Embedding a Carbon Footprint Project into an Undergraduate Class

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Outline

- Background
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- Implementation
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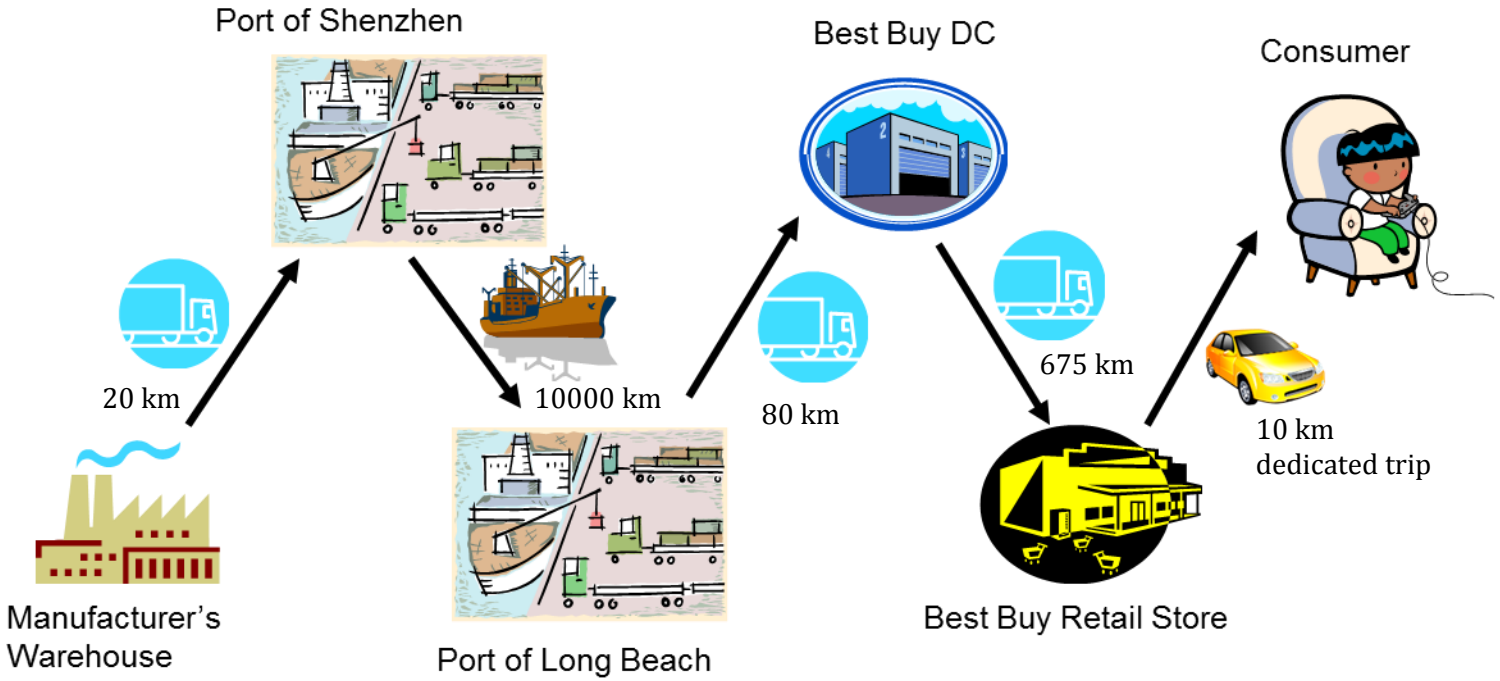
Background: the Class

- Definition: Supply Chain Management "provides goods and services to fulfill customer demand *responsively*, *efficiently* and *sustainably"*
- Sustainable Supply Chain Management (DS655)
  - A pre-existing senior-level elective for undergraduate Decision Sciences concentrators
  - I had developed the class in 2012 and previously taught it twice

A Sample Supply Chain: Nintendo Wii



Background: Carbon Footprints

- A Product Carbon Footprint (PCF) accounts for the resultant Greenhouse Gas emissions associated with providing a good or service
  - Transportation is only a component, but it is a universal and typically substantial portion
- Caveats:
  - PCFs are not likely to be very accurate
  - How much of the supply chain do we include?
    - Do we have the necessary data?
    - Do we have decision power to make or influence changes?
- **Idea is not to say product X emits 2.3456 kgCO_2e, but to show that logistic choices may impact resultant emissions**

Background: Campus as a Living Lab

- "Provides funds … to develop or redesign of a course that ties elements of sustainability into opportunities for learning using the campus physical plant."
- My proposal was funded for the 2013-2014 Academic Year at <$3K, solely for hiring student assistants for:
  - Data gathering, benchmarking and enhancing the underlying toolkit
  - Grading assistance to offset the time spent in developing and implementing the project (did not request a course release)

Goals

- Have students work with actual campus clients to perform a carbon footprint analysis for an existing campus process
  - Real world projects more motivating than those based only on secondary sources
  - Let students develop client handling skills
  - Provide benefits for clients
- Improve student skills:
  - Analysis
  - Oral and written communication
  - Teamwork
- Embed project into existing course without displacing material

Implementation: Project Partners

- 3 organizations involved
  - Office of Sustainability
  - SF State Bookstore
  - Outside food vendor: Café Rosso/Station Café/Village Market
- Fall 2013: Met with stakeholders from each organization to vet 3 potential PCF projects
  - Also determine if enhancements to the underlying carbon calculation tool would be needed
- Spring 2014: Partners' planned contributions during course
  - Provide a point of contact for students to learn about the process, collect data, ask questions
  - Attend final presentation, provide feedback to teams

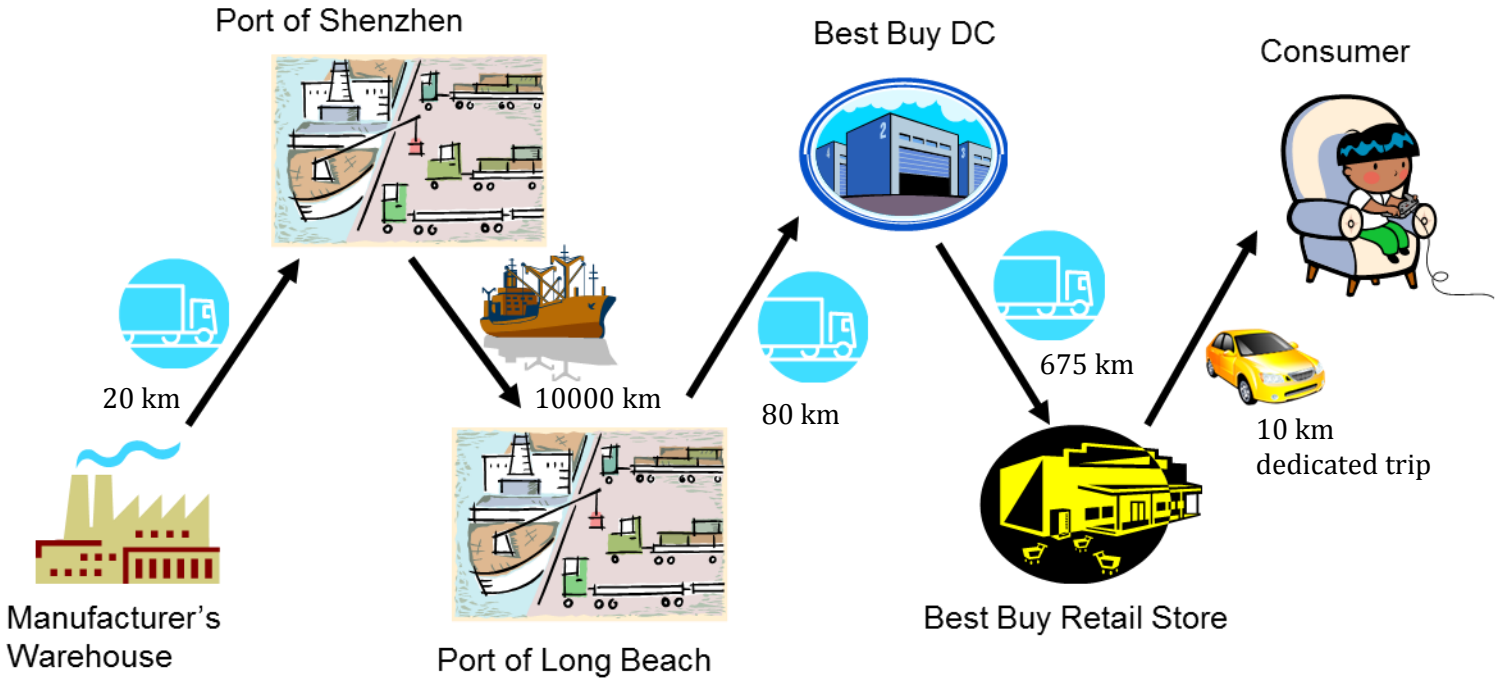
Implementation: Potential Projects

Client Partner	Potential Process/Product for Carbon Footprint
SFSU Bookstore	1-Electronics/Computer product
	2-Logo clothing sourced from Asia
	3- Textbook sourced from Europe
Office of Sustainability	4- Virgin paper vs. 100% recycled content paper
	5-Organic food item vs. non-organic version
	6-Hand dryer vs. paper towels in restrooms
Cafés	7. Juicing Oranges
	8. Bananas
	9. Melons

Implementation: CarbonCalc

- A spreadsheet I had previously developed
  - Simple to use
  - Easy to understand
  - Free
- Only Data, product weight and the following 4 inputs for each transportation link
  - Distance
  - Transport Mode, selected from a preset list
  - Utilization Rate (how fully packed is the vehicle?)
  - Backhaul Rate (are we returning empty?)
- Outputs: Carbon emissions for each link and the overall supply chain that can be assigned to that particular product

Which Link Has the Largest Carbon Footprint?



The Carbon Footprint for Transporting a Wii according to CarbonCalc

Key Outputs:	
Item Weight (kg)	Total Distance: 10,785
3.4	Total CO2e (kg) Associated with Item: 6.172

Link	Departing from	Arriving at	Transportation Mode	Distance (km)	Vehicle Weight Limit (kg)	kg CO2e per 100 km, full utilization	Utilization Rate (%)	Backhaul Rate (%)	Item's Share of Vehicle (%)	Item's share of CO2e (kg)
1	Shenzhen factory	Port of Shenzhen	Midsize_Diesel_Truck	20	6,250	0.015	90%	100%	0.1%	**0.011**
2	Port of Shenzhen	Port of Long Beach	Ship_LargeBulk_Carrier_Bunkerfuel	10,000	N/A	0.001	N/A	N/A	N/A	**0.238**
3	Port of Long Beach	Chino DC	Midsize_Diesel_Truck	80	6,250	0.015	90%	0%	0.1%	**0.089**
4	Chino DC	Colma Store	Midsize_Diesel_Truck	675	6,250	0.015	90%	10%	0.1%	**0.717**
5	Colma Store	Pacifica Home	Midsized_Car_Gasoline	10	38	0.677	9%	0%	9.0%	**5.117**

- The last link is the most emissions-intensive… Why?

Results: Spring 2014 Launch

- In late February students self-selected into 7 teams and picked from the nine projects available
- They had nearly half the term to meet with their clients, collecting data and asking questions
- Mid May- the end deliverables: document the carbon footprint associated with supporting a current product/process and suggest changes for improvement
  - Executive summary
  - Final presentation to fellow students, clients and professor

Results: Mixed Success

- Students seemed to pick what they felt would be the easy projects (hah!)
- Partner participation varied:
  - Office of Sustainability –the perfect partner!
  - One partner effectively went AWOL, had to allow those teams to make massive assumptions and/or switch to backup projects
- Student help was not always available as needed
  - Side benefit for Campus As a Living Lab? Spent less than $500 out of budgeted $2900, yet still had a project in production!

Conclusions and Lessons Learned

- My judgment: students did a better job on these real world projects than on prior ones based only on second sources
- The majority of students seemed to have favorable perceptions of the project
  - Some didn't, and end-of-term evaluation scores and comments reflected this
- Implementation takes more time than you think it will
  - Are your partners truly involved? (have backup plans)
  - Can you hire the student help that you need when you need it? (budget for a course release or two)