

Exploration

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Purpose

To explore metrics options based on data collected by Software Quality Assurance in a spreadsheet for document review and approval.

Libraries used

No libriries used yet

```
library(lubridate)
```

```
##  
## Attaching package: 'lubridate'  
## The following object is masked from 'package:base':  
##  
##     date
```

Data

The data is presented in a CSV file (saved from an Excel workbook) with the following columns and characteristics

SQA SQA/E Preforming the review

Project ID Unique ID assigned to the project may come from NPV or ePAS

Application Application Name (limited selection)

Doc Version Version number of the document, also known as the revision number

Doc ID, if needed unique identifier to distinguish between documents for the same deliver type within a project

Approver or Disapproval? Approval status from the following list

* **A** Approved

* **A-FP** Approved on first pass

* **D** Disapproved

Date of Approval or Disapproval Date action was taken

Reason for Disapproval: Selected from the following list

- Inaccurate information
- Incorrect scope
- Insufficient testing
- Insufficient traceability
- N/A
- Not compliant with procedure
- Not following configuration management
- Not following document version control
- Not using template
- Other
- Requirement deficiency

Import the data

The data is read in and variables are assigned more programically useful names.

```
FPA.Raw <- read.csv(file = "../data/First Pass Acceptance.csv",  
                    stringsAsFactors = FALSE,  
                    col.names = c("sqa",  
                                   "project",  
                                   "application",
```

```

        "deliverable",
        "version",
        "docID",
        "status",
        "date",
        "reason",
        "comments"))
FPA <- FPA.Raw

```

format the data

factors

Set the following data as factors:

*SQA

*Application

*Deliverable

*status

```

FPA$sqa <- as.factor(FPA$sqa)
FPA$application <- as.factor(FPA$application)
FPA$deliverable <- as.factor(FPA$deliverable)
FPA$status <- as.factor(FPA$status)

```

Clean up reason

convert blank fields in status to NA when status is converted to a factor

```

FPA$reason <- as.factor(FPA$reason)
levels(FPA$reason)

```

```

## [1] ""
## [2] "Inaccurate information"
## [3] "Incorrect scope"
## [4] "Insufficient testing"
## [5] "Not compliant with procedure"
## [6] "Not following document version control"
## [7] "Not using template"
## [8] "Other"
## [9] "Requirement deficiency"

```

```

levels(FPA$reason)[1] <- NA
levels(FPA$reason)

```

```

## [1] "Inaccurate information"
## [2] "Incorrect scope"
## [3] "Insufficient testing"
## [4] "Not compliant with procedure"
## [5] "Not following document version control"
## [6] "Not using template"
## [7] "Other"
## [8] "Requirement deficiency"

```

Date

```
FPA$date <- as.Date(FPA$date, format = "%d-%B-%y")
```

Add new fields

Month and year

From date create month and year fields

```
FPA$month <- month(FPA$date, label = TRUE)
FPA$year <- year(FPA$date)
```

deliverable UID

create an unique identification (UID) for each processed item so that each deliverable is uniquely identified across the entire data set. to do this the UID will consist of the Project, deliverable, docID and version seperated with a dash

```
FPA$UID <- paste(FPA$project,
                 FPA$deliverable,
                 FPA$docID,
                 FPA$version,
                 sep = "-"
                )
```

Deliverable Month

```
TEMPJUNK <- FPA
table(FPA$month)
```

```
##
## Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
## 241  28   0   0   0   0   0   0   0   0   0   0
```

```
FPA <- subset(FPA,
              subset = month == "Jan")
table(FPA$month)
```

```
##
## Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
## 241   0   0   0   0   0   0   0   0   0   0   0
```

```
FPA <- TEMPJUNK
FPA <- subset(FPA,
              subset = month == "Feb")
table(FPA$month)
```

```
##
## Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
##   0 28   0   0   0   0   0   0   0   0   0   0
```

```
FPA <- TEMPJUNK
FPA <- subset(FPA,
              subset = month == "Jan")
rm(TEMPJUNK)
```

Simple count metrics

Projects worked

```
length(unique(FPA$project))

## [1] 30

as.character(unique(FPA$application))

## [1] "Groninger"           "Assay File Database"
## [3] "PCN/SCN"             "WWLIMS"
## [5] "Pulse"               "DFCS"
## [7] "DPW"                 "QIMS"
## [9] "Abbott Transfusion Medicine" "Apollo/PHM"
## [11] "AFMS"                "SAS"
## [13] "Metrics Library"     "DaVinci"
## [15] "CMSNext"             "GS Reports"
## [17] "IRIS"                "ideaPoint"
## [19] "TODS"
```

Number of reviews

```
nrow(FPA)

## [1] 241
```

Number of Documents Reviewed

```
length(unique(FPA$UID))

## [1] 165
```

Number of Projects Started

```
length(unique(
  subset(
    subset(FPA,
           subset = ((status == "A" | status == "A-FP") & version == 1)),
    subset = deliverable == "Software Change Request")$project))

## [1] 3
```

Number of Projects Completed

```
length(unique(
  subset(
    subset(FPA,
      subset = ((status == "A" | status == "A-FP"))),
    subset = deliverable == "System Certification Summary")$project))

## [1] 3
```

Approval rate

probability of a document being approved when reviewed

```
nrow(unique(
  subset(FPA, subset = (status == "A" | status == "A-FP"))
))/nrow(FPA)

## [1] 0.6763485
```

First Pass Acceptance

probability of a document being approved when reviewed the first time

```
nrow(unique(
  subset(FPA, subset = status == "A-FP")
))/nrow(FPA)

## [1] 0.3858921
```

Number of deliverables by type

The number of each type of deliverable

```
table(FPA[!duplicated(FPA$UID),]$deliverable)

##
##          CII          Design Documentation
##          10          2
## Design Verification          FRS
##          6          5
##          IDP          IIVP
##          1          5
## IIVP results          ISSD
##          14          1
## Move to Production          Project Plan
##          2          6
## Release Notes          Software Change Request
##          1          7
## Software Compliance Assessment          System Certification Summary
##          7          4
## Test Protocol          Test Protocol Results
##          46          26
```

```
##          Traceability          URS
##          12          2
##      User Acceptance Protocol User Acceptance Protocol results
##          3          1
##          Validation Plan
##          4
```

number od deliverable per application

```
table(FPA[!duplicated(FPA$UID),]$application)
```

```
##
## Abbott Transfusion Medicine          AFMS
##          1          9
##      Alinity Source Verifier          Apollo/PHM
##          0          10
##      Assay File Database          CMSNext
##          2          2
##          DaVinci          DFCS
##          22          13
##          DPW          Groninger
##          4          1
##          GS Reports          ideaPoint
##          4          1
##          IRIS          Metrics Library
##          1          4
##          PCN/SCN          Pulse
##          6          11
##          QIMS          SAS
##          19          4
##          TODS          WWLIMS
##          1          50
```

distrubation of result of reviews

```
table(FPA$status)
```

```
##
##      A  A-FP  D
##      0   71  94  76
```

2 way table deliverables by application

```
table(FPA[!duplicated(FPA$UID),]$application,
      FPA[!duplicated(FPA$UID),]$deliverable)
```

```
##
##          CII Design Documentation Design Verification
## Abbott Transfusion Medicine    0          0          0
## AFMS                          1          0          0
## Alinity Source Verifier        0          0          0
```

##	Apollo/PHM	0	0	0
##	Assay File Database	0	0	0
##	CMSNext	0	0	0
##	DaVinci	1	0	0
##	DFCS	1	0	1
##	DPW	0	0	0
##	Groninger	0	0	0
##	GS Reports	0	0	0
##	ideaPoint	0	0	0
##	IRIS	0	0	0
##	Metrics Library	0	2	0
##	PCN/SCN	0	0	1
##	Pulse	0	0	0
##	QIMS	2	0	2
##	SAS	0	0	0
##	TODS	0	0	0
##	WVLIMS	5	0	2

##		FRS	IDP	IIVP	IIVP results	ISSD
##	Abbott Transfusion Medicine	0	0	0	0	0
##	AFMS	2	0	0	0	0
##	Alinity Source Verifier	0	0	0	0	0
##	Apollo/PHM	0	0	0	4	0
##	Assay File Database	0	0	0	0	0
##	CMSNext	0	0	0	0	0
##	DaVinci	1	1	1	1	1
##	DFCS	0	0	1	0	0
##	DPW	0	0	0	0	0
##	Groninger	0	0	0	0	0
##	GS Reports	0	0	0	0	0
##	ideaPoint	0	0	0	0	0
##	IRIS	0	0	0	1	0
##	Metrics Library	0	0	0	0	0
##	PCN/SCN	1	0	1	0	0
##	Pulse	0	0	0	2	0
##	QIMS	0	0	1	1	0
##	SAS	0	0	0	0	0
##	TODS	0	0	0	0	0
##	WVLIMS	1	0	1	5	0

##		Move to Production	Project Plan
##	Abbott Transfusion Medicine	0	0
##	AFMS	0	0
##	Alinity Source Verifier	0	0
##	Apollo/PHM	0	0
##	Assay File Database	0	1
##	CMSNext	0	0
##	DaVinci	0	1
##	DFCS	0	1
##	DPW	0	0
##	Groninger	0	0
##	GS Reports	2	2
##	ideaPoint	0	0
##	IRIS	0	0

##	Metrics Library	0	1
##	PCN/SCN	0	0
##	Pulse	0	0
##	QIMS	0	0
##	SAS	0	0
##	TODS	0	0
##	WVLIMS	0	0
##			
##		Release Notes	Software Change Request
##	Abbott Transfusion Medicine	0	0
##	AFMS	0	1
##	Alinity Source Verifier	0	0
##	Apollo/PHM	0	0
##	Assay File Database	0	1
##	CMSNext	0	1
##	DaVinci	1	1
##	DFCS	0	1
##	DPW	0	0
##	Groninger	0	0
##	GS Reports	0	0
##	ideaPoint	0	0
##	IRIS	0	0
##	Metrics Library	0	0
##	PCN/SCN	0	1
##	Pulse	0	0
##	QIMS	0	0
##	SAS	0	0
##	TODS	0	1
##	WVLIMS	0	0
##			
##		Software Compliance Assessment	
##	Abbott Transfusion Medicine		1
##	AFMS		0
##	Alinity Source Verifier		0
##	Apollo/PHM		1
##	Assay File Database		0
##	CMSNext		1
##	DaVinci		0
##	DFCS		0
##	DPW		0
##	Groninger		0
##	GS Reports		0
##	ideaPoint		1
##	IRIS		0
##	Metrics Library		0
##	PCN/SCN		2
##	Pulse		1
##	QIMS		0
##	SAS		0
##	TODS		0
##	WVLIMS		0
##			
##		System Certification Summary	Test Protocol
##	Abbott Transfusion Medicine	0	0

##	AFMS	0	3
##	Alinity Source Verifier	0	0
##	Apollo/PHM	0	5
##	Assay File Database	0	0
##	CMSNext	0	0
##	DaVinci	1	5
##	DFCS	0	1
##	DPW	1	1
##	Groninger	0	0
##	GS Reports	0	0
##	ideaPoint	0	0
##	IRIS	0	0
##	Metrics Library	0	0
##	PCN/SCN	0	0
##	Pulse	1	3
##	QIMS	0	7
##	SAS	1	2
##	TODS	0	0
##	WVLIMS	0	19

##		Test Protocol Results	Traceability	URS
##	Abbott Transfusion Medicine	0	0	0
##	AFMS	0	0	1
##	Alinity Source Verifier	0	0	0
##	Apollo/PHM	0	0	0
##	Assay File Database	0	0	0
##	CMSNext	0	0	0
##	DaVinci	4	1	1
##	DFCS	2	1	0
##	DPW	2	0	0
##	Groninger	0	1	0
##	GS Reports	0	0	0
##	ideaPoint	0	0	0
##	IRIS	0	0	0
##	Metrics Library	0	0	0
##	PCN/SCN	0	0	0
##	Pulse	3	1	0
##	QIMS	3	3	0
##	SAS	1	0	0
##	TODS	0	0	0
##	WVLIMS	11	5	0

##		User Acceptance Protocol
##	Abbott Transfusion Medicine	0
##	AFMS	0
##	Alinity Source Verifier	0
##	Apollo/PHM	0
##	Assay File Database	0
##	CMSNext	0
##	DaVinci	0
##	DFCS	3
##	DPW	0
##	Groninger	0
##	GS Reports	0

##	ideaPoint	0
##	IRIS	0
##	Metrics Library	0
##	PCN/SCN	0
##	Pulse	0
##	QIMS	0
##	SAS	0
##	TODS	0
##	WWLIMS	0
##		
##	User Acceptance Protocol results	
##	Abbott Transfusion Medicine	0
##	AFMS	0
##	Alinity Source Verifier	0
##	Apollo/PHM	0
##	Assay File Database	0
##	CMSNext	0
##	DaVinci	0
##	DFCS	1
##	DPW	0
##	Groninger	0
##	GS Reports	0
##	ideaPoint	0
##	IRIS	0
##	Metrics Library	0
##	PCN/SCN	0
##	Pulse	0
##	QIMS	0
##	SAS	0
##	TODS	0
##	WWLIMS	0
##		
##	Validation Plan	
##	Abbott Transfusion Medicine	0
##	AFMS	1
##	Alinity Source Verifier	0
##	Apollo/PHM	0
##	Assay File Database	0
##	CMSNext	0
##	DaVinci	1
##	DFCS	0
##	DPW	0
##	Groninger	0
##	GS Reports	0
##	ideaPoint	0
##	IRIS	0
##	Metrics Library	1
##	PCN/SCN	0
##	Pulse	0
##	QIMS	0
##	SAS	0
##	TODS	0
##	WWLIMS	1

Number of Projects Started revisited

```
length(unique(subset(FPA, subset = (((status == "A" | status == "A-FP")
                                     & version == 1)
                                     & deliverable == "Software Change Request" ))
             $project)) +
length(unique(
  subset(FPA,
    subset = (((status == "A" | status == "A-FP")
               & version == 1)
               & application == "GS Reports")
               & deliverable == "Project Plan"))
  $project))
```

```
## [1] 5
```

Projects completed round two

```
length(unique(
  subset(
    subset(FPA,
      subset = (((status == "A" | status == "A-FP")
                  & version == 1))),
    subset = deliverable == "System Certification Summary")$project)) +
length(unique(
  subset(
    subset(FPA,
      subset = (((status == "A" | status == "A-FP")
                  & version == 1))),
    subset = deliverable == "Move to Production")$project))
```

```
## [1] 5
```

Defects

```
table(FPA$reason)
```

```
##
##           Inaccurate information
##                               34
##           Incorrect scope
##                               1
##           Insufficient testing
##                               6
##           Not compliant with procedure
##                               17
## Not following document version control
##                               3
##           Not using template
##                               1
##                               Other
```

```
##                                7
##          Requirement deficiency
##                                1
```

defects verse application

```
table(as.character(subset(FPA, subset = (status == "D"))$application),
      subset(FPA, subset = (status == "D"))$reason)
```

```
##
##          Inaccurate information Incorrect scope
##  AFMS                                0            0
##  Apollo/PHM                          1            0
##  Assay File Database                  0            0
##  CMSNext                             2            0
##  DaVinci                             14            0
##  DFCS                                1            0
##  DPW                                 1            0
##  PCN/SCN                             2            1
##  Pulse                               0            0
##  QIMS                                7            0
##  TODS                                0            0
##  WWLIMS                              6            0
##
##          Insufficient testing Not compliant with procedure
##  AFMS                                0            4
##  Apollo/PHM                          0            0
##  Assay File Database                  0            1
##  CMSNext                             0            1
##  DaVinci                             0            4
##  DFCS                                0            0
##  DPW                                 0            0
##  PCN/SCN                             0            0
##  Pulse                               0            1
##  QIMS                                6            6
##  TODS                                0            0
##  WWLIMS                              0            0
##
##          Not following document version control
##  AFMS                                0
##  Apollo/PHM                          0
##  Assay File Database                  0
##  CMSNext                             0
##  DaVinci                             1
##  DFCS                                0
##  DPW                                 0
##  PCN/SCN                             0
##  Pulse                               0
##  QIMS                                0
##  TODS                                0
##  WWLIMS                              2
##
##          Not using template Other Requirement deficiency
```

##	AFMS	0	0	0
##	Apollo/PHM	0	1	0
##	Assay File Database	0	1	0
##	CMSNext	0	0	0
##	DaVinci	0	3	1
##	DFCS	1	0	0
##	DPW	0	0	0
##	PCN/SCN	0	0	0
##	Pulse	0	0	0
##	QIMS	0	2	0
##	TODS	0	0	0
##	WWLIMS	0	0	0

defects verse deliverable

```
table(as.character(subset(FPA, subset = (status == "D"))$deliverable),
      subset(FPA, subset = (status == "D"))$reason)
```

##			
##		Inaccurate information	Incorrect scope
##	CII	4	0
##	FRS	0	0
##	IDP	1	0
##	IIVP	2	0
##	IIVP results	1	0
##	Project Plan	5	0
##	Release Notes	0	0
##	Software Change Request	2	0
##	Software Compliance Assessment	1	1
##	System Certification Summary	3	0
##	Test Protocol	8	0
##	Test Protocol Results	2	0
##	Traceability	5	0
##	URS	0	0
##	User Acceptance Protocol	0	0
##	Validation Plan	0	0
##			
##		Insufficient testing	
##	CII	0	
##	FRS	0	
##	IDP	0	
##	IIVP	0	
##	IIVP results	0	
##	Project Plan	0	
##	Release Notes	0	
##	Software Change Request	0	
##	Software Compliance Assessment	0	
##	System Certification Summary	0	
##	Test Protocol	6	
##	Test Protocol Results	0	
##	Traceability	0	
##	URS	0	
##	User Acceptance Protocol	0	

##	Validation Plan	0	
##			
##			Not compliant with procedure
##	CII	0	
##	FRS	2	
##	IDP	0	
##	IIVP	0	
##	IIVP results	1	
##	Project Plan	0	
##	Release Notes	1	
##	Software Change Request	2	
##	Software Compliance Assessment	0	
##	System Certification Summary	0	
##	Test Protocol	1	
##	Test Protocol Results	7	
##	Traceability	0	
##	URS	2	
##	User Acceptance Protocol	0	
##	Validation Plan	1	
##			
##			Not following document version control
##	CII	1	
##	FRS	0	
##	IDP	0	
##	IIVP	0	
##	IIVP results	0	
##	Project Plan	0	
##	Release Notes	0	
##	Software Change Request	0	
##	Software Compliance Assessment	0	
##	System Certification Summary	0	
##	Test Protocol	2	
##	Test Protocol Results	0	
##	Traceability	0	
##	URS	0	
##	User Acceptance Protocol	0	
##	Validation Plan	0	
##			
##			Not using template Other
##	CII	0	0
##	FRS	0	0
##	IDP	0	1
##	IIVP	0	0
##	IIVP results	0	0
##	Project Plan	0	1
##	Release Notes	0	1
##	Software Change Request	0	0
##	Software Compliance Assessment	0	1
##	System Certification Summary	0	0
##	Test Protocol	0	1
##	Test Protocol Results	0	1
##	Traceability	0	1
##	URS	0	0
##	User Acceptance Protocol	1	0

```
## Validation Plan 0 0
##
## Requirement deficiency
## CII 0
## FRS 1
## IDP 0
## IIVP 0
## IIVP results 0
## Project Plan 0
## Release Notes 0
## Software Change Request 0
## Software Compliance Assessment 0
## System Certification Summary 0
## Test Protocol 0
## Test Protocol Results 0
## Traceability 0
## URS 0
## User Acceptance Protocol 0
## Validation Plan 0
```

Rejects by deliverable

```
table(as.character(subset(FPA, subset = (status == "D"))$deliverable))
```

```
##
## CII FRS
## 5 3
## IDP IIVP
## 2 2
## IIVP results Project Plan
## 2 6
## Release Notes Software Change Request
## 2 5
## Software Compliance Assessment System Certification Summary
## 3 3
## Test Protocol Test Protocol Results
## 23 10
## Traceability URS
## 6 2
## User Acceptance Protocol Validation Plan
## 1 1
```

rejections by project

```
table(as.character(subset(FPA, subset = (status == "D"))$application))
```

```
##
## AFMS Apollo/PHM Assay File Database
## 4 2 2
## CMSNext DaVinci DFCS
## 3 23 2
## DPW PCN/SCN Pulse
```


##	1	3	1
##	QIMS	TODS	WVLIMS
##	23	1	11