The post [Factor Analysis in R with Psych Package: Measuring Consumer Involvement](https://lucidmanager.org/measuring-consumer-involvement/) appeared first on [The Lucid Manager](https://lucidmanager.org/).

The first step for anyone who wants to promote or sell something is to understand the psychology of potential customers. Getting into the minds of consumers is often problematic because measuring psychological traits is a complex task. Researchers have developed many parameters that describe our feelings, attitudes, [personality](https://lucidmanager.org/free-personality-test/) and so on. One of these measures is consumer involvement, which is a measure of the attitude people have towards a product or service.

The most common method to measure psychological traits is to ask people a battery of questions. Analysing these answers is complicated because it is difficult to relate the responses to a survey to the software of the mind. While the answers given by survey respondents are the directly measured variables, what we like to know are the hidden (latent) states in the mind of the consumer. Factor Analysis is a technique that helps to discover latent variables within a responses set of data, such as a customer survey.

The basic principle of measuring consumer attitudes is that the consumer’s state of mind causes them to respond to questions in a certain way. Factor analysis seeks to reverse this causality by looking for patterns in the responses that are indicative of the consumer’s state of mind. Using a computing analogy, factor analysis is a technique to reverse-engineer the source code by analysing the input and output.

This article introduces the concept of consumer involvement and how it can be predictive of other important marketing metrics such as service quality. An example using data from tap water consumers illustrates the theory. The data collected from these consumers is analysed using factor analysis in R, using the [psych package](https://personality-project.org/r/).

**What is Consumer Involvement?**

Involvement is a marketing metric that describes the relevance of a product or service in somebody’s life. [Judy Zaichkowsky](http://www.sfu.ca/~zaichkow/research.html) defines consumer involvement formally as “a person’s perceived relevance of the object based on inherent needs, values, and interests”. People who own a car will most likely be highly involved with purchasing and driving the vehicle due to the money involved and the social role it plays in [developing their public self](https://horizonofreason.com/first-law-of-consumer-behaviour/). Consumers will most likely have a much lower level of involvement with the instant coffee they drink than with the clothes they wear.

From a managerial point of view, involvement is crucial because it is causally related to willingness to pay and perceptions of quality.  Consumers with a higher level of involvement are willing to pay more for a service and have a more favourable perception of quality. Understanding [involvement in the context of urban water supply](https://lucidmanager.org/tap-water-involvement/) is also important because sustainably managing water as a common pool resource requires the active involvement of all users.

The level of consumer involvement depends on a complex array of factors, which are related to psychology, situational factors and the marketing mix of the service provider. The lowest level of involvement is considered a state of inertia which occurs when people habitually purchase a product without comparing alternatives.

Cult products have the highest possible level of involvement as customers are fully devoted to a particular product or brand. Commercial organisations use this knowledge to their advantage by maximising the level of consumer involvement through branding and advertising. This strategy is used effectively by the [bottled water industry](https://lucidmanager.org/bottled-water-marketing/). Manufacturers focus on enhancing the emotional aspects of their product rather than on improving the cognitive elements. Water utilities tend to use a reversed strategy and emphasise the cognitive aspects of tap water, the pipes, plants and pumps, rather than trying to create an emotional relationship with their consumers.

**Measuring Consumer Involvement**

Asking consumers directly about their level of involvement would not lead to a stable answer because each respondent will interpret the question differently. The best way to measure psychological states or psychometrics is to ask a series of questions that are linguistically related to the topic of interest.

The most cited method to measure consumer involvement in the Personal Involvement Index, developed by Judy Zaichowsky. This index is a two-dimensional scale consisting of:

* cognitive involvement (importance, relevance, meaning, value and need)
* affective involvement (involvement, fascination, appeal, excitement and interest).

The survey instrument consists of ten semantic-differential items. A Semantic Differential is a type of a rating scale designed to measure the meaning of objects, events or concepts. The concept that is being measured, such as involvement, is translated into a list of several synonyms and their associated antonyms.

In the involvement survey, participants are asked to position their views between two extremes such as Worthless and Valuable or Boring and Interesting. The level of involvement is defined as the sum of all answers, which is a number between 10 and 70.

Personal Involvement Inventory (Zaichowsky 1994).

**Exploratory Analysis**

For my dissertation about c[ustomer service in water utilities](https://lucidmanager.org/invisible-water-utility/), I measured the level of involvement that consumers have with tap water. 832 tap water consumers completed this survey in Australia and the United States.

This data set contains other information, and the code selects only those variable names starting with “*p*” (for Personal Involvement Inventory). Before any data is analysed, customers who provided the same answer to all items, or did not respond to all questions, are removed as these are most likely invalid responses., which leaves 757 rows of data.

A boxplot is a convenient way to view the responses to multiple survey items in one visualisation. This plot immediately shows an interesting pattern in the answers. It seems that responses to the first five items were generally higher than those for the last five items. This result seems to indicate a demarcation between cognitive and affective involvement.

Responses to Personal Involvement Index by tap water consumers.

Next step in the exploratory analysis is to investigate how these factors correlate with each other. The correlation plot below shows that all items strongly correlate with each other. In correspondence with the boxplots above, the first five and the last five items correlate more strongly with each other. This plot suggests that the two dimensions of the involvement index correlate with each other.

Correlation matrix for the Personal Involvement Index

**Factor Analysis in R**

Factor Analysis is often confused with Principal Component Analysis because the outcomes of are very similar when applied to the same data set. Both methods are similar but have a different purpose. Principal Component Analysis is a data-reduction technique that serves to reduce the number of variables in a problem. The specific purpose of Factor Analysis is to uncover latent variables. The mathematical principles for both techniques are similar, but not the same and should not be confused.

One of the most important decisions in factor analysis is to decide how to rotate the factors. There are two types: orthogonal or oblique. In simple terms, orthogonal rotations seek to reduce the correlation between dimensions and oblique rotation allow for dimensions to relate to each other. Given the strong correlations in the correlation plot and the fact that both dimensions measure involvement, this analysis uses oblique rotation. The visualisation below shows how each of the items how, and the two dimensions relate to each other.

Factor analysis in R with Psych package.

This simple exploratory analysis shows the basic principle of how to analyse psychometric data. The psych package has a lot more specialised tools to dig deeper into the information. This article has not assessed the validity of this construct, or evaluated the reliability of the factors. Perhaps that is for a future article.

**The R Code**

You can view the code below. Go to my [Github Repository](https://github.com/pprevos/r.prevos.net/tree/master/Marketing) to see the code and the data source.

## ConsumerInvolvement.R

library(tidyverse)

library(psych)

consumers <- read\_csv("customers\_quan.csv") %>%

select(starts\_with("p"))

dim(consumers)

## Data clesaning

sdevs <- apply(consumers, 1, sd, na.rm = TRUE)

incomplete <- apply(consumers, 1, function(i) any(is.na(i)))

consumers <- consumers[sdevs != 0 & !incomplete, ]

dim(consumers)

## Exploratory Analysis

consumers %>%

rownames\_to\_column(var = "Subject") %>%

gather(Item, Response, -Subject) %>%

ggplot(aes(Item, Response)) + geom\_boxplot(fill = "#f7941d") +

ggtitle("personal Involvement Index",

subtitle = paste("Tap Water Consumers USA and Australia (n =",

nrow(consumers), ")"))

ggsave("involvement\_explore.png", dpi = 300)

png("involvement\_correlation.png", width = 1024, height = 1024)

corPlot(consumers)

dev.off()

piiFac <- fa(consumers, nfactors = 2, rotate = "oblimin")

png("involvement\_factors.png", width = 1024, height = 768)

fa.diagram(piiFac)

dev.off()