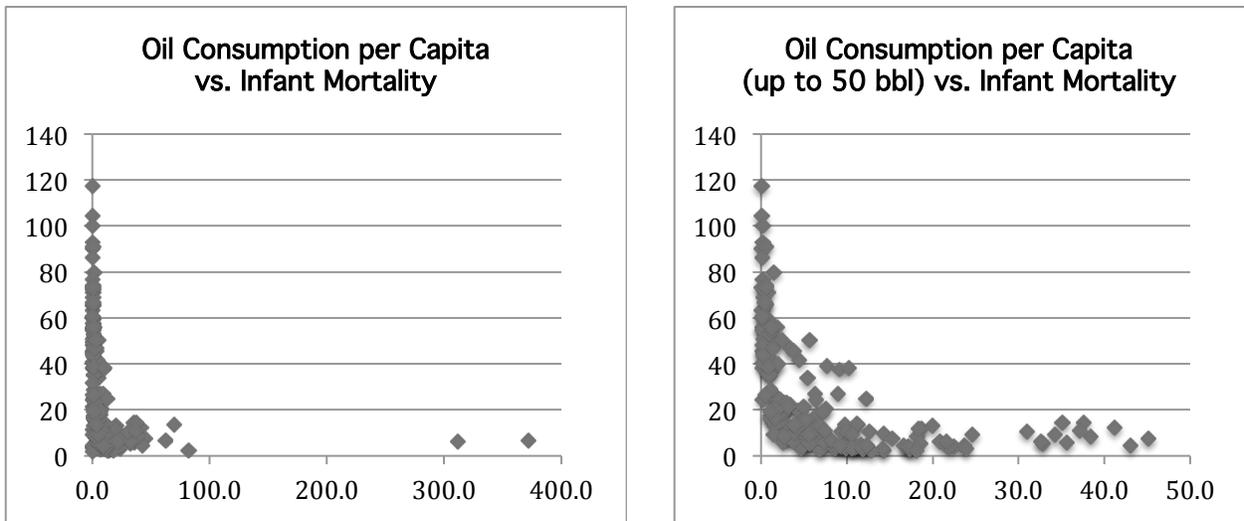
You also need to make sure students know how to discern outliers and not confuse them with extreme values (which may or may not be outliers). Examples of outlier points include the Virgin Islands, Gibraltar, Saint Pierre and Miquelon, and Singapore. These countries and territories show very high oil consumption relative to GDP because they serve as refueling ports for cargo ships. Equatorial Guinea has a high infant mortality relative to GDP due to extreme corruption (below left). Botswana, Gabon, Namibia, and South Africa have low life expectancy relative to HDI due to AIDS (below right).

GDP per Capita vs. Infant Mortality

Life Expectancy vs. HDI
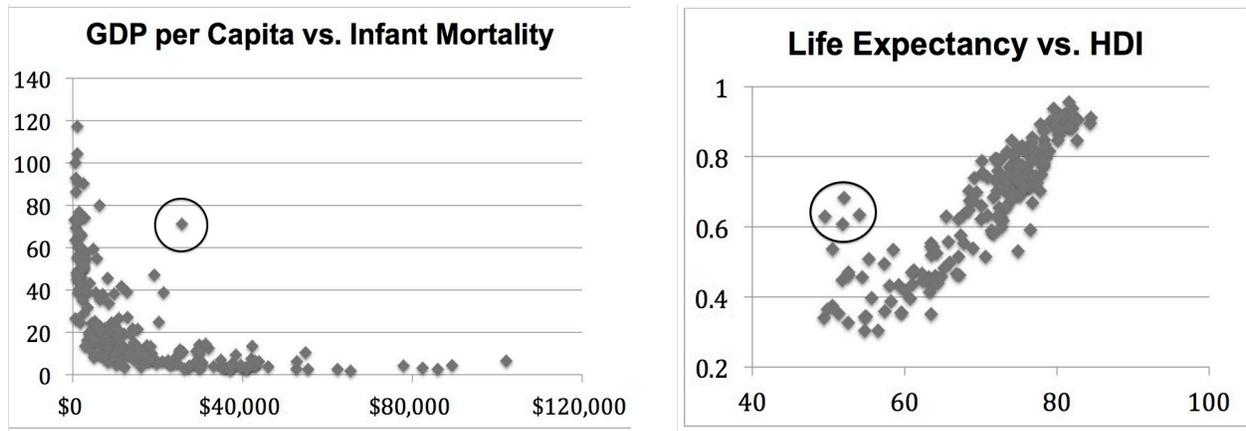
An effective way to identify specific outliers is to use the "data sort" function to put all the data in the order of the parameter of interest then look for the a corresponding parameter that does not follow the pattern. In the example below, the data was sorted in order of infant mortality to compare this to per capita petroleum consumption. Three outliers of interest are Singapore, the Czech Republic, and Macau (for comparison, US infant mortality is 6.17 per 100 live births and its oil consumption is 21.6 barrels per capita). For reasons mentioned earlier, the oil consumption data for Singapore (along with a few other small island states) is a statistical artifact that has nothing to do with the transportation habits of the general population.

Location	Infant mortality	Barrels consumed per capita
Japan	2.13	12.8
Bermuda	2.48	14.4
Norway	2.48	18.1
Singapore	2.53	82.0
Sweden	2.6	11.9
Czech Republic	2.63	6.8
Hong Kong	2.73	17.3
Macau	3.13	4.7

Logistics: The students should be able to compile and graph the data for birth rate and infant mortality within a 40-minute period. The making of graphs from the complete spreadsheet will require at least another 40 minutes. If you choose to have your students build an entire spreadsheet from scratch (Advanced Study), you may divide the work and give one or two students the responsibility of making sure the countries line up after the data is submitted by the rest of the group. This will also require more class meetings.

Degree of Difficulty: 2—Not all students might be proficient with spreadsheets, so you may want to teach a few key students how to make scatter plots. These students can in turn teach this to everyone else.