# Financial and Operational Cost Barriers to E-Government Systems:

## Evidence from Afghanistan

DSE 200X: Final Project Presentation

Email Ismail

# Abstract

This research aims to identify the financial or operational cost barriers facing the E-Gov systems in Afghanistan. Accordingly, an empirical study was conducted using statistical and descriptive analysis research methods to determine the existing operational cost barriers. This study takes as its sample a total of 387 employees from 10 different government institutions in Afghanistan. The final results of the descriptive analysis indicated that respondents agreed on the existence of one operational cost barrier and expressed their partial agreement on the remaining two. Moreover, the inferential analysis of the spearman correlation showed a moderate positive dependency between desired survey items, meaning that the existence of one barrier could influence the other two and vice-versa.

# Motivation

Electronic Government (E-Gov) refers to the systems of information communication technologies governments use to deliver public services. The e-Gov adoption rate is increasing rapidly in developing countries, promoting good governance and accountability within the public sector [1]. Moreover, evidence shows that E-Gov can facilitate the delivery mechanisms needed by citizens and stakeholders in a streamlined, efficient and cost-effective manner, making it an ideal solution for developing countries such as Afghanistan [2]. While developed countries compete to offer advanced E-Gov services, many developing countries find themselves unable to gain the fundamental advantages of E-Gov.

Lack of financial resources is considered a significant obstacle to the implementation and mangement of e-government in many countries. Consequently, to successfully implement the e-gov initiative, it's essential to ensure the availability of budgetary resources. [3] The cost of installation, operation, and maintenance of the E-Gov system, the cost of training, IT professional and consultants, and the shortage of financial resources in the public sector is considered significant operational cost barriers to e-Gov system implementation. [4]

The financial availability of most e-Government projects in developing countries depends on monetary aid from international organizations such as the United Nations and other agencies of developed countries. This type of provision is unsustainable and makes the implementation processes of e-Government initiatives vulnerable to failure, especially when funding from these donors ends. [5] Understanding the financial barriers to E-Gov systems in developing countries is of utmost necessity. Hence, the current research project focus on finding the operational cost and financial barriers of E-Gov systems in the developing country of Afghanistan. The information and results of this paper may assist the Ministry of Information and Communication Technology, National Statistics and Information Authority, Ministry of Finance and other government institutions of Afghanistan involved in the management, development, and implementation of E-Gov systems.

# Dataset

The data was collected between the year 2018 to 2019 by the Office of the Chief Executive of Afghanistan's (OCE), Prevention of Corruption and System Development Unit in collaboration with the American University of Afghanistan's (AUAF) - Science, Technology, and Mathematics Division (STM). [6]

The data is collected from 387 government employees, chosen as participants randomly from the Office of the Chief Executive, Ministry of Justice, Ministry of Economy, Ministry of Agriculture, Ministry of Defense, Ministry of Energy and Water, Ministry of Foreign Affairs, Ministry of Finance, Supreme Audit Office, and Academy of Science government institutions of Afghanistan. Furthermore, the government employees who responded to the questionnaire held Senior to Junior positions.

As the data collection method, a survey questionnaire was set up for this project, grounded on a comprehensive literature review and the study of definitions. A final set of 32 items was designed for the questionnaire and organized according to the five major types of E-Gov barriers. In the interest of comprehension, the questionnaire was presented in both English and Dari languages. The resulting final questionnaire was divided into six sections: questions of demographics, strategy, policy and legal barriers, technological and IT infrastructure barriers, organizational and cultural barriers, and operational cost barriers of E-Gov implementation in Afghanistan. The mentioned categories contain a total of 32 variables; however, this research project deals explicitly with the three survey items related to operational cost barriers.

***Note. A detailed description of dataset's categories and variables have been provided within the Juypter Notebook pdf at the end of this presentation.***

# Data Preparation and Cleaning

As the data collection method, a survey questionnaire was set up for this project, grounded on a comprehensive literature review and the study of definitions. A final set of 32 items was designed for the questionnaire. The final questionnaire was divided into six sections: demographics, barriers to strategy, policy and legal obstacles, technological and IT infrastructure barriers, organizational and cultural barriers, and operational cost barriers to E-Gov implementation in Afghanistan.

Since this research project only focuses on the three operational cost items, the Pandas library of Python was used to select the desired variables (OPC1, OPC2, OPC3) from the data frame.

Furthermore, the mentioned columns contained null values; hence, to avoid underestimating individual scores, the missing values have been handled through item mean substitution (IMS). IMS effectively represents the original data if the missing values are equal to or less than 20%, making it the ideal imputation technique for our dataset. Consequently, to substitute and fill the null values with the mean of each desired column, Python's Scikit-learn library SimpleImputer object has been used.

# Research Question(s)

This research project aims to answer the following question:

What are financial/operational cost barriers to E-Government/public information systems implementation in context of the developing country of Afghanistan?

# Methods

In order to present the analysis and findings of this research project with clarity and immediacy, descriptive and inferential statistical methods have been used. Furthermore, the descriptive and inferential statistical analyses have been analyzed and visualized using the Python programming language within the Jupyter Notebook, a web-based interactive computing platform.

Specifically, for the analysis, imputation, and visualization of desired variables, Pandas, Numpy, Scikit-Learn, Matplotlib, and Seaborn Python libraries have been used. The inferential analysis used the Spearman Rank correlation, a Python programming language built-in correlation (corr) function's Spearman method, to analyze the correlation between the variables of interest. Spearman rank correlation is often used when the same rank is repeated multiple times in a small dataset, such as Likert scale survey values. Hence, it is the ideal method for the current research project as we are working with the Likert Scale dataset [10].

# Findings

Based on the existing literature, the costs of developing, implementing, and maintaining e-government services can be critical constraints on innovation. [7] Moreover, among several issues of information communication technology (ICT) infrastructure, operational cost and maintenance of e-government initiatives are particularly critical against e-government systems. [8]

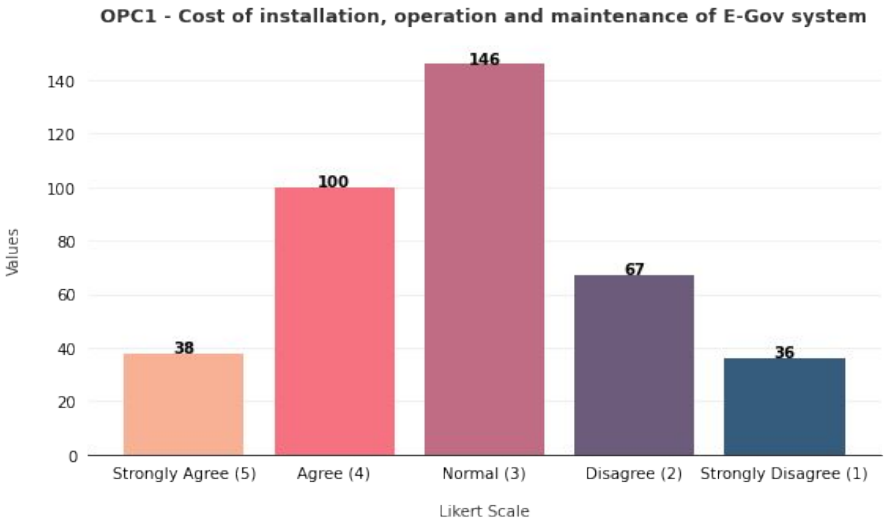


Figure 1. Frequency of responses to the question of “Cost of installation, operation and maintenance of E-Gov systems” as an operational cost barrier to E-Gov in Afghanistan.

As shown in figure-1, out of 387 participants in our survey, 146 were neutral in their opinion, 38 expressed their strong agreement, and 100 agreed, with only 36 stating their strong disagreement and 67 disagreeing on the subject. There seems to be a balance between the survey participant's responses. However, the participants slightly leaned towards the agree side of Likert when expressing their opinion on the cost of installation, operation and maintenance of the E-Gov system' as an operational cost barrier to E-Gov in Afghanistan. Therefore, we can conclude that the responses obtained for this survey item are not entirely aligned with the existing literature, which shows cost of training, IT professional and consultants as a significant barrier to the E-Gov in other similar countries. Ultimately, coming to our research question cost of installation, operation and maintenance of E-Gov systems could be a moderate operational cost barrier to E-Gov systems in Afghanistan.

Based on the existing literature, apart from ICT infrastructure, training, education, and setup cost of e-government initiatives are considered among barriers that require a high level of investment. Moreover, knowledge, investment, and training are regarded as the key barriers against e-gov systems and projects. [9] To this end, most of the survey participants leaned towards the Agree side of the Likert when expressing their opinion on the cost of training, IT professionals and Consultants as an operational cost barrier to E-Gov in Afghanistan.

Hence, the responses obtained align with this existing literature, which shows the cost of training, IT professionals and consultants as a significant barrier to the E-Gov projects/system in other similar countries.

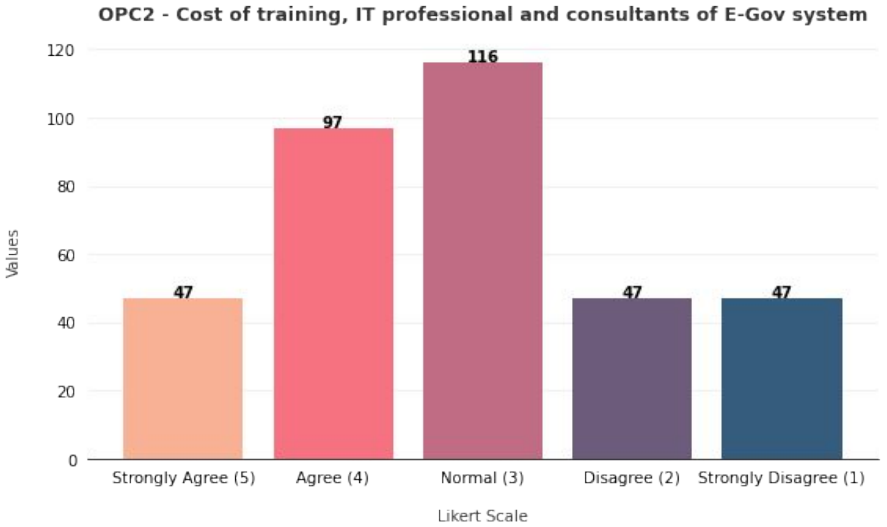


Figure 2. Frequency of responses to the question of “cost of training, IT professionals and consultants of E-Gov systems” as an operational cost barrier to E-Gov in Afghanistan.

As shown in figure 2, out of 387 participants in our survey, 116 were neutral in their opinion, 47 expressed their strong agreement, and 97 agreed, with only 47 stating their strong disagreement and 47 disagreeing on the subject. There is a stark difference in the number of participants on the polar opposite side of the Likert. Therefore, to answer the research question, this difference simply illustrates that there is an agreement on the cost of training, IT professionals and consultants being a barrier to E-Gov projects/systems in Afghanistan.

As previously mentioned, lack of financial resources and funding in the context of developing countries is considered among the challenges facing e-government system implementations. [9] The financial availability of most e-Government projects in developing countries depends on monetary aid from international organizations such as the United Nations and other agencies of developed countries. This type of provision is unsustainable and makes the implementation processes of e-Government initiatives vulnerable to failure, especially when funding from these donors ends. [5]

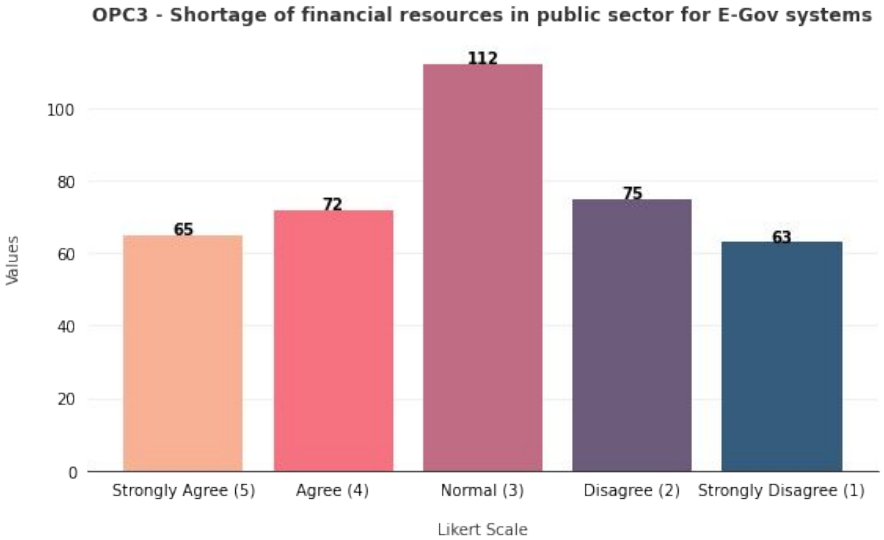


Figure 3. Frequency of responses to the question of “shortage of financial resources in public sector for E-Gov systems” as an operational cost barrier to E-Gov in Afghanistan.

As shown in figure 3, out of 387 participants in our survey, 112 were neutral in their opinion, 65 expressed their strong agreement, and 72 agreed, with 63 stating their strong disagreement and 75 disagreeing on the subject. There also seems to be a balance between the survey participant's responses. And the participants equally leaned towards both sides of the Likert when expressing their opinion on the shortage of financial resources in the public sector for the E-Gov system' as an operational cost barrier in Afghanistan. Therefore, we can conclude that the responses obtained are not aligned with the existing literature, which shows the shortage of financial resources in the public sector as a significant barrier to the E-Gov in other similar countries.

## Findings - Spearman Correlation Analysis

Spearman rank correlation is a statistical method to analyze the linear relationship between the strategy, policy, and legal barriers in Likert scale variables. This method elaborates on any significant correlation between the variables. The correlation between the two variables is signified by the letter P and measured with a number, which differs between -1 and +1. Zero means there is no correlation, whereas 1 indicates a complete or perfect correlation. The sign P shows the direction of the correlation. A negative P implies that the variables are inversely related. The strength of the correlation increases from 0 to +1 and 0 to -1. Spearman rank correlation is often used when the same rank is repeated multiple times in a small dataset, such as Likert scale survey values [10].

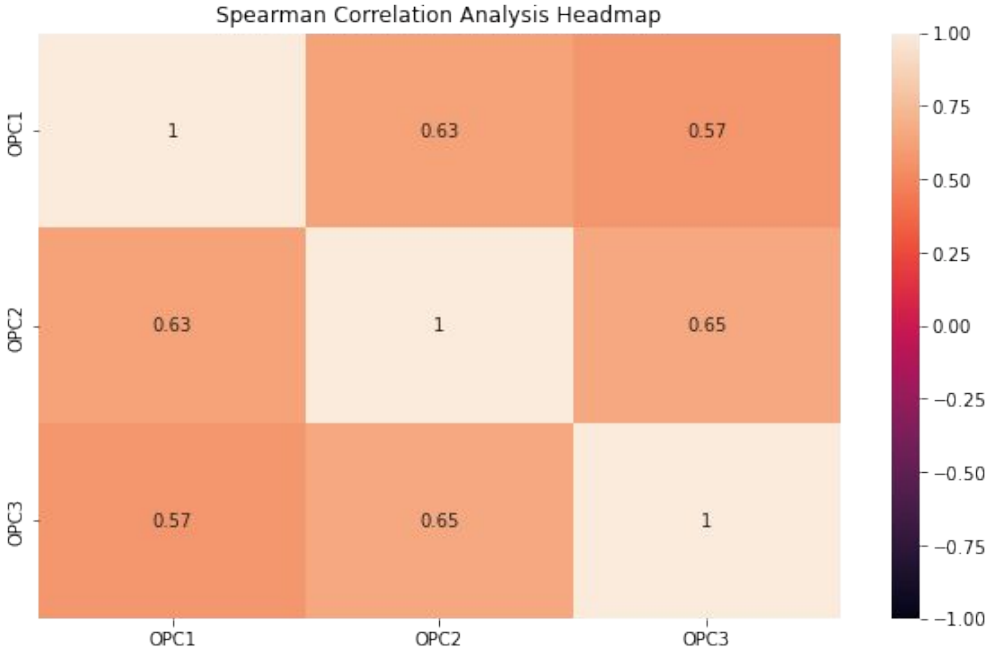


Figure 4. Spearman Rank Correlation Heatmap.

As shown in Figure 4, most variables have a moderate positive correlation. Survey item OPC3 - shortage of financial resources in the public sector for E-Gov projects has a positive relationship (0.57, 0.65) with survey items OPC1 - the cost of installation, operation and maintenance of E-Gov systems, and OPC2 - cost of training, IT professional and consultants, meaning there is a tandem dependency between the mentioned variables. Hence, in simple terms, we can conclude that the shortage of financial resources in the public sector for E-Gov projects will lead to financial issues for the cost of installation, operation and maintenance of E-Gov systems. Similarly, it will also limit financial resources for the cost of training, IT professionals and consultants. Since we have a positive correlation, the impact will also be vice-versa. A decreased shortage of financial resources or having enough financial resources will solve the financial issues of operation and maintenance of E-Gov systems and training IT professionals and consultants.

# Limitations

The first limitation of the current project is that the data was collected between 2018 and 2019, during the previous regime of the Afghan Government when the country had the ultimate support of the international community in the Information Technology sector. However, after august 2021, the international community support is solely focused on humanitarian aid, and the country is facing economic collapse. In conclusion, the current data might not be the best representation of the current financial status of the E-Gov sector in Afghanistan.

The other limitation of the current research project relevant to the dataset is that all 387 survey respondents from 10 different government institutions were limited to the geographical boundary of Kabul, the capital of Afghanistan. However, future projects of a similar kind can be expanded to include participants from other provinces of Afghanistan as well.

The absence of previously existing E-Gov literature in Afghanistan was one of the main limitations of this project while conducting the literature review. Therefore, although this paper's findings will only fill a fraction of the knowledge gap, still further research is required in this area.

Furthermore, since the respondents were selected randomly, the lack of sufficient expertise among respondents appeared to be another limitation. Therefore, future studies should only include individuals with on-ground knowledge and adequate expertise in the field of Information Communication Technology and E-Gov in particular.

# Conclusions

As it's evident from the research question, this research aims to identify the financial or operational cost barriers facing the E-Government systems in Afghanistan. Accordingly, an empirical study was conducted using both the inferential and descriptive statistical analysis research methods to determine the existing operational cost barriers. This study takes as its sample a total of 387 employees from 10 different government institutions in Afghanistan. The final results of the descriptive analysis indicated that respondents agreed on the existence of one operational cost barrier and expressed their partial agreement on the remaining two barriers listed in the survey. Moreover, the inferential analysis of the spearman correlation showed a moderate positive dependency between survey item OPC3 (shortage of financial resources in the public sector), with survey items OPC1 (the cost of installation, operation and maintenance of E-Gov systems) and OPC2 (cost of training, IT professional and consultants). This relationship means that one barrier could influence the other two and vice-versa. Ultimately, the findings of this research contribute towards filling the knowledge gap of the E-Gov sector financial or operational cost barriers.

Based on the current study of the operational cost barriers facing E-Gov in Afghanistan, the Information Technology public sector needs to become aware of the existing obstacles. The information and results of this paper may assist the Ministry of Information and Communication Technology, National Statistics Authority and ministry of Finance of Afghannistan.

# Acknowledgements

I would like to express my gratitude to the Office of the Chief Executive of Afghanistan’s - Prevention of Corruption and System Development Unit members and Science, Technology and Mathemtics Division of the American University of Afghanistan for taking their time and collecting the dataset.

# References


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In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.impute import SimpleImputer # For filling the null values
import seaborn as sns # For heatmaps of Spearman Correlation
```

In [2]:

```
df = pd.read_csv('./AFG E-Gov Barriers Data.csv')
```

In [3]:

```
df.columns
```

Out[3]:

```
Index(['NO', 'Gender', 'Age', 'Government Organization', 'Education',
       'Position', 'St1', 'St2', 'St3', 'St4', 'St5', 'St6', 'TI1', 'T
I2',
       'TI3', 'TI4', 'TI5', 'TI6', 'TI7', 'TI8', 'TI9', 'PL1', 'PL2',
'PL3',
       'PL4', 'PL5', 'OC1', 'OC2', 'OC3', 'OC4', 'OC5', 'OC6', 'OC7',
'OC8',
       'OC9', 'OPC1', 'OPC2', 'OPC3'],
      dtype='object')
```

The dataset and survey questionnaire is grounded on a comprehensive literature review and the study of definitions. A final set of 32 items was designed for the questionnaire and organized according to the five major types of E-Gov barrier. In the interest of comprehension, the questionnaire was presented in both English and Dari, with a pilot study being deployed among 35 respondents to validate the clarity and comprehensibility of the survey questions. Respondents were also asked for their opinions on the degree to which the questionnaire items were explicit and the degree to which they were appropriate to determine the aspects for which they were intended. Furthermore, Correlation Analysis (Pearson) has been deployed as well, where we check If Sig. < 0,05 D valid, If Sig. > 0,05 D not valid and delete the survey items. In line with the answers of respondents to the pilot study, all survey items were validated and were thus retained for the final study. The resulting final questionnaire was separated into six sections: questions of demographics, barriers to strategy, policy and legal barriers, technological and IT infrastructure barriers, organizational and cultural barriers, and operational cost barriers of E-Gov implementation in Afghanistan.

Each row, or sample, consists of the following variables:

**The first section contains five demographic and profile characteristics:**

- **Gender:** Gender of survey participant
- **Age:** Age of survey participant
- **Organization:** afliate organization (all were public sector government institutions)
- **Education:** Survey participants level of education (e.g. Diploma, Bachelor, Master, PhD)
- **Position:** Survey participant job title or position within the public sector organization

**Strategy (St) Barriers to E-Gov in Afghanistan:**

- **St1:** Absence of implementation guidance
- **St2:** Unclear vision and management strategy

- **St3:** Over-ambitious E-Gov milestones
- **St4:** Lack of shared E-Gov goals and objectives
- **St5:** Lack of ownership and governance
- **St6:** Funding issues and centralization of funding for government agencies

**Technological & IT infrastructure (TI) Barriers to E-Gov in Afghanistan:**

- **TI1:** Lack of architecture interoperability and systems integration
- **TI2:** Different security models
- **TI3:** Inflexibility of legacy systems
- **TI4:** Incompatible of technical and data standards
- **TI5:** Privacy and security issues such as online theft and fraud
- **TI6:** Shortage of reliable networks and low bandwidth
- **TI7:** Inadequate security of government hardware and software
- **TI8:** Unauthorized external and internal access to information system
- **TI9:** Lack of open source software and standards

**Policy & legal (PL) Barriers to E-Gov in Afghanistan:**

- **PL1:** Lack of legal bases and comprehensive policy
- **PL2:** Lack of security rules, policies and privacy law
- **PL3:** Data ownership conflicts
- **PL4:** Lack of political commitment and coordination
- **PL5:** Digital divide

**Organizational & cultural (OC) Barriers to E-Gov in Afghanistan:**

- **OC1:** Lack of relevant in-house management and IT skills
- **OC2:** Complexity of reengineering government processes and procedures
- **OC3:** Lack of knowledge for security risks
- **OC4:** Slow pace of government reform
- **OC5:** Lack of agency readiness
- **OC6:** Lack of cooperation and coordination between government agencies
- **OC7:** Lack of effective leadership support
- **OC8:** Pervasive corruption in government entities
- **OC9:** Resistance to change

**Operational Cost (OPC) Barriers to E-Gov in Afghanistan:**

- **OPC1:** Cost of installation, operation and maintenance of E-Gov system
- **OPC2:** Cost of training, IT professional and consultants
- **OPC3:** Shortage of financial resources in public sector

In [4]:

```
df.head(10)
```

Out[4]:

| | NO | Gender | Age | Government Organization | Education | Position | St1 | St2 | St3 | St4 | ... | OC3 | OC4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | Male | 31-40 | Ministry of Justice | N.A. | Director | 5 | 5 | 5 | 4 | ... | 5 | 4 |
| **1** | 2 | Male | 31-40 | Ministry of Justice | Bachelor | Head of Supervision | 5 | 4 | 4 | 4 | ... | 3 | 3 |
| **2** | 3 | Female | 31-40 | Ministry of Justice | Bachelor | Technical Expert | 5 | 5 | 4 | 4 | ... | 4 | 4 |
| **3** | 4 | Female | 32-41 | Ministry of Justice | Bachelor | Officer of Human Rights | 4 | 3 | 4 | 4 | ... | 3 | 3 |
| **4** | 5 | Female | N.A. | Ministry of Justice | Bachelor | Executive Director | 4 | 3 | 2 | 4 | ... | 4 | 3 |
| **5** | 6 | Male | 21-30 | Ministry of Justice | Master | Member of Civil Audit Directorate | 4 | 2 | 4 | 4 | ... | 4 | 4 |
| **6** | 7 | Female | 31-40 | Ministry of Justice | PhD | Director | 4 | 3 | 4 | 5 | ... | 4 | 4 |
| **7** | 8 | Female | 31-40 | Ministry of Justice | PhD | Member of Provincial Oversight | 3 | 4 | 4 | 5 | ... | 2 | 2 |
| **8** | 9 | Male | 31-40 | Ministry of Justice | Bachelor | Member of Secretariat | 4 | 3 | 3 | 4 | ... | 3 | 4 |
| **9** | 10 | Female | Above 41 | Ministry of Justice | Bachelor | Member of Civil Right | 4 | 1 | 2 | 4 | ... | 3 | 3 |

10 rows × 38 columns

***Selecting the colunms relevant to the financial barriers of E-Government/public information system implemenation in Afghanistan.***

**Operational Cost (OPC) Barriers to E-Gov in Afghanistan:**

- **OPC1:** Cost of installation, operation and maintenance of E-Gov system
- **OPC2:** Cost of training, IT professional and consultants
- **OPC3:** Shortage of financial resources in public sector

In [5]:

```
#Selecting the colunms relevant to the financial barriers of
#E-Government/public information system implemenation in Afghanistan.
data = df[['OPC1','OPC2','OPC3']]
```

In [6]:

```
data.head()
```

Out[6]:

| | OPC1 | OPC2 | OPC3 |
|---|---|---|---|
| **0** | 5.0 | 3 | 4 |
| **1** | 5.0 | 4 | 5 |
| **2** | 4.0 | 4 | 5 |
| **3** | 4.0 | 4 | 4 |
| **4** | 3.0 | 2 | 2 |

In [7]:

```
#finding null values within the relevant colunms of our dataset.
```

In [8]:

```
bool_series_OPC1 = pd.isnull(data["OPC1"])
```

In [9]:

```
data[bool_series_OPC1]
```

Out[9]:

| | OPC1 | OPC2 | OPC3 |
|---|---|---|---|
| **108** | NaN | 1 | 1 |
| **235** | NaN | 4 | 5 |
| **378** | NaN | 5 | 3 |

In [10]:

```
bool_series_OPC2 = pd.isnull(data["OPC2"])
```

In [11]:

```
data[bool_series_OPC2]
```

Out[11]:

| | OPC1 | OPC2 | OPC3 |
|---|---|---|---|

In [12]:

```
bool_series_OPC3 = pd.isnull(data["OPC3"])
```

In [13]:

```
data[bool_series_OPC3]
```

Out[13]:

| | OPC1 | OPC2 | OPC3 |
|---|---|---|---|

To avoid underestimation of individual scores, the missing values have been handled through item mean substitution (IMS). IMS is an effective representation of the original data if the missing values are equal to or less than 20%, which makes it the ideal imputation technique for our dataset, and clearly based on the above boolean series, missing values are below 12%.

To fill the null values with mean of each colunms scikit learn's library SimpleImputer object has been used.

In [14]:

```
#we first initialize an instance of the SimpleImputer class by indicating the strate
#(mean) as well as specifying the missing values that you want to locate (np.nan).

imputer = SimpleImputer(strategy='mean', missing_values=np.nan)

#Once the instance is created, you use the fit() function to fit the imputer on the
#we want to work on.

imputer = imputer.fit(data[['OPC1']])

#now we use the transform() function to fill the missing values based on the
#strategy you specified in the initializer of the SimpleImputer class.

data['OPC1'] = imputer.transform(data[['OPC1']])
```

```
/var/folders/88/vlrz89sn15jdmcdgfjsnyvjw0000gn/T/ipykernel_85806/20675
52833.py:14: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas
-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
 (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.htm
l#returning-a-view-versus-a-copy)
  data['OPC1'] = imputer.transform(data[['OPC1']])
```

In [15]:

```
#Making sure that our data doesn't contain any null values:
data.isnull().any()
```

Out[15]:

```
OPC1    False
OPC2    False
OPC3    False
dtype: bool
```

Now to avoid the confusion since we are working with likerat scale variables, we will convert all columns from float and int to only integar (int) data type:

In [16]:

```
data = data.astype(int)
```

In [17]:

```
data.head()
```

Out[17]:

| | OPC1 | OPC2 | OPC3 |
|---|---|---|---|
| **0** | 5 | 3 | 4 |
| **1** | 5 | 4 | 5 |
| **2** | 4 | 4 | 5 |
| **3** | 4 | 4 | 4 |
| **4** | 3 | 2 | 2 |

It's Worth Mentioning that, The survey instrument of the current data was developed using items adopted from previous studies mainly from 'IS success model'.

**Hence, the participants were asked to indicate how frequently each statement fits them using 5-Point Likert Scale, wherein 1 indicates Strongly Disagree, 2 Disagree, 3 Normal, 4 Agree, with 5 indicating Strongly Agree.**

Participant's frequency of responses on the quesiton: St6 / Funding issues and centralization of funding for government agencies, as strategy barrier to E-Gov in Afghanistan.

**(5) Strongly Agree = 90 / (4) Agree = 116 / (3) Normal = 106 / (2) Disagree = 59 / (1) Strongly Disagree = 16**

In [18]:

```
OPC1_data = data['OPC1'].value_counts()
df_OPC1 = pd.DataFrame(OPC1_data)
df_OPC1.head()
```

Out[18]:

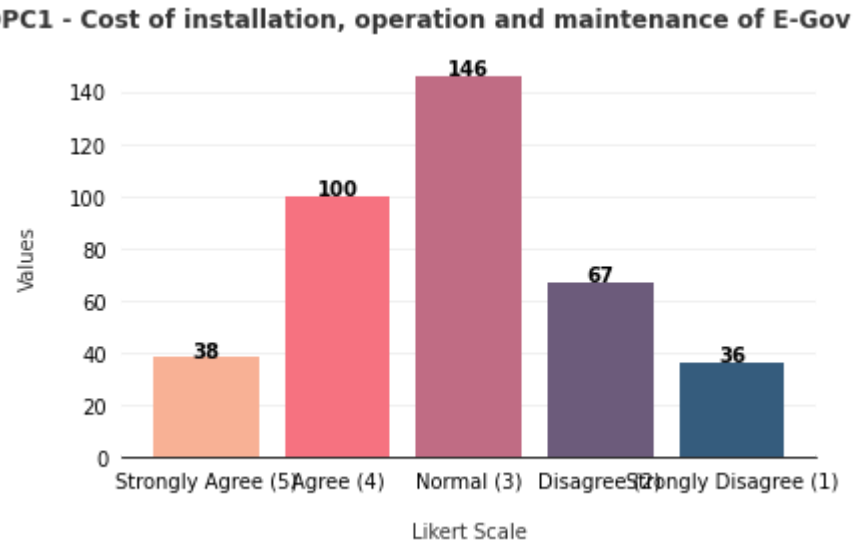
| | OPC1 |
|---|---|
| **3** | 146 |
| **4** | 100 |
| **2** | 67 |
| **5** | 38 |
| **1** | 36 |

Participant's frequency of responses on the quesiton: OPC1 / Cost of installation, operation and maintenance of E-Gov system, as an operational cost barrier to E-Gov in Afghanistan.

**(5) Strongly Agree = 38 / (4) Agree = 100 / (3) Normal = 146 / (2) Disagree = 67 / (1) Strongly Disagree = 36**

In [19]:

```
x=['Strongly Agree (5)','Agree (4)','Normal (3)','Disagree (2)','Strongly Disagree (
y=[38,100,146,67,36]

fig, ax = plt.subplots()
# Set default figure size.
plt.rcParams['figure.figsize'] = (8, 5)



bars = plt.bar(x,y,color=['#F8B195', '#F67280', '#C06C84', '#6C5B7B', '#355C7D'])

#plt.xticks(rotation=0)


# Here we remove the top, right and left spines (figure borders)
# which really aren't necessary for a bar chart, except for bottom
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
ax.spines['left'].set_visible(False)
ax.spines['bottom'].set_visible(True)
#---------------------------------------
# Second, remove the ticks as well.
ax.tick_params(bottom=False, left=False)
#---------------------------------------
# Third, add a horizontal grid (but keep the vertical grid hidden).
# Color the lines a light gray as well.
ax.set_axisbelow(True)
ax.yaxis.grid(True, color='#EEEEEE')
ax.xaxis.grid(False)
#-----------------------------------
# Add text annotations to the top of the bars.
# Note, you'll have to adjust this slightly (the 0.3)
# with different data.
for bar in bars:
  ax.text(
      bar.get_x() + bar.get_width() / 2,
      bar.get_height() + 0.3,
      round(bar.get_height(), 1),
      horizontalalignment='center',
      weight='bold'
  )

# Add labels and a title. Note the use of `labelpad` and `pad` to add some
# extra space between the text and the tick labels.
ax.set_xlabel('Likert Scale', labelpad=15, color='#333333')
ax.set_ylabel('Values', labelpad=15, color='#333333')
ax.set_title('OPC1 - Cost of installation, operation and maintenance of E-Gov system
             weight='bold')


fig.tight_layout()
```




In [20]:

```
OPC2_data = data['OPC2'].value_counts()
df_OPC2 = pd.DataFrame(OPC2_data)
df_OPC2.head()
```

Out[20]:

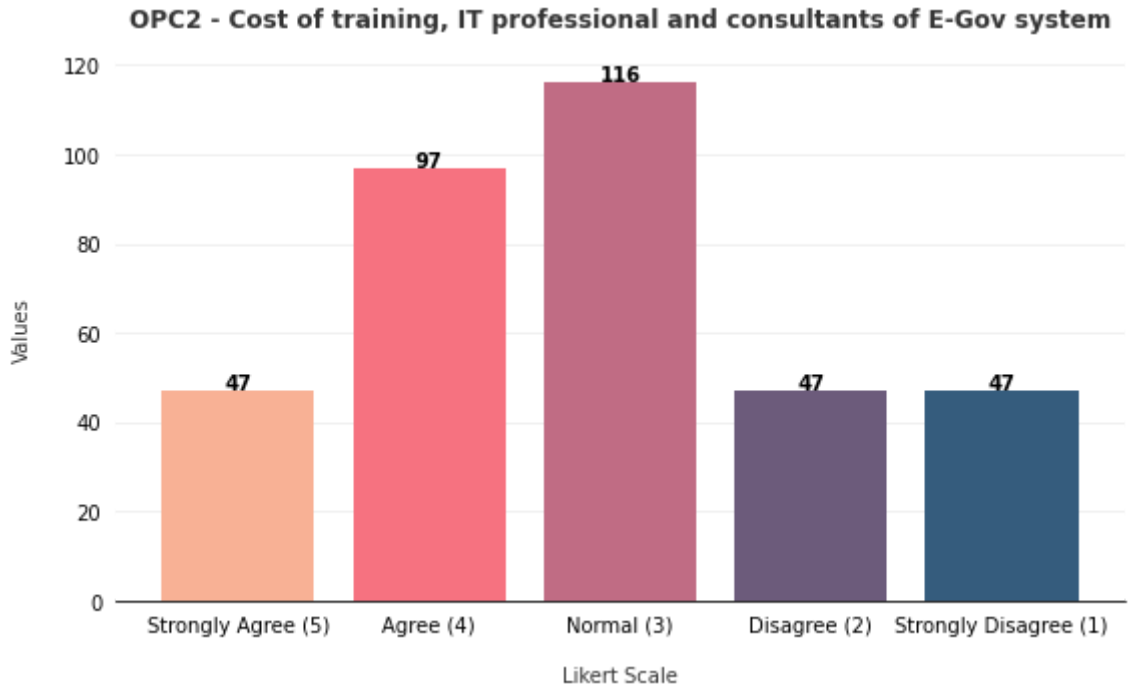
| | OPC2 |
|---|---|
| **3** | 116 |
| **4** | 97 |
| **2** | 80 |
| **5** | 47 |
| **1** | 47 |

Participant's frequency of responses on the quesiton: OPC2 / Cost of training, IT professional and consultants of E-Gov system as an operational cost barrier to E-Gov in Afghanistan.

**(5) Strongly Agree = 47 / (4) Agree = 97 / (3) Normal = 116 / (2) Disagree = 47 / (1) Strongly Disagree = 47**

In [21]:

```
x=['Strongly Agree (5)','Agree (4)','Normal (3)','Disagree (2)','Strongly Disagree (
y=[47,97,116,47,47]

fig, ax = plt.subplots()
# Set default figure size.
plt.rcParams['figure.figsize'] = (8, 5)



bars = plt.bar(x,y,color=['#F8B195', '#F67280', '#C06C84', '#6C5B7B', '#355C7D'])

#plt.xticks(rotation=0)


# Here we remove the top, right and left spines (figure borders)
# which really aren't necessary for a bar chart, except for bottom
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
ax.spines['left'].set_visible(False)
ax.spines['bottom'].set_visible(True)
#---------------------------------------
# Second, remove the ticks as well.
ax.tick_params(bottom=False, left=False)
#---------------------------------------
# Third, add a horizontal grid (but keep the vertical grid hidden).
# Color the lines a light gray as well.
ax.set_axisbelow(True)
ax.yaxis.grid(True, color='#EEEEEE')
ax.xaxis.grid(False)
#-----------------------------------
# Add text annotations to the top of the bars.
# Note, you'll have to adjust this slightly (the 0.3)
# with different data.
for bar in bars:
  ax.text(
      bar.get_x() + bar.get_width() / 2,
      bar.get_height() + 0.3,
      round(bar.get_height(), 1),
      horizontalalignment='center',
      weight='bold'
  )

# Add labels and a title. Note the use of `labelpad` and `pad` to add some
# extra space between the text and the tick labels.
ax.set_xlabel('Likert Scale', labelpad=15, color='#333333')
ax.set_ylabel('Values', labelpad=15, color='#333333')
ax.set_title('OPC2 - Cost of training, IT professional and consultants of E-Gov syst
             weight='bold')


fig.tight_layout()
```




In [22]:

```
OPC3_data = data['OPC3'].value_counts()
df_OPC3 = pd.DataFrame(OPC3_data)
df_OPC3.head()
```

Out[22]:

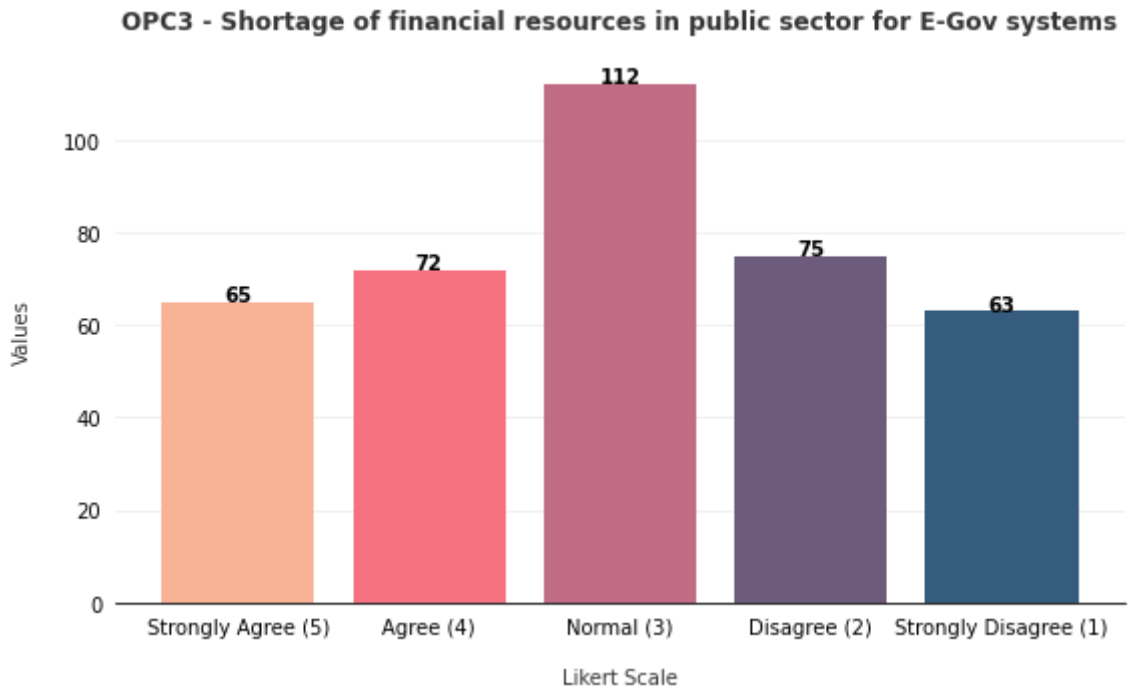
| | OPC3 |
|---|---|
| **3** | 112 |
| **2** | 75 |
| **4** | 72 |
| **5** | 65 |
| **1** | 63 |

Participant's frequency of responses on the quesiton: OPC3 / Shortage of financial resources in public sector for E-Gov systems as an operational cost barrier to E-Gov in Afghanistan.

**(5) Strongly Agree = 65 / (4) Agree = 72 / (3) Normal = 112 / (2) Disagree = 75 / (1) Strongly Disagree = 63**

In [23]:

```
x=['Strongly Agree (5)','Agree (4)','Normal (3)','Disagree (2)','Strongly Disagree (
y=[65,72,112,75,63]

fig, ax = plt.subplots()
# Set default figure size.
plt.rcParams['figure.figsize'] = (8, 5)



bars = plt.bar(x,y,color=['#F8B195', '#F67280', '#C06C84', '#6C5B7B', '#355C7D'])

#plt.xticks(rotation=0)


# Here we remove the top, right and left spines (figure borders)
# which really aren't necessary for a bar chart, except for bottom
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
ax.spines['left'].set_visible(False)
ax.spines['bottom'].set_visible(True)
#-------------------------------------
# Second, remove the ticks as well.
ax.tick_params(bottom=False, left=False)
#-------------------------------------
# Third, add a horizontal grid (but keep the vertical grid hidden).
# Color the lines a light gray as well.
ax.set_axisbelow(True)
ax.yaxis.grid(True, color='#EEEEEE')
ax.xaxis.grid(False)
#-----------------------------------
# Add text annotations to the top of the bars.
# Note, you'll have to adjust this slightly (the 0.3)
# with different data.
for bar in bars:
  ax.text(
      bar.get_x() + bar.get_width() / 2,
      bar.get_height() + 0.3,
      round(bar.get_height(), 1),
      horizontalalignment='center',
      weight='bold'
  )

# Add labels and a title. Note the use of `labelpad` and `pad` to add some
# extra space between the text and the tick labels.
ax.set_xlabel('Likert Scale', labelpad=15, color='#333333')
ax.set_ylabel('Values', labelpad=15, color='#333333')
ax.set_title('OPC3 - Shortage of financial resources in public sector for E-Gov syst
             weight='bold')


fig.tight_layout()
```




In [24]:

```
#For statistical analysis here we will use the Spearman Rank Correlation to find the
#the variables of the dataset, or in simple term between the answers of the survey r
```

In [25]:

```
Data_Cor = data.corr(method="spearman")
print(Data_Cor)
```

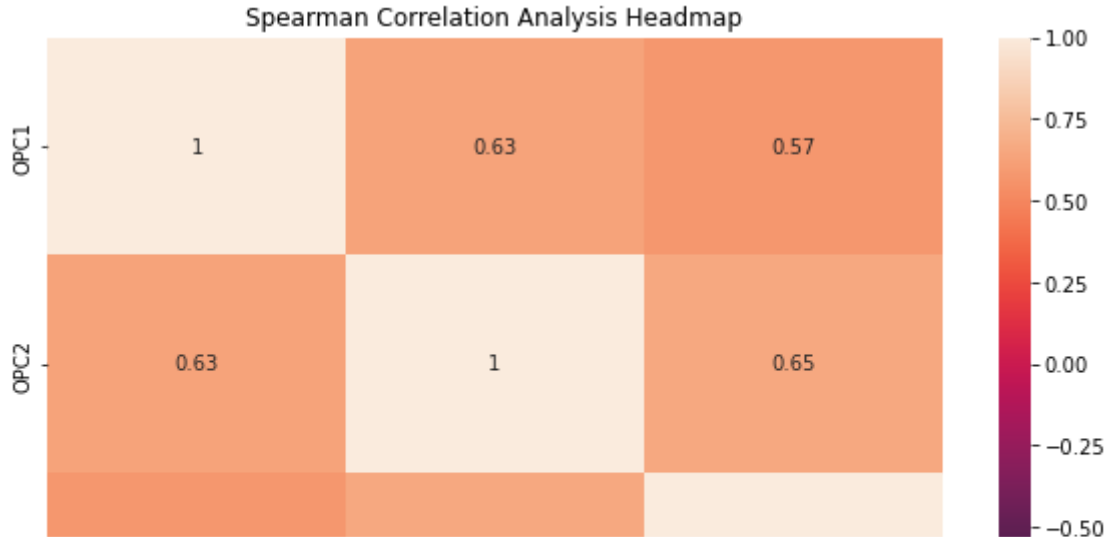
```
          OPC1      OPC2      OPC3
OPC1  1.000000  0.626577  0.571430
OPC2  0.626577  1.000000  0.649727
OPC3  0.571430  0.649727  1.000000
```

In [26]:

```
plt.figure(figsize=(10,6))
sns.heatmap(Data_Cor, vmin=-1,vmax=1, annot=True)
plt.title("Spearman Correlation Analysis Headmap")
```

Out[26]:

```
Text(0.5, 1.0, 'Spearman Correlation Analysis Headmap')
```




In [ ]: