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NET ZERO NAVIGATOR

**The High Cost of Low Prices:  
Roadmap to Sustainable Supply Chains**  
Guest Lecture at Boston University's Metropolitan College

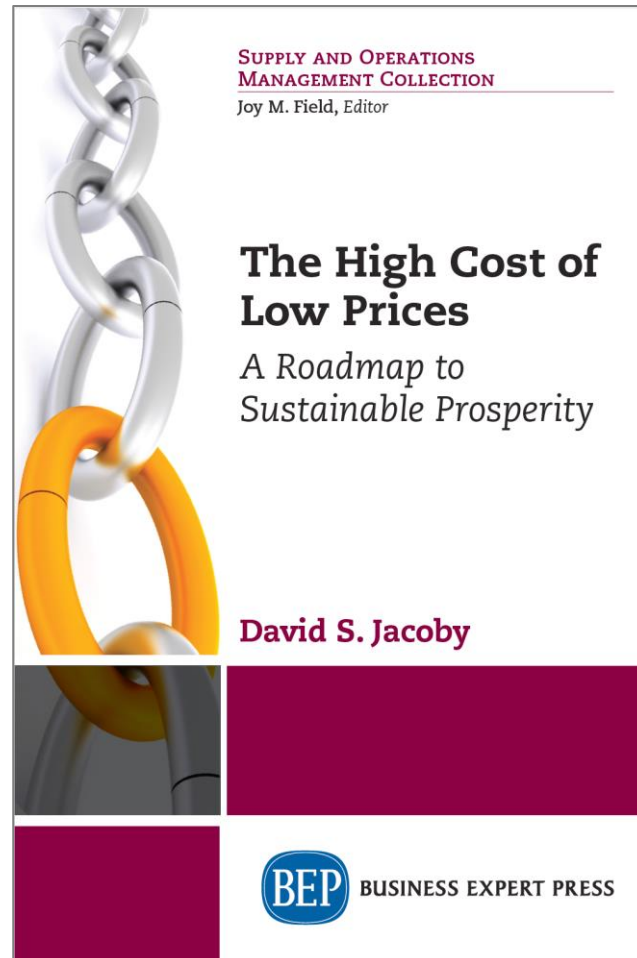
April 27, 2022

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# THE HIGH COST OF LOW PRICES



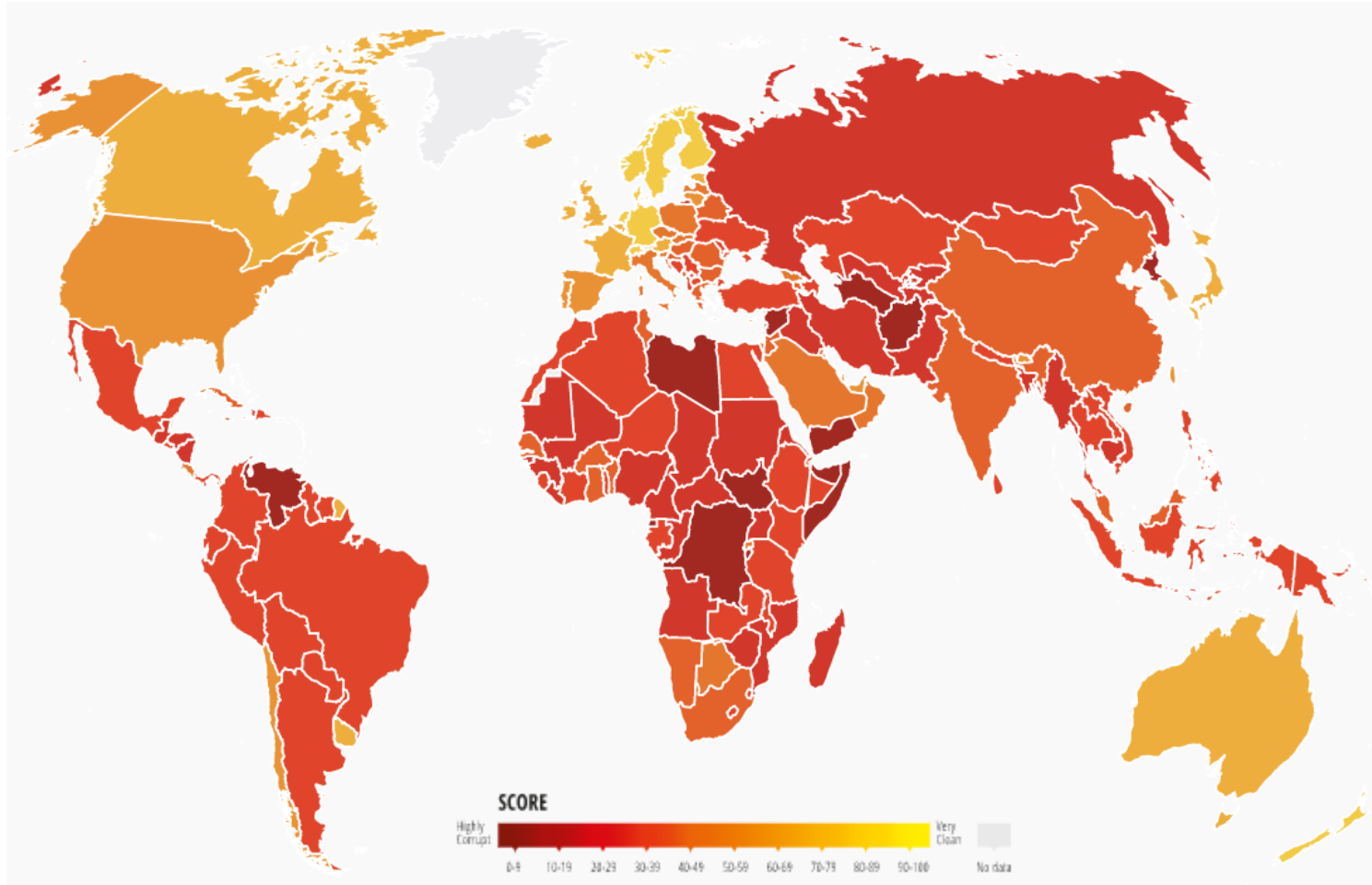


# THE PRICE OF MODERN DEVELOPMENT

- Machine Guns and Street Protests: Snapshots of Resource Depletion
  - Abuja, Nigeria, 2012
  - London, England, 2010
- Cities of Pipes and Gas Masks: Devastating our Ecology
  - Ras Laffan, Qatar, 2010
  - Jubail, Saudi Arabia, 2017
- Beggars and Thieves: Dehumanizing our Society
  - Lagos, Nigeria, 2012
  - Bogotá, Colombia, 2015



# Corruption Index



<https://www.transparency.org/en/cpi/2021>

April 27, 2022



# WHY IS THIS HAPPENING?

- Comfort and Convenience
- Consumption Patterns and Consumerism
- Construction, Development, and Power
- Dirty (and Wasteful) Manufacturing Processes
- Using Energy to Make Energy
- Careless Management of Toxic Chemicals and Waste Disposal
- Businesses Aggressively Catering to Consumer Wants



# EVERYDAY LOW PRICES





# WHAT WILL HAPPEN IF WE DO NOTHING?

- Extinction
- Overpopulation
- Consumerism
- Industrialization
- Air pollution



# A Bottle of Water: Clear with a Trail of Black

## D-Factor for a Bottle of Water: 1.4

Major Cost	SubCost	NAICS Classification	Cost Structure Percentage	Cost (USD)	Country	Depletion	Devastation	Dehumanization	D-Factor
<b>Grocery Store</b>									
Labor	Retail Sales	General Merchandise Stores	5%	\$ 0.06	USA	0.045	0.023	0.004	0.072
	Management	General Merchandise Stores	1%	\$ 0.01	USA	0.009	0.005	0.001	0.014
Capital	Facility Overhead	General Merchandise Stores	4%	\$ 0.05	USA	0.036	0.018	0.003	0.058
	Total		10%	\$ 0.12					0.144
<b>Transportation and Distribution</b>									
Labor	Driver 1	Truck Transportation	6%	\$ 0.07	Japan	0.029	0.024	0.004	0.057
	Warehousing	Warehousing and Storage	5%	\$ 0.06	Japan	0.022	0.018	0.003	0.043
	Driver 2	Truck Transportation	3%	\$ 0.04	Japan	0.014	0.012	0.002	0.029
Capital	Ships and Trucks	Truck Transportation	10%	\$ 0.12	USA	0.091	0.046	0.007	0.144
	Warehouse	Warehousing and Storage	6%	\$ 0.07	USA	0.056	0.029	0.004	0.089
	Total		31%	\$ 0.36					0.362
<b>Bottle Manufacturing and Bottling</b>									
Labor	Plant Labor	Beverage and Tobacco Product Manufacturing	3%	\$ 0.03	China	0.010	0.020	0.010	0.040
	Management	Beverage and Tobacco Product Manufacturing	1%	\$ 0.02	China	0.005	0.010	0.005	0.020
Manufacturin	Bottle Blowing	Beverage and Tobacco Product Manufacturing	6%	\$ 0.08	China	0.024	0.051	0.025	0.100
	Bottle washing, filling, & capping	Beverage and Tobacco Product Manufacturing	4%	\$ 0.05	China	0.015	0.030	0.015	0.060
	Drying	Beverage and Tobacco Product Manufacturing	3%	\$ 0.03	China	0.010	0.020	0.010	0.040
	Labeling & printing	Printing and Related Support Activities	4%	\$ 0.05	China	0.015	0.030	0.015	0.060
	PE Film Packaging	Plastics and Rubber Products Manufacturing	5%	\$ 0.06	China	0.019	0.040	0.020	0.080
	Total		25%	\$ 0.30					0.399
<b>Chemical Processing (for Bottles)</b>									
Labor	Plant Labor	Chemical Manufacturing	1%	\$ 0.02	China	0.005	0.010	0.005	0.020
	Management	Chemical Manufacturing	1%	\$ 0.01	China	0.002	0.005	0.002	0.010
	Chemicals: Polyethylene Terephthalate (PET)								
Chemical Proc	and Ethylene Glycol (EG)	Chemical Manufacturing	6%	\$ 0.08	China	0.024	0.051	0.025	0.100
	Esterification	Chemical Manufacturing	1%	\$ 0.02	China	0.006	0.012	0.006	0.023
	Pre-polymerization	Chemical Manufacturing	1%	\$ 0.02	China	0.006	0.012	0.006	0.023
	Polymerization	Chemical Manufacturing	1%	\$ 0.02	China	0.006	0.012	0.006	0.023
	Total		13%	\$ 0.15					0.199
<b>Water Processing</b>									
Labor	Plant Labor	Beverage and Tobacco Product Manufacturing	2%	\$ 0.02	Thailand	0.005	0.012	0.005	0.023
	Management	Beverage and Tobacco Product Manufacturing	1%	\$ 0.01	Thailand	0.002	0.006	0.003	0.011
Processing Op	Quartz Sand Filtration	Machinery Manufacturing	3%	\$ 0.04	Thailand	0.008	0.020	0.009	0.038
	Active Carbon Filtration	Machinery Manufacturing	3%	\$ 0.04	Thailand	0.008	0.020	0.009	0.038
	Reverse Osmosis or Ultrafiltration	Machinery Manufacturing	2%	\$ 0.02	Thailand	0.006	0.014	0.006	0.026
	Mineralization	Machinery Manufacturing	3%	\$ 0.04	Thailand	0.008	0.020	0.009	0.038
	Sterilization	Machinery Manufacturing	3%	\$ 0.04	Thailand	0.008	0.020	0.009	0.038
	Total		18%	\$ 0.20					0.213
<b>Extraction</b>									
Labor	Water extraction system maintenance	Beverage and Tobacco Product Manufacturing	0.6%	\$ 0.01	Indonesia	0.002	0.004	0.002	0.009
	Crude oil extraction	Mining	0.0%	\$ 0.00	Indonesia	0.000	0.000	0.000	0.000
Equipment	Water pumps & Piping	Beverage and Tobacco Product Manufacturing	2.2%	\$ 0.03	Indonesia	0.009	0.018	0.009	0.035
	Exploration	Mining	0.0%	\$ -	Indonesia	-	-	-	-
	Drilling & Completion	Mining	0.3%	\$ 0.00	Indonesia	0.001	0.003	0.001	0.005
	Production	Mining	1.1%	\$ 0.01	Indonesia	0.004	0.009	0.004	0.017
	Transportation (pipeline to processing)	Pipeline Transportation	1.1%	\$ 0.01	Indonesia	0.004	0.009	0.004	0.017
	Total		11%	\$ 0.06					0.083
<b>SUMMATION OF DIRECT AND INDIRECT IMPACTS</b>									
Labor				0.35		0.151	0.150	0.046	0.348
Equipment & Facilities				0.85		0.365	0.485	0.204	1.053
	<b>Total (D-Factor)</b>		100%			<b>0.52</b>	<b>0.63</b>	<b>0.25</b>	<b>1.40</b>
	<b>D-Factor per \$</b>					37%	45%	18%	1.17
	Cost of a bottle of water	\$	1.20						

Source: Jacoby, David Steven. The High Cost of Low Prices: A Roadmap to Sustainable Prosperity. Business Expert Press, 2017.





# A Cup of Coffee: Waking Up to the Consequences

## D-Factor for a Cup of Coffee 2.0

Major Cost	SubCost	NAICS Classification	Cost Structure Percentage	Cost (USD)	Country	Depletion	Devastation	Dehumanization	D-Factor
<b>Retail</b>									
Labor	Retail Sales	Food and Beverage Stores	2.5%	\$ 0.05	Canada	0.05	0.02	0.02	0.09
	Management	Food and Beverage Stores	0.5%	\$ 0.01	Canada	0.01	0.00	0.00	0.02
Capital	Facility Overhead	Food and Beverage Stores	5.1%	\$ 0.11	Canada	0.11	0.03	0.03	0.17
	Total		8.1%	\$ 0.17		-	-	-	0.28
<b>Transportation</b>									
Labor	Truck Drivers	Truck Transportation	0.3%	\$ 0.01	Canada	0.01	0.00	0.00	0.01
Capital	Trucks (warehouse to retail)	Truck Transportation	1.3%	\$ 0.03	Canada	0.03	0.01	0.01	0.05
	Total		1.7%	\$ 0.04		-	-	-	0.06
<b>Roasting/packaging</b>									
Labor	Machine operators	Beverage and Tobacco Product Manufacturing	8.5%	\$ 0.18	Mexico	0.05	0.10	0.10	0.24
	Management	Beverage and Tobacco Product Manufacturing	6.1%	\$ 0.13	Mexico	0.03	0.07	0.07	0.17
Capital	Roasting Machinery	Beverage and Tobacco Product Manufacturing	24.4%	\$ 0.51	Mexico	0.13	0.27	0.27	0.67
	Packaging Machinery	Beverage and Tobacco Product Manufacturing	7.3%	\$ 0.15	Mexico	0.04	0.08	0.08	0.20
	Packaging	Beverage and Tobacco Product Manufacturing	2.4%	\$ 0.05	Mexico	0.01	0.03	0.03	0.07
	Total		48.8%	\$ 1.03		-	-	-	1.35
<b>Transportation</b>									
Labor	Ship Crew	Water Transportation	0.7%	\$ 0.01	Mexico	0.00	0.01	0.01	0.02
	Truck Drivers	Truck Transportation	0.5%	\$ 0.01	Mexico	0.00	0.01	0.01	0.01
	Container Ship Colombia to US	Water Transportation	1.0%	\$ 0.02	Liberia	0.00	0.02	0.02	0.04
Capital	Truck from Port to Roaster	Truck Transportation	0.7%	\$ 0.01	USA	0.01	0.01	0.01	0.02
	Truck from Roaster to Warehouse	Truck Transportation	0.5%	\$ 0.01	USA	0.01	0.00	0.00	0.02
	Total		3.4%	\$ 0.07		-	-	-	0.11
<b>Milling</b>									
Labor	Machine Operators	Food Manufacturing	1.2%	\$ 0.02	Mexico	0.01	0.01	0.01	0.03
	Management	Food Manufacturing	0.9%	\$ 0.02	Mexico	0.00	0.01	0.01	0.02
Capital	Milling Machinery	Food Manufacturing	3.2%	\$ 0.07	Mexico	0.02	0.04	0.04	0.09
	Packaging Machinery	Food Manufacturing	0.6%	\$ 0.01	Mexico	0.00	0.01	0.01	0.02
	Total		5.9%	\$ 0.12		-	-	-	0.16
<b>Transportation</b>									
Labor	Truck Drivers	Truck Transportation	0.2%	\$ 0.00	Colombia	0.00	0.00	0.00	0.00
Equipment	Trucks (Farm to Mill)	Truck Transportation	0.7%	\$ 0.01	Colombia	0.00	0.01	0.01	0.02
	Total		0.8%	\$ 0.02		-	-	-	0.02
<b>Cultivation</b>									
Labor	Cultivation	Agriculture, Forestry, Fishing and Hunting	10.6%	\$ 0.22	Colombia	0.04	0.13	0.13	0.30
	Harvesting	Agriculture, Forestry, Fishing and Hunting	2.6%	\$ 0.06	Colombia	0.01	0.03	0.03	0.07
Land, machinery, and	Machinery and land rent	Agriculture, Forestry, Fishing and Hunting	2.8%	\$ 0.06	Colombia	0.01	0.03	0.03	0.08
	Utility and fuel	Utilities	2.5%	\$ 0.05	Colombia	0.01	0.03	0.03	0.07
	Fertilizer and chemicals	Chemical Manufacturing	4.3%	\$ 0.09	Colombia	0.02	0.05	0.05	0.12
	Maintenance	Agriculture, Forestry, Fishing and Hunting	2.5%	\$ 0.05	Colombia	0.01	0.03	0.03	0.07
	Interest	Services	1.8%	\$ 0.04	Colombia	0.01	0.02	0.02	0.05
	Taxes	Services	1.2%	\$ 0.02	Colombia	0.00	0.01	0.01	0.03
	All other	Agriculture, Forestry, Fishing and Hunting	3.1%	\$ 0.06	Colombia	0.01	0.04	0.04	0.09
	Total		31.3%	\$ 0.66		-	-	-	0.88
<b>SUMMATION OF DIRECT AND INDIRECT IMPACTS</b>									
Labor			0.36	0.75		0.22	0.40	0.40	1.03
Components, Equipment & Facilities			0.64	1.35		0.42	0.71	0.71	1.83
	<b>Total (D-Factor)</b>		1.00	2.10		0.42	0.71	0.71	1.83
	<b>D-Factor per \$</b>					23%	39%	39%	0.87
Cost of a cup of Coffee				\$ 2.10					

Source: Jacoby, David Steven. The High Cost of Low Prices: A Roadmap to Sustainable Prosperity. Business Expert Press, 2017.



# A Tank of Gasoline: Driving the Last Mile

## D-Factor for a Tank of Fuel: 89

Major Cost	SubCost	NAICS Classification	Cost Structure	Cost (USD)	Country	Depletion	Devastation	Dehumanization	D-Factor		
Gas Station	Labor	Retail Sales	Gasoline Stations	2.3%	0.08	France	0.265	0.337	0.074	0.676	
	Management	Gasoline Stations		0.5%	0.20	France	0.053	0.067	0.015	0.135	
	Capital	Facility Overhead	Gasoline Stations	1.8%	0.79	France	0.212	0.270	0.059	0.541	
	Total			4.5%	1.97					1.351	
Transport to Gas Station (Tanker Truck)	Labor	Truck Driver	Truck Transportation	0.6%	0.26	France	0.071	0.090	0.020	0.180	
	Company Management	Truck Transportation		0.2%	0.09	France	0.024	0.030	0.007	0.060	
	Equipment an	Truck	Truck Transportation	0.8%	0.35	France	0.094	0.120	0.026	0.240	
	Fuel	Petroleum and Coal Products Manufacturing		0.4%	0.18	France	0.047	0.060	0.013	0.120	
Total			2.0%	0.88					0.601		
Storage Terminal	Labor	Maintenance personnel	Pipeline Transportation	0.8%	0.33	Belgium	0.151	0.130	0.020	0.300	
	Company Management	Pipeline Transportation		0.4%	0.18	Belgium	0.080	0.069	0.011	0.160	
	Capital	Tanks	Fabricated Metal Product Manufacturing	1.3%	0.55	Belgium	0.251	0.216	0.033	0.501	
	Piping	Fabricated Metal Product Manufacturing		0.5%	0.22	Belgium	0.100	0.086	0.013	0.200	
	Pumps	Electrical Equipment, Appliance, and Component Manufacturing		1.0%	0.44	Belgium	0.201	0.173	0.027	0.400	
	Power	Utilities		1.1%	0.46	Belgium	0.211	0.182	0.028	0.421	
	Total			5.0%	2.17					1.982	
Transport to Storage Terminal (pipeline)	Labor	Maintenance personnel	Pipeline Transportation	0.2%	0.07	Netherlands	0.033	0.017	0.001	0.053	
	Company Management	Pipeline Transportation		0.1%	0.03	Netherlands	0.017	0.009	0.001	0.026	
	Equipment an	Line Pipe	Fabricated Metal Product Manufacturing	0.4%	0.16	Netherlands	0.083	0.043	0.003	0.129	
	Pumps	Electrical Equipment, Appliance, and Component Manufacturing		0.2%	0.10	Netherlands	0.050	0.026	0.002	0.077	
	Pigging Equipment	Electrical Equipment, Appliance, and Component Manufacturing		0.2%	0.07	Netherlands	0.033	0.017	0.001	0.052	
	Monitoring Equipment	Computer and Electronic Product Manufacturing		0.2%	0.10	Netherlands	0.050	0.026	0.002	0.077	
	Power	Utilities		0.3%	0.13	Netherlands	0.067	0.035	0.002	0.103	
Total			1.5%	0.66					0.517		
Refining	Labor	Refinery Operations and Maintenance Personnel	Petroleum and Coal Products Manufacturing	2.4%	1.05	Germany	0.423	0.242	0.052	0.728	
	Refinery Supervision	Petroleum and Coal Products Manufacturing		0.8%	0.35	Germany	0.144	0.081	0.017	0.243	
	Company Management	Petroleum and Coal Products Manufacturing		0.4%	0.18	Germany	0.072	0.040	0.009	0.121	
	Utilities (Capital Cost)	Utilities		1.6%	0.70	Germany	0.289	0.162	0.034	0.485	
	Capital	Civil Works	Construction	0.8%	0.35	Germany	0.144	0.081	0.017	0.243	
	Process Units	Petroleum and Coal Products Manufacturing		6.4%	2.80	Germany	1.156	0.647	0.137	1.941	
	Piping and Scaffolding	Fabricated Metal Product Manufacturing		0.8%	0.35	Philippines	0.023	0.232	0.091	0.345	
	Import/Export Facilities	Pipeline Transportation		0.8%	0.35	Germany	0.144	0.081	0.017	0.243	
	Fuel	Petroleum and Coal Products Manufacturing		1.6%	0.70	Russia	0.452	0.386	0.159	1.036	
	Catalysts & Chemicals	Chemical Manufacturing		0.4%	0.18	Germany	0.072	0.040	0.009	0.121	
	Total			16.0%	7.00					5.506	
	Transportation to refinery (Pipeline)	Labor	Maintenance Personnel	Pipeline Transportation	0.5%	0.22	Turkey	0.047	0.117	0.056	0.220
		Company Management	Pipeline Transportation		0.3%	0.11	Turkey	0.023	0.058	0.028	0.110
Equipment an		Line Pipe	Fabricated Metal Product Manufacturing	1.3%	0.55	Turkey	0.117	0.292	0.140	0.549	
Pumps		Electrical Equipment, Appliance, and Component Manufacturing		0.8%	0.33	Turkey	0.070	0.175	0.084	0.310	
Pigging Equipment		Electrical Equipment, Appliance, and Component Manufacturing		0.5%	0.22	Turkey	0.047	0.117	0.056	0.220	
Monitoring Equipment		Computer and Electronic Product Manufacturing		0.8%	0.33	Turkey	0.070	0.175	0.084	0.310	
Power		Utilities		1.0%	0.44	Turkey	0.094	0.233	0.112	0.439	
Total			5.0%	2.19					2.197		
Production	Labor	Field Maintenance (MRO personnel)	Mining	3.4%	1.48	Pakistan	0.114	1.143	0.050	1.307	
	Field Management (Specialists)	Mining		1.5%	0.66	Saudi Arabia	0.493	0.259	0.181	0.933	
	Company Management	Mining		0.4%	0.16	Saudi Arabia	0.123	0.065	0.045	0.233	
	Equipment an	Onsite Tree	Fabricated Metal Product Manufacturing	0.8%	0.33	Saudi Arabia	0.266	0.129	0.091	0.467	
	Chemicals	Chemical Manufacturing		3.0%	1.31	USA	0.993	0.505	0.079	1.577	
	Workover Consumables	Machinery Manufacturing		3.0%	1.31	USA	0.993	0.505	0.079	1.577	
	Pumps	Electrical Equipment, Appliance, and Component Manufacturing		3.0%	1.31	USA	0.993	0.505	0.079	1.577	
Total			15.0%	6.57					7.670		
Drilling	Labor	Roughnecks	Mining	4.5%	1.97	Kuwait	4.861	0.840	0.421	6.122	
	Rig Specialists	Mining		6.8%	2.95	Kuwait	7.291	1.260	0.631	9.183	
	Company Management	Mining		1.1%	0.49	Kuwait	1.215	0.210	0.105	1.530	
	Site Preparation Labor	Construction		0.9%	0.39	Kuwait	0.972	0.168	0.084	1.224	
	Equipment an	Rig (including BOP and Wellhead)	Machinery Manufacturing	9.0%	3.94	Kuwait	9.722	1.681	0.841	12.244	
	Drilling consumables	(Bits, OCTG, Chemicals, Downhole Tools)		12.4%	5.42	Kuwait	13.368	2.311	1.157	16.835	
	Mud	Chemical Manufacturing		4.5%	1.97	Kuwait	4.861	0.840	0.421	6.122	
	Cement	Construction		3.6%	1.58	Kuwait	3.889	0.672	0.337	4.898	
	Site Preparation Machinery	Machinery Manufacturing		2.3%	0.98	Kuwait	2.450	0.420	0.210	3.061	
	Total			45.0%	19.70					61.219	
Exploration	Labor	Geologists	Mining	0.6%	0.26	Kuwait	0.648	0.112	0.056	0.816	
	Machinery Operators (Seismographs, etc.)	Mining		0.5%	0.20	Kuwait	0.486	0.084	0.042	0.612	
	Exploration Crew	Mining		0.4%	0.18	Kuwait	0.434	0.075	0.038	0.547	
	Company Management	Mining		0.2%	0.09	Kuwait	0.214	0.037	0.019	0.269	
	Equipment an	Imaging Equipment	Computer and Electronic Product Manufacturing	0.9%	0.39	Kuwait	0.972	0.168	0.084	1.224	
	Exploration Rig (Trucks)	Machinery Manufacturing		1.5%	0.66	Kuwait	1.620	0.280	0.140	2.041	
	Fuel	Petroleum and Coal Products Manufacturing		1.2%	0.53	Kuwait	1.296	0.224	0.112	1.633	
Lab Analysis Equipment	Computer and Electronic Product Manufacturing		0.8%	0.33	Kuwait	0.810	0.140	0.070	1.020		
Total			6.0%	2.63					3.408		
<b>SUMMATION OF DIRECT AND INDIRECT IMPACTS</b>											
Labor				29%	12.87		18.27	5.54	1.98	25.79	
Equipment & Facilities				71%	30.88		46.27	12.25	4.89	63.42	
<b>Total (D-Factor)</b>					<b>64.54</b>		<b>17.80</b>	<b>6.87</b>	<b>89.21</b>		
D-Factor per \$							72%	20%	8%	2.04	
Cost of a tank of fuel	\$			43.77	\$	0.61	18.00	gallons per tank			

Source: Jacoby, David Steven. The High Cost of Low Prices: A Roadmap to Sustainable Prosperity. Business Expert Press, 2017.



# An iPad: Small Components with a Global Footprint

## D-Factor for an iPad: 630

Major Cost	SubCost	NAICS Classification	Cost Structure			Depletion	Devastation	Dehuman-ization	D-Factor	
			Percentage	Cost (USD)	Country					
<b>Retail Store</b>										
Labor	Retail Sales	Electronics and Appliance Stores	1.05%	\$ 5.63	USA	4.3	2.2	0.3	6.76	
	Management	Electronics and Appliance Stores	0.35%	\$ 1.88	USA	1.4	0.7	0.1	2.25	
Capital	Facility Overhead	Electronics and Appliance Stores	2.11%	\$ 11.25	USA	8.5	4.3	0.7	13.51	
	Total		3.52%	\$ 18.76					22.52	
<b>Transport, Logistics, &amp; Distribution</b>										
Labor	Ship Crew	Water Transportation	0.07%	\$ 0.36	China	0.1	0.2	0.1	0.48	
	Truck Drivers	Truck Transportation	0.06%	\$ 0.30	USA	0.2	0.1	0.0	0.36	
Equipment	Container ship China to US	Water Transportation	0.27%	\$ 1.44	China	0.5	1.0	0.5	1.91	
	Truck from Port to Warehouse	Truck Transportation	0.12%	\$ 0.66	USA	0.5	0.3	0.0	-	
	Truck from Warehouse to Retail Outlet	Truck Transportation	0.04%	\$ 0.24	USA	0.2	0.1	0.0	-	
Total			0.56%	\$ 3.00					2.75	
<b>Manufacturing &amp; Assembly</b>										
Labor	Assembly	Electrical Equipment, Appliance, and Component Manufacturing	1.35%	\$ 7.20	China	2.3	4.9	2.4	9.58	
	Plant Supervision	Electrical Equipment, Appliance, and Component Manufacturing	0.40%	\$ 2.15	China	0.7	1.4	0.7	2.86	
	Company Management	Electrical Equipment, Appliance, and Component Manufacturing	0.26%	\$ 1.40	USA	1.1	0.5	0.1	1.68	
Components	Memory	Electrical Equipment, Appliance, and Component Manufacturing	8.91%	\$ 47.50	Japan	18.5	15.5	2.6	36.58	
	Display	Electrical Equipment, Appliance, and Component Manufacturing	16.31%	\$ 87.00	South Korea	47.0	37.3	10.0	94.32	
	Touchscreen	Electrical Equipment, Appliance, and Component Manufacturing	7.50%	\$ 40.00	China	12.9	27.0	13.3	53.19	
	Processor	Electrical Equipment, Appliance, and Component Manufacturing	4.31%	\$ 23.00	South Korea	12.4	9.9	2.6	24.93	
	Camera	Electrical Equipment, Appliance, and Component Manufacturing	2.32%	\$ 12.35	Japan	4.8	4.0	0.7	9.51	
	Wireless Module	Electrical Equipment, Appliance, and Component Manufacturing	7.78%	\$ 41.50	India	3.9	33.8	16.8	54.53	
	User Interface and Sensors	Electrical Equipment, Appliance, and Component Manufacturing	2.81%	\$ 15.00	South Korea	8.1	6.4	1.7	16.26	
	Power Management	Electrical Equipment, Appliance, and Component Manufacturing	1.87%	\$ 10.00	India	0.9	8.1	4.1	13.14	
	Battery	Electrical Equipment, Appliance, and Component Manufacturing	6.00%	\$ 32.00	South Korea	17.3	13.7	3.7	34.69	
	Electromechanical Systems	Electrical Equipment, Appliance, and Component Manufacturing	9.47%	\$ 50.50	USA	38.2	19.4	3.0	60.64	
	Accessories	Electrical Equipment, Appliance, and Component Manufacturing	1.03%	\$ 5.50	China	1.8	3.7	1.8	7.31	
Total			70.32%	\$ 375.10					419.23	
<b>Extraction</b>										
Labor	Mining	Mining	2.46%	\$ 13.13	China	4.2	8.9	4.4	17.46	
	Logging	Agriculture, Forestry, Fishing and Hunting	1.48%	\$ 7.88	China	2.5	5.3	2.6	10.48	
	Extraction Supervision	Mining	0.74%	\$ 3.94	China	1.3	2.7	1.3	5.24	
	Mangement (overhead)	Mining	0.25%	\$ 1.31	China	0.4	0.9	0.4	1.75	
Materials	Silica (for circuit boards and glass) - 355g	Mining	2.46%	\$ 13.13	China	4.2	8.9	4.4	17.46	
	Bauxite (for Aluminum) - 125g	Mining	5.91%	\$ 31.51	Australia	38.3	6.6	0.6	45.50	
	Crude Oil (for plastics used in Ipad and packaging) - 135g	Mining	3.45%	\$ 18.38	China	5.9	12.4	6.1	24.44	
	Lithium Oxides (for battery) - 155g	Mining	2.95%	\$ 15.75	China	5.1	10.6	5.2	20.95	
	Rare Earth Oxides (used in the battery and electronics) - 5g	Mining	4.92%	\$ 26.26	China	8.5	17.7	8.7	34.92	
	Paper (used in packaging) - 631g	Agriculture, Forestry, Fishing and Hunting	0.98%	\$ 5.25	China	1.7	3.5	1.7	6.98	
	Total			25.60%	\$ 136.54					185.17
	<b>SUMMATION OF DIRECT AND INDIRECT IMPACTS</b>									
Labor			8.47%	45.17		18.16	26.90	12.07	58.88	
	Components, Equipment & Facilities		91.53%	488.22		239.82	245.02	88.78	570.79	
<b>Total (D-Factor)</b>			100.00%	533.39		<b>257.98</b>	<b>271.92</b>	<b>100.85</b>	<b>629.67</b>	
<b>D-Factor per \$</b>						41%	43%	16%	0.90	
<b>Cost of an iPad</b>				\$699						

Source: Jacoby, David Steven. The High Cost of Low Prices: A Roadmap to Sustainable Prosperity. Business Expert Press, 2017.



# An iPad: Small Components with a Global Footprint

## D-Factor for a Transatlantic Flight: 2,023

Major Cost	SubCost	NAICS Classification	Cost Structu	Cost (USD)	Country	Depletion	Devastation	Dehumanization	D-Factor
<b>Retail and Marketing</b>									
Labor	Admin	Nonstore Retailers	7.0%	\$ 98.00	United Kingdom	34.57	26.26	3.43	64.25
	Management	Nonstore Retailers	1.0%	\$ 14.00	United Kingdom	4.94	3.75	0.49	9.18
	IT	Services	3.5%	\$ 49.00	United Kingdom	17.28	13.13	1.71	32.13
Facility Overh	Office	Nonstore Retailers	5.0%	\$ 70.00	United Kingdom	24.69	18.76	2.45	45.90
	IT Infrastructure	Computer and Electronic Product Manufacturing	5.0%	\$ 70.00	United Kingdom	24.69	18.76	2.45	45.90
	Total		21.5%	\$ 301.00					197.35
<b>Aircraft Operations</b>									
Labor	Pilot	Air Transportation	7.0%	\$ 98.00	United Kingdom	34.57	26.26	3.43	64.25
	Flight Attendants	Air Transportation	10.0%	\$ 140.00	United Kingdom	49.38	37.51	4.89	91.79
Equipment an	Aircraft	Air Transportation	0.5%	\$ 7.00	USA	5.29	2.69	0.42	8.41
	Maintenance	Air Transportation	10.0%	\$ 140.00	Brazil	52.31	77.89	26.84	157.04
	Total		27.5%	\$ 385.00					321.49
<b>Fuel</b>									
Labor	Truck Driver	Truck Transportation		\$ -	Kuwait	-	-	-	-
	Company Management	Truck Transportation		\$ -	Kuwait	-	-	-	-
Equipment an	Truck	Truck Transportation		\$ -	Kuwait	-	-	-	-
	Fuel	Petroleum and Coal Products Manufacturing	28.2%	\$ 394.80	Kuwait	974.33	168.42	84.32	1,227.06
	Total		28.2%	\$ 394.80					1,227.06
<b>Ground Operations</b>									
Labor	Truck Driver	Truck Transportation	7.0%	\$ 98.00	USA	74.12	37.66	5.90	117.67
	Company Management	Truck Transportation		\$ -	USA	-	-	-	-
Equipment an	Truck	Truck Transportation	1.0%	\$ 14.00	USA	10.59	5.38	0.84	16.81
	Fuel	Petroleum and Coal Products Manufacturing		\$ -	USA	-	-	-	-
	Total		8.0%	\$ 112.00					134.48
<b>Fixed Costs</b>									
Labor	Truck Driver	Truck Transportation	7.0%	\$ 98.00	United Kingdom	34.57	26.26	3.43	64.25
	Company Management	Truck Transportation	6.8%	\$ 95.20	United Kingdom	33.58	25.51	3.33	62.42
Equipment an	Truck	Truck Transportation	1.0%	\$ 14.00	USA	10.59	5.38	0.84	16.81
	Fuel	Petroleum and Coal Products Manufacturing		\$ -	USA	-	-	-	-
	Total		14.8%	\$ 207.20					143.48
<b>SUMMATION OF DIRECT AND INDIRECT IMPACTS</b>									
Labor			49%	\$ 690.20		\$ 283.01	\$ 196.34	\$ 26.60	505.95
Equipment & Facilities			51%	709.80		1,102.49	297.27	118.16	1,517.92
<b>Total (D-Factor)</b>						<b>1,385.50</b>	<b>493.61</b>	<b>144.76</b>	<b>2,023.87</b>
<b>D-Factor per \$</b>						68%	24%	7%	<b>1.45</b>
Cost of an airplane ticket		\$	1,400						

Source: Jacoby, David Steven. The High Cost of Low Prices: A Roadmap to Sustainable Prosperity. Business Expert Press, 2017.



# Regional Approaches

- The European Model
- The American Model
- Asian Approaches
- African And Middle Eastern Approaches



# ROADMAP FOR THE FUTURE: THE AGENDA FOR CHANGE

- Voluntary Behavior Change
- Three Easy (but Unpalatable) Solutions
  - Shift the international supply chain to countries that have lower D-Factors. The result would be more expensive goods.
  - Localize supply chains.
  - Eliminate the supply chain altogether by reducing consumption, either by changes in behavior and values, or by limiting population growth.

## Recommendations

- Tax Carbon at the Source
- Mandate Clean Power
- Mandate Clean Fuel
- Mandate 100% Recyclable Consumer Products
- Mandate Reporting into the UN Global Compact
- Institute a Balanced Scorecard of Progressively Tightening Key Performance Indicators
- Develop Human Zoning Principles, Benchmarks, and Standards
- Put a Label On It
- Report GPI instead of GDP



# What Companies Are Doing

- The American Petroleum Institute (API)
- Shell, BP, and Suncor: decarbonization
- Pfizer: energy efficiency
- Sandvik: cobalt recycling
- Heidelbergcement: renewables
- IKEA: wood heritage
- Alcatel-Lucent: recycle, reuse



# SUSTAINABLE SUPPLY CHAIN PRACTICES

- Long-term supply agreements - WalMart
- Closed-loop supply chains with "extended product responsibility" for reverse logistics – Nike (returning sneakers)
- End-of-Life Planning & “Design for Disassembly” - EU
- Design for Reverse Logistics programs - HP, Kodak
- Nested packaging – Ford floorboards
- Using recycled packaging can reduce the cost of packaging - Dell and Walmart
- Requiring suppliers to abide by sustainability principles and practices – Alcatel strategic sourcing





# THE COST WILL BE ACCEPTABLE

- The Energy Sector Will Shift to Renewables
- Process Industries Will Develop Non-Toxic Alternatives
- Discrete Manufacturing Industries Will Enhance Measurement and Reporting
- Transportation Industries Will Increase R&D
- Retail Will Embrace Recycling and Green Building



# ALL STAKEHOLDERS HAVE A ROLE TO PLAY

- Non-governmental organizations (NGOs): adopt, endorse, and/or refine these recommendations
- Regional, national, and local regulatory agencies, governmental bodies, and lenders should refine and adapt the recommendations to local circumstances, and set up pilot programs.
- Independent specialists including consulting and accounting firms as well as technical experts and engineers, should measure, report on, and compare the Key Performance Indicators.

The stakes are high and the effort is large, but the human capacity and talent to adapt is larger, and the future can be clean and bright for all.



# Contact

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Books: [From Bogota to Beijing: Life and Development After Globalization](#), [The High Cost of Low Prices: A Roadmap to Sustainable Prosperity](#), [Trump, Trade, and the End of Globalization](#); [Reinventing the Energy Supply Chain: Cleaner, Greener, Smarter -- Supply Chain Roadmaps from Digital Oilfields through Hydrogen Fuel Cells](#); [Guide to Supply Chain Management](#); [Optimal Supply Chain Management in Oil, Gas & Power Generation](#).

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If you like, you can book a meeting directly in my calendar by clicking on this [link](#).