University of Alberta
Interdisciplinary Consulting Association

Notes or Interviewer's comments

Water conservation

40 min.

March 2014 | by Faheem Khan and Keita Hill

Target Skills

- Note taking
- Mental Math
- Problem Structuring
- Estimation

Background

McKinsey & Company estimates that **between 2010 to 2030**, the resource productivity of water, measured in **GDP per cubic meter of water** consumed, will need to improve by an **annual rate of 3.7 %** to meet global demand[1].

Note to interviewer: Read the background to the candidate at a controlled pace. Post-interview, compare the candidate's notes to the bolded key details.

In their new book, *Resource Revolution*, Stefan Heck and Matt Rogers identify five potential approaches[1] to improve resource productivity:

1. **Substitution** (the replacing of costly, clunky, or scarce materials with less scarce, cheaper, and higher-performing ones)
2. **Optimization** (embedding software in resource-intensive industries to improve, dramatically, how companies produce and use scarce resources)
3. **Virtualization** (moving processes out of the physical world)
4. **Circularity** (finding value in products after their initial use)
5. **Waste elimination** (greater efficiency, achieved by means including the redesign of products and services).

1. In order to meet global water demand in 2030, what is the total water resource productivity improvement required between 2010 and 2030?

Note to interviewer: This PST-style question on compound growth can be given to the candidate at any time during the case. The intent is to test the candidate's ability to solve an impromptu math question and then smoothly return to the case.

Procedurally, a strong candidate will:

- ☐ Recall/retrieve the annual resource productivity growth rate of 3.7 %.
- ☐ Confirm that compound growth is to be used, or ask for this clarification.

- ☐ Model the total change via compound growth rather than simple growth.
- ☐ Arrive at the approximate solution, 200%, in thirty seconds or less.

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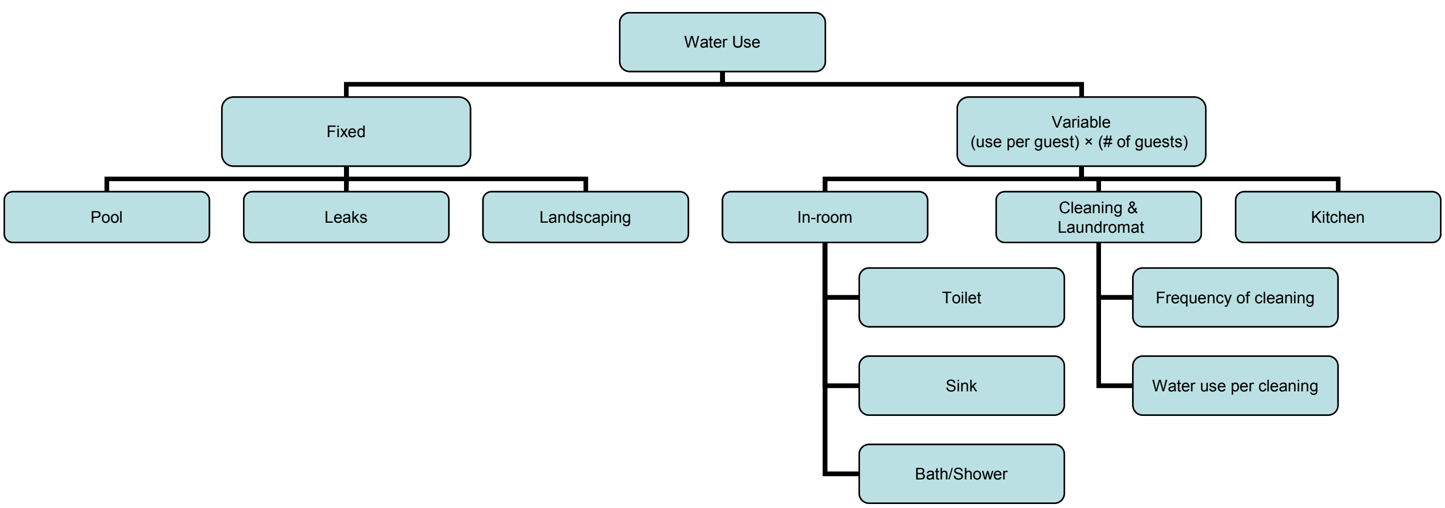
Possible solution: Apply the "Rule of 72". Dividing 72 by the annual rate of growth gives the doubling time in years. Since $70/3.5 = 20$, the doubling time is approximately 20 years, which is also the number of years between 2010 and 2030. Testing this hypothesis, multiply $3.7 \times 20 = 74 \approx 72$. The total percentage is thus approximately 200% resource productivity improvement in GDP per cubic metre of water.

2. Suppose a hotel chain is looking for ways to reduce water use. In determing the potential reduction in water use at hotel properties, what areas would you investigate?

Note to interviewer:
Answer clarifying questions assuming the hotel chain is industry standard. Require the candidate to draw reasonable assumptions. If the candidate's reason for asking a question is not clear, ask the candidate to explain their reasoning behind their question.

Procedurally, a strong candidate will:

- ☐ Take a moment to ask clarifying questions.
- ☐ Take a minute or two to identify an issue tree, such as the following.



Note to interviewer:
Is the candidate's issue tree mutually-exclusive and collectively exhaustive?

A very strong candidate may synthesize the issue tree with possible approaches to water productivity improvement (Substitution, Optimization, Virtualization, Circularity, Waste elimination).

3. Exhibit 1 compares the water faucets currently installed in guest rooms to a proposed alternative. Estimate the potential global annual water savings if the hotel chain replaces all faucets across its 303 global properties.

Procedurally, a strong candidate will:

- ☐ Write out an approach (equation) and estimate reasonable values for each parameter/variable.

Possible solution:

Water saved = # Hotels × Rooms per hotel × Occupancy Rate × Savings per Occupied Room

Suppose that the hotel chain occupancy rate is 50% over the course of the year, and that the average hotel has 100 rooms.

Savings per occupied room = Savings for each time the sink is used × Times used per day

A number of methods can be used to estimate the number of times that a sink in an occupied room is used per day. Usage could be segmented by time of day, season, type of customer, occupancy of room. Suppose that based on one he average room sink is used 5 times per day.

The water savings come from three sources: water saved during the action of turning on the tap, water saved while the tap is turned on, and water saved during the action of turning off the tap

Water savings for each sink = Average Flowrate × time saved

Suppose that for type A it takes 3 seconds to turn on the faucet and 3 seconds to turn off the faucet; and that for Type B is takes 0.5 seconds for each. Then we can estimate the time saved as 6-1 = 5 seconds.

Suppose that flowrate is 0.1 L/s. (Then it would take 10 seconds to fill a 1 L water bottle, which seems reasonable for a bathroom sink.)

Then the savings is 0.1 × 5 = 0.5 L per use.

0.5 L × 5 times/day = 2.5 L/day/room occupied

2.5 L/day/room occupied × 100 rooms × 0.5 occupancy factor × 300 hotels × 360 days/year = 13.5 million litres.

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Note to interviewer:
Ex. Virtualization: water meters for each room; circularity: greywater reuse; waste elimination: fixing leaks.

Note to interviewer:
Give the candidate Exhibit 1. You can ask the candidate their impressions from the exhibit (formulate a hypothesis) before posing the problem statement.

Note to interviewer:
The candidate may also suggest to segment by property type: vacation destination versus business. Suggest that business travellers make up 80% of the hotel chain's business.

Procedurally, a very strong candidate will :

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- ❑ Immediately suggest that the next step is to answer Question 4.

4. Should the hotel chain replace their existing faucets (Type A) with the new faucets (Type B)? The hotel requires a 5 year Return on Investment.

Possible solution: Calculate years until breakeven. Suppose the old faucets cost \$10 per unit for removal and disposal. Then, each faucet replaced costs \$55 + \$10 = \$65 and the savings are 2.5 L/day/room occupied × 0.5 occupancy factor × 360 days = 450 litres of water. At a cost of \$0.01/L, this is an annual savings of \$4.50. The breakeven period without time adjustment is therefore \$65/\$4.50 = 14 years > 5 years.

Note to interviewer:
Guide the candidate away from a full cost-benefit analysis.
Only when asked, provide that the cost of water is **\$0.01/L**.
Only when asked, provide that old faucets cost **\$10/unit to remove**.
Although a strong candidate will ask, for simplicity, suppose that the service life of both faucets is indefinite.

5. Now suppose the hotel chain is building a new hotel. Which type of faucet should be installed?

Possible solution: The cost differential for installation of Type B faucets is \$5, and the annual savings are \$4.50, so the breakeven period is under 2 years which is less than 5 years. Therefore, the hotel should install Type B faucets.

6. On your way to a team meeting, you happen to run into the lead client. What are the key insights you have gained so far?

Note to interviewer:
Candidates should be able to respond immediately, but a candidate can be provided with up to 30 seconds to prepare a response if required.

End of Case.

References

Heck, Stefan and Matt Rogers. McKinsey Quarterly. "Are you ready for the resource revolution?" McKinsey & Company. March 2014.

Feedback / Citing this Case

The ICA values your feedback. Send your comments to ica@ualberta.ca.

Khan, Faheem and Keita Hill. March 2014. "Transforming transportation in Tropolis." University of Alberta Interdisciplinary Consulting Association: Edmonton, Alberta, Canada.

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Exhibit 1.

Notes or Interviewer's comments

A. Currently installed faucets

Photo copyright Gerber Plumbing Fixtures LLC

Usage notes:
Volume of water controlled separately for hot/cold water separately

Cost: $50/unit installed

B. Proposed replacement faucets

Usage notes: Rotating the handle gradually shifts the ratio of hot to cold water, thereby modifying temperature while lifting the handle upward increases volume of water.

Cost: $55/unit installed