

McKinsey Problem Solving Test

Practice Case - TOYO

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TOYO Piano

TOYO Piano (TOYO) is a Japan-based company offering a full range of piano-related products and services. Since its establishment in 1934, the company has vastly expanded its business and presence. Nowadays, TOYO has stores and services centers in over 20 different countries from all 5 continents. TOYO has a reputation for superior customer and after-sales services.

TOYO operates on three major business lines:

- **New Piano Retailer:** TOYO sells brand new pianos mainly of Japanese brands, with which it has great relationship with. This business line concentrates on developed countries like Japan, Korea, the United States, and Europe.
- **Used Piano Refurbishing:** TOYO buys back old pianos, typically 50 years old, from developed countries, refurbishes them, and sells to developing markets like South East Asia countries. TOYO possesses a large distribution network and the best-in-class refurbishment technology, which enable it to stay competitive with this business line.
- **Piano Services:** TOYO also provides Piano enhancement and maintenance services like painting, fixing, tuning, etc. to individuals and organizations. Despite having a premium brand image, TOYO faces an increasing competition from various small local services provider.

The recent worldwide economic downturn has been causing TOYO major damages as TOYO global revenue has vastly decreased for the last 3 years. The TOYO global Managing Director thinks that the problem does not lie in the economic recession but instead in TOYO's business model. He states that the giant-size model is no longer suitable with the highly dynamic business environment nowadays as it is slow in recognizing pitfalls and adapting changes. The recent recession is just a triggering event to the long-existing problem within TOYO.

Table 1 shows TOYO Piano Worldwide Revenue in recent years.

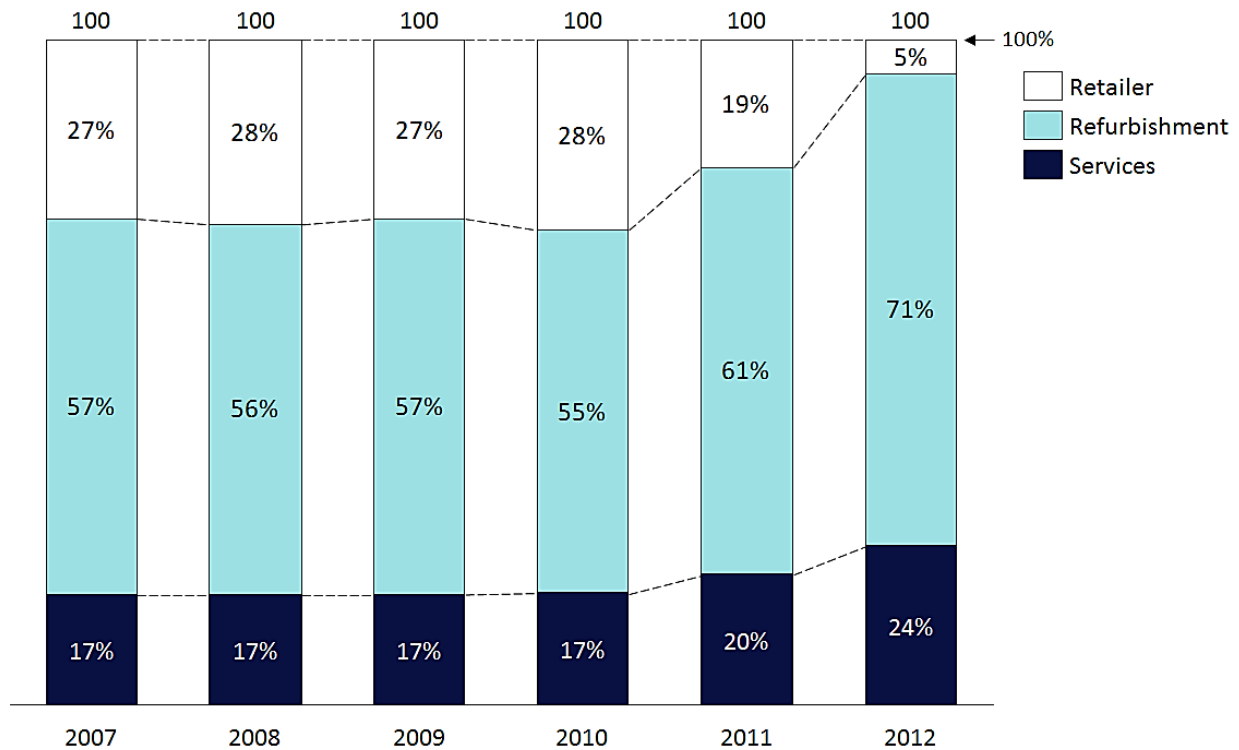
Table 1						
TOYO Piano Worldwide Revenue (in \$US Millions)						
	2007	2008	2009	2010	2011	2012
Revenue	2,549	2,734	2,812	2,789	2,395	1,923

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Exhibit 1 shows breakdown of TOYO Worldwide revenue into its business lines. In Exhibit 1, the data for business line is presented as a percentage of the total TOYO revenue in each specific year.

Exhibit 1

TOYO Worldwide Revenue Breakdown by Business Lines



1. Which of the following statements best describes the concern of the TOYO managing director?
 - A) The director is concerned that TOYO's global revenue has been decreasing and the big size does not allow TOYO to survive through the recession
 - B) The director is concerned that TOYO's business model is not suitable with the current recession time
 - C) The director is concerned that the fast-changing business environment does not favor big and complex companies like TOYO
 - D) The director is concerned that recessions will trigger problems existing within TOYO

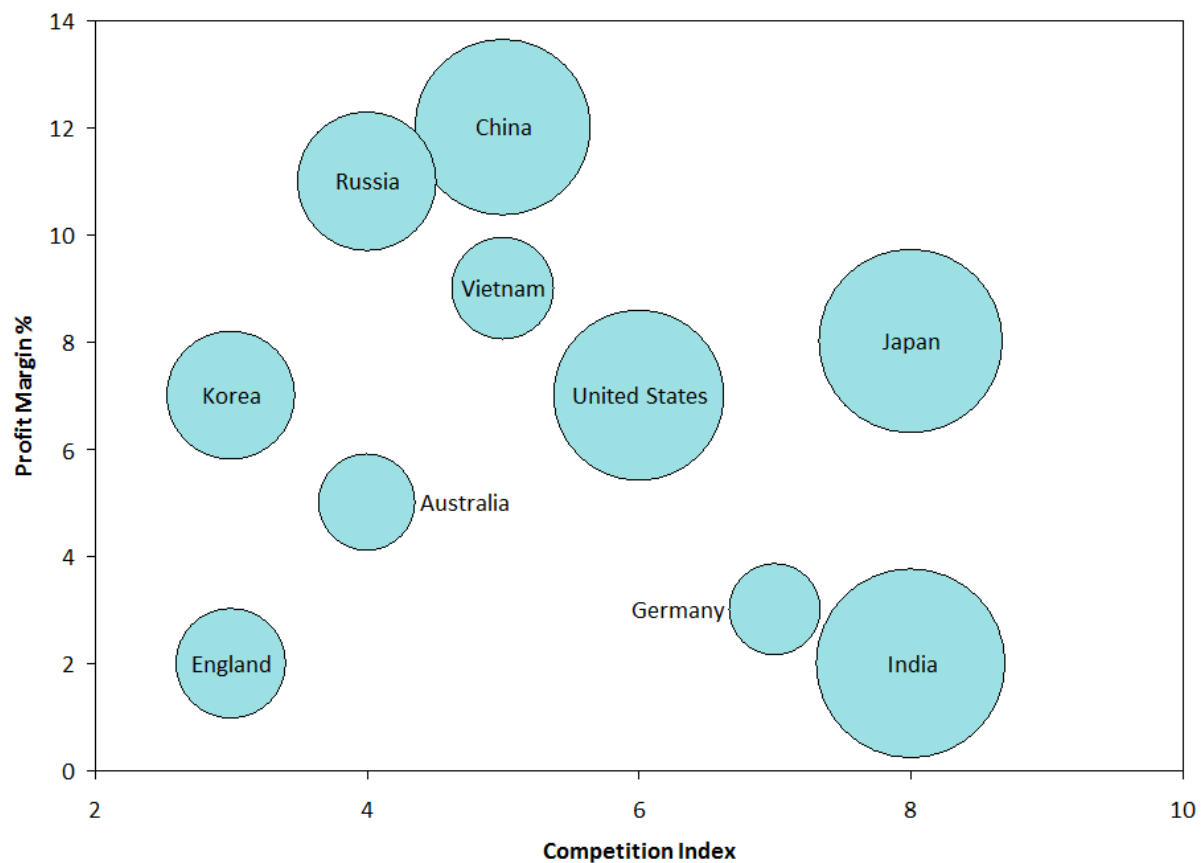
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2. Based on the data presented in Table 1 and Exhibit 1, which of the following statements is true?
- A) Revenue from Refurbishment has stayed relatively flat for the last 6 years
 - B) Revenue from Services has increased since 2010
 - C) The sales growth rate has been increasing between 2007 and 2009
 - D) The sales reduction rate has been increasing between 2009 and 2012
3. Which of the following statements, if true, best explain why the Retail line sales is negatively impacted the most by the recession?
- A) TOYO has the best-in-class refurbishment technology, which enables it to maintain the competitive quality throughout the recession
 - B) Piano vendors cut their price charged to retailers in response to the recession
 - C) People tend to cut spending in recession time by switching to lower-cost instruments like guitars, keyboards, etc.
 - D) People tend to cut spending in recession time by switching to lower-cost piano

In an effort to simplify the company geography structure, the team gathers data on various countries that TOYO has presence in to find out which market is dragging TOYO overall profitability down. Exhibit 2 maps 10 countries under consideration onto a grid which illustrates TOYO's current profit margin, competition index, and TOYO's current revenue in each country in 2012. Competition index is a measurement of how intensive competition in a market is with a higher index indicating more intensive competition. TOYO's current revenue is represented by bubbles with bigger size indicating larger revenue.

Exhibit 2

2012 TOYO Piano's Profit Margin, Competition Index, and Sales Size in the 10 Markets Under Consideration



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4. Based on the data in Exhibit 2 regarding TOYO performance and market position in various countries, which of the following is a valid conclusion?
- A) England has the worst outlook among 10 countries
 - B) Korea and United States contribute approximately the same amount to TOYO's overall profit
 - C) China contributes the most to TOYO's overall profit among 10 countries
 - D) TOYO's overall profit margin is approximately 7%
5. Which of the following statements, if true, would NOT help support an argument AGAINST exiting the India market?
- A) Many smaller competitors in India will not be able to survive through this recession
 - B) Detailed breakdown of India shows the major profitability issues lie in only the retails business line
 - C) Despite not being profitable, India is the major source of used piano for refurbished piano sold to other countries
 - D) The Managing Director clearly believes that size is harming TOYO

Hypothesizing that people tend to choose lower-cost piano during the recession time, the team decides to study the impact on refurbishment profitability. The following facts have been gathered and confirmed:

- People do choose cheaper refurbished piano during recession time
- Transportation cost is the same for all refurbished piano and is relatively not affected by the recession
- The refurbishment cost varies by piano, but generally is proportionate with the purchase cost of each piano
- To keep the premium brand image, TOYO has been keeping the selling price of each particular piano at the same level with before the recession
- The selling price varies by piano, but generally is proportionate with the purchase cost of each piano

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6. Which of the following is a valid conclusion based on the above facts?
- A) Total profit of the Refurbishment business line has been decreasing during the recession
 - B) Average total cost of each piano sold has increased during the recession
 - C) Average profit margin of pianos sold has decreased during the recession
 - D) TOYO is selling less piano during the recession

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In an attempt to cut cost for after-sales services, the team gathers information regarding various support methods:

- Whenever there is a support request from a customer, TOYO give the customer a diagnostic phone call. Sometimes the issue is resolved right away.
- Most of the time, a technician is sent to the customer's home for physical supporting. If the technician is unable to resolve the issue, a more senior sound engineer is sent.
- In some occasions, a senior sound engineer is sent directly after the diagnostic call depending on value of the piano and the complexity of the problem
- TOYO received a total of approximately 1 million support requests worldwide every year

Table 2 represents cost and share of each support method.

Table 2			
After-sales Services Methods' Cost and Frequency in 2012			
Support Method	Explanation	Cost per try (\$US)	Percent of all requests using this method (percent)
Call diagnostic	Every time when a support request is received	15	c (100)
Technician	A junior specialist is sent to the customer's home	70	t (60)
Sound Engineer	A more senior specialist is sent to the customer's home	100	s (30)

7. Which of the following figures is closest to the total worldwide cost of after-sales supporting for TOYO Piano?

- A) \$60 million
- B) \$70 million
- C) \$80 million
- D) \$90 million

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8. Which of the following equation best approximate the percentage, p , of all support requests successfully resolved through diagnostic calls?

- A) $p = c$
- B) $p = c - t - s$
- C) $p > 100 - t - s$
- D) $p < 100 - t - s$

The team decides to investigate the potential impact of a call optimization program on TOYO Piano. The program involves setting up a centralized call center in India, which will perform all support calls globally. The program also includes a capability building for the newly-organized team to increase the rate of success of the diagnostic call. Generally if a request normally needs to be escalated to the Sound Engineering level ultimately, it cannot be resolved in the diagnostic call even with the capability building program. The program will cost \$10 million.

9. What is the maximum level of requests involving technicians TOYO needs to stay at in order to make the call optimization program financially beneficial after 2 years?

- A) 45% of all requests
- B) 50% of all requests
- C) 52% of all requests
- D) 60% of all requests

* * *

THE END OF THE PRACTICE CASE!

It would be greatly appreciated if you can spend a few minutes tell us how are we doing! It will greatly help us better help future candidates like you!

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Answer Key

In this answer key, we will show the question classification and detail explanation of how and why choices are and are not correct. We will be using concepts and terminologies explained in details in <http://www.mconsultingprep.com/problem-solving-test/how-to-prepare>

1. Client Interpretation – C

Choice A, B, and D do not correct reflect the Director’s concern because of the following underlined words and phrases.

- A) *The director is concerned that TOYO’s global revenue has been decreasing and the big size does not allow TOYO to survive through the recession*
- B) *The director is concerned that TOYO’s business model is not suitable with the current recession time*
- C) *The director is concerned that the fast-changing business environment does not favor big and complex companies like TOYO*
- D) *The director is concerned that recessions will trigger problems existing within TOYO*

2. Facts Reading – D

Choice A, B, and C are not correct because of the following reasons.

- A) *Revenue from Refurbishment has stayed relatively flat for the last 6 years*
Wrong Calculation: Revenue from Refurbishment has been declining since 2010 (from \$1,523 million in 2010 down to \$1,362 million in 2012).
- B) *Revenue from Services has increased since 2010*
Mis-read Facts: You would pick this if you are unaware that the Exhibit 1 shows business lines’ size as the **percentage of TOYO sales**. The exhibit does not present size as absolute value. So even though Service share has increased since 2010, its absolute value has going down, making this choice not correct.
- C) *The sales growth rate has been increasing between 2007 and 2009*
Wrong Calculation: Sales revenue growth rate has not been increasing (7% in 2008 and 3% in 2009).
- D) *The sales reduction rate has been increasing between 2009 and 2012*
This is correct. Sales reduction rate was 14% in 2011 and 20% in 2012

3. Root-cause Problem – D

Choice A, B, and C are not correct because of the following reasons.

- A) *TOYO has the best-in-class refurbishment technology, which enables it to maintain the competitive quality throughout the recession*

Wrong subject: The question specifically asks about the Retail business line. The statement on A is relevant only when there is a clear linkage between the Retail and Refurbish lines which is not the case here.

- B) *Piano vendors cut their price charged to retailers in response to the recession*

Wrong subject: This statement talks about the **cost** side of the Retail business line when the question asked about the **revenue** side.

Wrong trend: Even if the question asks about profit (to make the subject become relevant), this statement is still wrong. Because if vendors lower their price, **positive** impact is created!

- C) *People tend to cut spending in recession time by switching to lower-cost instruments like guitars, keyboards, etc.*

Wrong subject: if people switch to lower-cost instruments, all business lines will be negatively impacted, not just only the Retail side.

- D) *People tend to cut spending in recession time by switching to lower-cost piano*

This is correct in both subject and trend. By switching to lower-cost piano, people will tend to buy refurbished pianos instead of brand new pianos. This statement logically leads to the facts that the Retail line negatively impacted the most.

4. Facts Reading – C

Choice A, B, and D are not correct because of the following reasons.

- A) *England has the worst outlook among 10 countries*

Mis-read Facts: You would pick this if you are unaware that the bottom left area of the grid is not the “bad” area in this case. The lower the Competition Index, the better outlook for the market.

- B) *Korea and United States contribute approximately the same amount to TOYO’s overall profit*

Mis-read Facts: You would pick this if you are unaware that the question asks about the absolute value for profit while the chart shows the profit margin %.

- C) *China contributes the most to TOYO’s overall profit among 10 countries*

This is correct because China is among the biggest markets (size of the bubble) and is the highest-margin market among 10 countries.

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- D) *TOYO's overall profit margin is approximately 7%*

Mis-read Facts: You would pick this if you are unaware that this grid only maps out **10 countries in consideration**. This is not a comprehensive list of all countries TOYO has business in. So even though it looks like these ten countries have an average profit margin of 7%, it cannot be logically concluded that TOYO's overall profit is 7%.

5. Root-cause Reason (Twist version) – D

Choice A, B, and C, if true, ARE arguments against exiting the India market because of the following reasons.

- A) *Many smaller competitors in India will not be able to survive through this recession*

If this is true, the competition in India will become less intensive, meaning a better outlook for the country.

- B) *Detailed breakdown of India shows the major profitability issues lie in only the retails business line*

If this is true, the profitability problem in India will become easy to isolate and fix. TOYO can just close the Retail business line instead of completely exiting the country.

- C) *Despite not being profitable, India is the major source of used piano for refurbished piano sold to other countries*

If this is true, exiting India will put a negative impact on the Refurbishment business line of TOYO overall. As said in the case introduction, “a large distribution network” is one of the two critical factors for the Refurbishment line to prosper.

- D) *The Managing Director clearly believes that size is harming TOYO*

Only in choice D, the statement, if true, would SUPPORT exiting India. As shown on the grid, India is a big market, having profitability problem in an intensive competition. If size is harming TOYO, cutting a big market like India will put a positive impact on TOYO.

6. **Fact-based Conclusion – C**

Profit margin of each piano sold has decreased during the recession

C is correct; it can be logically concluded from the provided facts. To have an as visual explanation as possible, let's set Profit TOYO gets each refurbished piano sold is PM%. Pri is Price; T is transportation cost; RC is Refurbishment Cost; PC is Purchase Cost

$$\begin{aligned}\text{PM\%} &= \text{Profit} / \text{Selling Price} \\ &= (\text{Pri} - \text{T} - \text{RC} - \text{PC}) / \text{Pri} \\ &= (\text{Pri} / \text{Pri}) - (\text{T} / \text{Pri}) - (\text{RC} / \text{Pri}) - (\text{PC} / \text{Pri})\end{aligned}$$

According to the facts, (RC / Pri) and (PC / Pri) are constant. Thus, as Pri decreases (according to a fact provided, even though price of each particular piano stays the same, people tend to choose cheaper pianos during the recession, making average Price go down), (T / Pri) increases, resulting in a decreasing PM%.

Notice: If you are good at math, no need to go through the long process as presented above. It is just for presentation purpose of show you how conclusion C is logically correct.

Choice A, B, and C cannot be logically concluded based on the provided facts.

A) *Total profit of the Refurbishment business line has been decreasing during the recession*

Un-proven: There is no fact on the number of piano sold. Even though profit margin may go down, total profit may go up if there are more pianos sold.

B) *Average total cost of each piano sold has increased during the recession*

Proven false: According to facts provided, Purchase Cost and Refurbishment Cost will decrease as Price decrease during the recession. Transportation cost stays constant. So the Total cost will decrease.

D) *TOYO is selling less piano during the recession*

Un-proven: It is not mentioned anywhere on the case about number of piano sold during recession. This is an example of a “fit-well” conclusion. It seems to fit to the fact that Total revenue is going down during the recession. However, when price decreases, number of piano sold can stay constant or slightly increase and still have overall revenue going down.

7. **Facts Reading – D**

\$90 million

	Cost per try	# of requests	Total cost
Call instruction	\$15	1,000,000	\$15,000,000
Technician	\$70	600,000	\$42,000,000
Sound Engineer	\$100	300,000	\$30,000,000
Total			\$87,000,000

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8. Formulae – C

$$p > 100 - t - s$$

Choice A, B, and D are not correct because of the following reasons.

A) $p = c$

You would pick this if you are unaware that all requests need to be called but not all of them can be successfully resolved.

B) $p = c - t - s$

You would pick this if you are unaware that some cases do require **both** technicians and sound engineer (when a technician is sent but unable to resolve the issue)

D) $p < 100 - t - s$

You would pick this if you are rushing just to get this question done. All 100% requests must be resolved (in other word, $p + t + s$ cannot < 100).

9. Word Problems – C

52% of all requests

There is more than one way to set up the equation for this question. As mentioned on our free materials online, you should set up your equation in the way that makes the most sense to you. The unknown variable in the equation is not necessarily the variable asked in the question. Below is just an example of how I would set up the equation. Let y be the number of requests normally need to be escalated to the *technician* level but now can be resolved with diagnostic calls right away in order to make the program breaks even.

Cost of the program = Benefit of the program

Cost of the program = Benefit per year * number of year

10,000,000 = $(70 * y) * 2$

y = $\sim 70,000$

From this, we can easily find out the new level of technician cases is $600,000 - 70,000 = 530,000$, approximately 53% of all requests. C is the max value not exceeding 53%.

Common mistakes that lead to choice A, B, and D:

A) *45% of all requests*

Mis-setup equation: You would pick this if you are unaware that the question asks about the 2-year timeframe.

B) *50% of all requests*

Mis-setup equation: You would pick this if you are unaware that every request needs a diagnostic call anyway.

C) *60% of all requests*

Mis-calculation (or other miscellaneous mistakes)

* * *

We hope this free practice case is helpful in your preparation for the Problem Solving Test. If you have not done so, please visit our website for free in-depth theories and practice on the Problem Solving Test (breakdown by question types).

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