Influencing Factors on Internal Audit Maturity Using PLS-PM

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System Information

```
#install.packages("sessioninfo")
sessioninfo::session_info()
```

```
## ─ Session info ─────────────────────────────────────────────────────────────
##  setting  value
##  version  R version 4.3.2 (2023-10-31 ucrt)
##  os       Windows 11 x64 (build 22621)
##  system   x86_64, mingw32
##  ui       RTerm
##  language (EN)
##  collate  Portuguese_Brazil.utf8
##  ctype    Portuguese_Brazil.utf8
##  tz       America/Sao_Paulo
##  date     2024-01-21
##  pandoc   3.1.11.1 @ C:/Users/RESEARCH/AppData/Local/Pandoc/ (via rmarkdown)
##
## ─ Packages ─────────────────────────────────────────────────────────────────
##  package     * version date (UTC) lib source
##  bslib         0.6.1   2023-11-28 [1] CRAN (R 4.3.2)
##  cachem        1.0.8   2023-05-01 [1] CRAN (R 4.3.2)
##  cli           3.6.2   2023-12-11 [1] CRAN (R 4.3.2)
##  digest        0.6.34  2024-01-11 [1] CRAN (R 4.3.2)
##  evaluate      0.23    2023-11-01 [1] CRAN (R 4.3.2)
##  fastmap       1.1.1   2023-02-24 [1] CRAN (R 4.3.2)
##  htmltools     0.5.7   2023-11-03 [1] CRAN (R 4.3.2)
##  jquerylib     0.1.4   2021-04-26 [1] CRAN (R 4.3.2)
##  jsonlite      1.8.8   2023-12-04 [1] CRAN (R 4.3.2)
##  knitr         1.45    2023-10-30 [1] CRAN (R 4.3.2)
##  lifecycle     1.0.4   2023-11-07 [1] CRAN (R 4.3.2)
##  R6            2.5.1   2021-08-19 [1] CRAN (R 4.3.2)
##  rlang         1.1.3   2024-01-10 [1] CRAN (R 4.3.2)
##  rmarkdown     2.25    2023-09-18 [1] CRAN (R 4.3.2)
##  rstudioapi    0.15.0  2023-07-07 [1] CRAN (R 4.3.2)
##  sass          0.4.8   2023-12-06 [1] CRAN (R 4.3.2)
##  sessioninfo   1.2.2   2021-12-06 [1] CRAN (R 4.3.2)
##  xfun          0.41    2023-11-01 [1] CRAN (R 4.3.2)
##  yaml          2.3.8   2023-12-11 [1] CRAN (R 4.3.2)
##
##  [1] C:/Users/RESEARCH/AppData/Local/Programs/R/R-4.3.2/library
##
## ────────────────────────────────────────────────────────────────────────────
```

```
set.seed(2024)
```

Library

```
#install.packages("formattable", dependencies=TRUE)
```

```
#install.packages("rlist", dependencies=TRUE)
```

```
library(plspm)
library(readxl)
require(pwr)
```

```
## Carregando pacotes exigidos: pwr
```

```
require(formattable)
```

```
## Carregando pacotes exigidos: formattable
```

```
##
## Attaching package: 'formattable'
```

```
## The following object is masked from 'package:plspm':
##
##     normalize
```

```
library(car)
```

```
## Carregando pacotes exigidos: carData
```

```
library(effectsize)
```

Size of Sample

```
sample<-pwr.f2.test(u=7, v=NULL, f2=0.15, sig.level=0.05, power=0.8)
sample[["v"]]+sample[["u"]]+1
```

```
## [1] 102.9149
```

```
rm("sample")
```

Variables Meaning

IAM: Internal Audit Maturity

QUAL: Qualification

STRATOR: Strategic Orientation

ASSES: Assessment

EVALRESP: Evaluate Responsibility

DRRELAREA: Direct Responsibility for Related Areas

INVAREA: Involvement Areas

PARTN: Partnership

TYPINF: Types of Information

Reading DataFrame and Transformation

```
table <-read_excel('Base tratada.xlsx', sheet = 'Base tratada', range = 'A1:AX1999')
table[is.na(table)] <- 0
```

```
colnames(table)
```

```
##  [1] "AEXP"      "CIA"       "FPESQ"     "HTREIN"    "CODETIC"   "CARTA"
##  [7] "MANOPER"   "EAI"       "ICP"       "MISSAO"    "MAI"       "FAVEXT"
## [13] "FAVINT"    "FCOMRES"   "FCTERC"    "FRACONT"   "FRAGOV"    "FRAGR"
## [19] "ASOOC"     "PREST"     "BENCH"     "REMERG"    "CINTER"    "CNEG"
## [25] "ECASO"     "MPRAT"     "PAUDIT"    "MODEL"     "GUIA"      "RFCOAUD"
## [31] "RDCONFG"   "RDGR"      "RDETIC"    "RDFRAUD"   "RDGOVRC"   "RDCREPFIN"
## [37] "ECONF"     "ERCUSTO"   "ECIBER"    "EGR"       "EREPFIN"   "EFIN"
## [43] "EFRAUD"    "EGOVCULT"  "ETI"       "ERTERC"    "EOPER"     "EAUDEXT"
## [49] "ESUST"     "TERC"
```

```
colnames(table)[1] <- "QUAL1" #AEXP para QUAL1
colnames(table)[2] <- "QUAL2" #CIA para QUAL2
colnames(table)[3] <- "QUAL3" #FPESQ para QUAL3
colnames(table)[4] <- "QUAL4" #HTREIN para QUAL4
colnames(table)[5] <- "STRATOR1" #CODETIC para STRATOR1
colnames(table)[6] <- "STRATOR2" #CARTA para STRATOR2
colnames(table)[7] <- "STRATOR3" #MANOPER para STRATOR3
colnames(table)[8] <- "STRATOR4" #EAI para STRATOR4
colnames(table)[9] <- "STRATOR5" #ICP para STRATOR5
colnames(table)[10] <- "STRATOR6" #MISSAO para STRATOR6
colnames(table)[11] <- "IAM" #IAM
colnames(table)[12] <- "ASSES1" #FAVEXT para ASSES1
colnames(table)[13] <- "ASSES2" #FAVINT para ASSES2
colnames(table)[14] <- "ASSES3" #FCOMRES para ASSES3
colnames(table)[15] <- "PARTN1" #FCTERC para PARTN1
colnames(table)[16] <- "EVALRESP1" #EVALRESPCONT para EVALRESP1
colnames(table)[17] <- "EVALRESP2" #EVALRESPGOV para EVALRESP2
colnames(table)[18] <- "EVALRESP3" #EVALRESPGR para EVALRESP3
colnames(table)[19] <- "PARTN2" #ASTRATOROC para PARTN2
colnames(table)[20] <- "PARTN3" #PREST para PARTN3
colnames(table)[21] <- "TYPINF1" #BENCH para TYPINF1
colnames(table)[22] <- "TYPINF2" #REMERG para TYPINF2
colnames(table)[23] <- "TYPINF3" #CINTER para TYPINF3
colnames(table)[24] <- "TYPINF4" #CNEG para TYPINF4
colnames(table)[25] <- "TYPINF5" #ECASTRATOR para TYPINF5
colnames(table)[26] <- "TYPINF6" #MPRAT para TYPINF6
colnames(table)[27] <- "TYPINF7" #PAUDIT para TYPINF7
colnames(table)[28] <- "TYPINF8" #MODEL para TYPINF8
colnames(table)[29] <- "TYPINF9" #GUIA para TYPINF9
colnames(table)[30] <- "STRATOR7" #RFCOAUD para OE7
colnames(table)[31] <- "DRRELAREA1" #RDCONFG para DRRELAREA1
colnames(table)[32] <- "DRRELAREA2" #RDGR para DRRELAREA2
colnames(table)[33] <- "DRRELAREA3" #RDETIC para DRRELAREA3
colnames(table)[34] <- "DRRELAREA4" #RDEVALRESPUD para DRRELAREA4
colnames(table)[35] <- "DRRELAREA5" #RDGOVRC para DRRELAREA5
colnames(table)[36] <- "DRRELAREA6" #RDCREPFIN para DRRELAREA6
colnames(table)[37] <- "INVAREA1" #ECONF para INVAREA1
colnames(table)[38] <- "INVAREA2" #ERCUSTO para INVAREA2
colnames(table)[39] <- "INVAREA3" #ECIBER para INVAREA3
colnames(table)[40] <- "INVAREA4" #EGR para INVAREA4
colnames(table)[41] <- "INVAREA5" #EREPFIN para INVAREA5
```

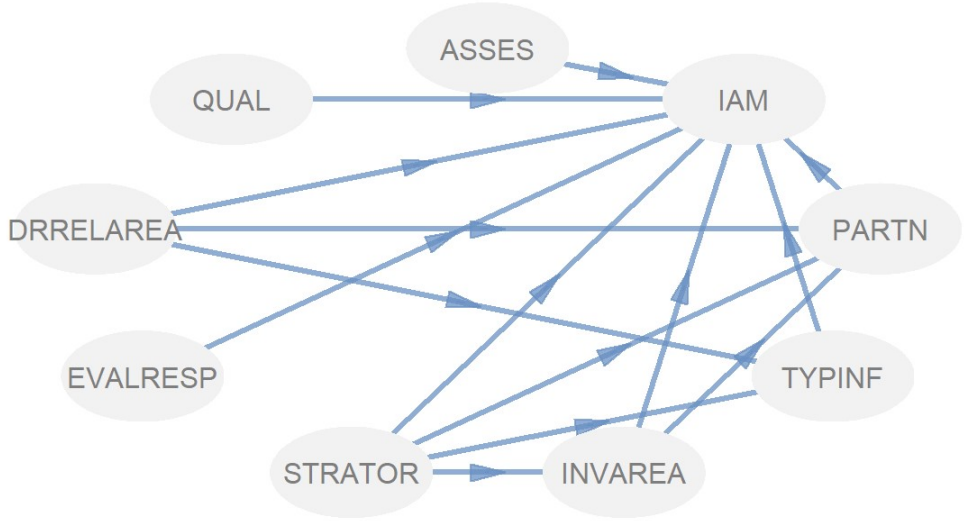
```
colnames(table)[42] <- "INVAREA6" #EFIN para INVAREA6
colnames(table)[43] <- "INVAREA7" #EEVALRESPUD para INVAREA7
colnames(table)[44] <- "INVAREA8" #EGOVCULT para INVAREA8
colnames(table)[45] <- "INVAREA9" #ETI para INVAREA9
colnames(table)[46] <- "INVAREA10" #ERTERC para INVAREA10
colnames(table)[47] <- "INVAREA11" #EOPER para INVAREA11
colnames(table)[48] <- "INVAREA12" #EAUDEXT para INVAREA12
colnames(table)[49] <- "INVAREA13" #ESUST para INVAREA13
colnames(table)[50] <- "PARTN4" #TERC para PARTN4
colnames(table)
```

```
##  [1] "QUAL1"      "QUAL2"      "QUAL3"      "QUAL4"      "STRATOR1"
##  [6] "STRATOR2"   "STRATOR3"   "STRATOR4"   "STRATOR5"   "STRATOR6"
## [11] "IAM"        "ASSES1"     "ASSES2"     "ASSES3"     "PARTN1"
## [16] "EVALRESP1"  "EVALRESP2"  "EVALRESP3"  "PARTN2"     "PARTN3"
## [21] "TYPINF1"    "TYPINF2"    "TYPINF3"    "TYPINF4"    "TYPINF5"
## [26] "TYPINF6"    "TYPINF7"    "TYPINF8"    "TYPINF9"    "STRATOR7"
## [31] "DRRELAREA1" "DRRELAREA2" "DRRELAREA3" "DRRELAREA4" "DRRELAREA5"
## [36] "DRRELAREA6" "INVAREA1"   "INVAREA2"   "INVAREA3"   "INVAREA4"
## [41] "INVAREA5"   "INVAREA6"   "INVAREA7"   "INVAREA8"   "INVAREA9"
## [46] "INVAREA10"  "INVAREA11"  "INVAREA12"  "INVAREA13"  "PARTN4"
```

Triangular matrix

```
path.matrix <- matrix(0, nrow = 9, ncol = 9)
path.matrix[9,]<-rep(1,9) # every variable explain IAM
path.matrix[9,9]<-0 # without feeedback
path.matrix[8,6]<-1 # effect from INVAREA to PARTN
path.matrix[8,3]<-1 # effect from DRRELAREA to PARTN
path.matrix[8,5]<-1 # effect from STRATOR to PARTN
path.matrix[7,5]<-1 # effect from STRATOR to TYPINF
path.matrix[6,5]<-1 # effect from STRATOR to INVAREA
path.matrix[7,3]<-1 # effect from DRRELAREA to TYPINF
colnames(path.matrix)=rownames(path.matrix)<-c("ASSES","QUAL","DRRELAREA", "EVALRESP", "STRATOR", "INVAREA", "TYPI
NF", "PARTN","IAM")
```

```
innerplot(path.matrix)
```



Block Variable

Defining the block of variables. Each line is a latent variable

Each indicators present in line is the relection of the LV.

```
block.indicators <- list(
    c('ASSES1','ASSES2', 'ASSES3'), #faq
    c('QUAL1','QUAL2','QUAL3','QUAL4'), #QUAL
    c('DRRELAREA1','DRRELAREA2','DRRELAREA3','DRRELAREA4','DRRELAREA5','DRRELAREA6'),
    c('EVALRESP1','EVALRESP2', 'EVALRESP3'),
    c('STRATOR1','STRATOR2','STRATOR3','STRATOR4','STRATOR5','STRATOR6','STRATOR7'),
    c('INVAREA1','INVAREA2','INVAREA3','INVAREA4','INVAREA5','INVAREA6','INVAREA7','INVAREA8','INVAREA9','INVAREA1
0','INVAREA11','INVAREA12','INVAREA13'),
    c('TYPINF1','TYPINF2','TYPINF3','TYPINF4','TYPINF5','TYPINF6','TYPINF7','TYPINF8','TYPINF9'),
   c("PARTN1","PARTN2","PARTN3","PARTN4"),
   c('IAM'))
```

Scale Definition

Definig the scale (what is numeric and what is nominal=non-metric)

```
scaled <- list(
    rep("NOM",3), #faq
    c("NUM", "NOM","NOM","NUM"), #QUAL
    rep("NOM",6), #rdac
    rep("NOM",3), #fra
    rep("NOM",7), #STRATOR
    rep("NOM",13), #ec
    rep("NOM",9), #bia
    c("NOM", "NOM","NOM","NUM"), #pt
    c("NUM") #mai
    )
```

Reflexive Mode

All Latent Variables are reflexive

```
modes <- rep("A",9)
```

External Model Validation

First running to measure indicators

```
model_pls1 = plspm(table,
                   path.matrix,
                   block.indicators,
                   modes = modes,
                   scaling = scaled,
                   scaled = TRUE,
                   scheme = "path",
                   tol = 1e-7, #tolerância
                   maxiter=300, #número de interações máximas
                   boot.val =TRUE, #com bootstrapping
                   br=100) #número de amostra bootstrapping
```

```
## Warning: Setting row names on a tibble is deprecated.
```

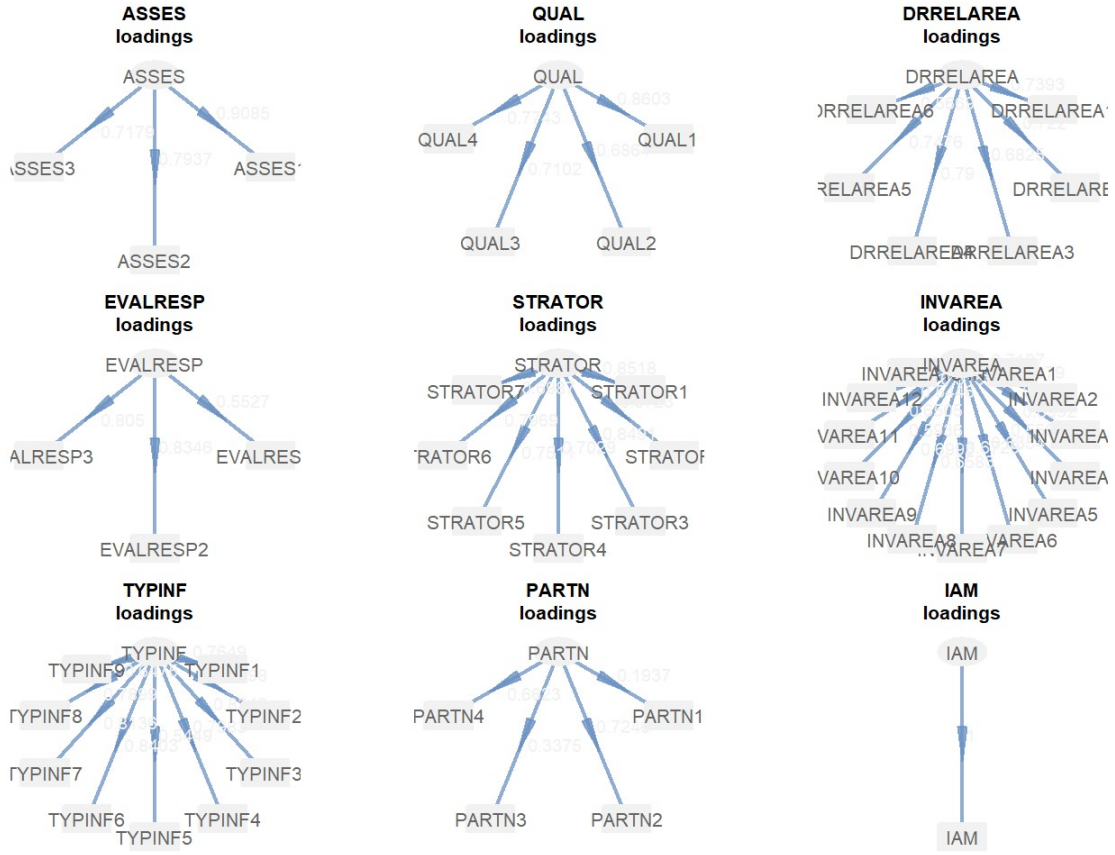
Alpha Cronbach, Rho, Eigenvalue

```
options(repr.plot.width = 1, repr.plot.height = 0.75, repr.plot.res = 100)
formattable(model_pls1$unidim , list(
   C.alpha = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
   DG.rho = formatter("span", style = x ~ ifelse(x < 0.5, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
   eig.1st=color_tile("white", "yellow"),
   eig.2nd=color_tile("white", "purple")
))
```

	Mode	MVs	C.alpha	DG.rho	eig.1st	eig.2nd
ASSES	A	3	**0.7463813**	**0.85564981**	1.993188	0.5923898
QUAL	A	4	**0.7557806**	**0.84582067**	2.318345	0.7143565
DRRELAREA	A	6	**0.8021518**	**0.85924359**	3.043606	0.8220197

	Mode	MVs	C.alpha	DG.rho	eig.1st	eig.2nd
EVALRESP	A	3	**0.6039255**	**0.79126296**	1.677185	0.7377764
STRATOR	A	7	**0.8997010**	**0.92140957**	4.392699	0.6712617
INVAREA	A	13	**0.8713187**	**0.89423412**	5.156630	1.0539624
TYPINF	A	9	**0.9112693**	**0.92779984**	5.320419	0.8108628
PARTN	A	4	**0.1567167**	**0.01751683**	1.262489	1.1879879
IAM	A	1	**1.0000000**	**1.00000000**	1.000000	0.0000000

```
plot(model_pls1, what="loadings", arr.width = 0.1)
```



```
options(repr.plot.width = 1, repr.plot.height = 0.75, repr.plot.res = 100)
formattable(model_pls1$outer_model, list(
    loading = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(colo
r = "green", font.weight = "bold"))),
   communality = formatter("span", style = x ~ ifelse(x < 0.5, style(color = "red", font.weight = "bold"), style(c
olor = "green", font.weight = "bold"))),
   redundancy=color_tile("white", "yellow")
))
```

name	block	weight	loading	communality	redundancy
ASSES1	ASSES	0.56934845	**0.9084924**	**0.82535837**	0.00000000
ASSES2	ASSES	0.33541023	**0.7937113**	**0.62997759**	0.00000000
ASSES3	ASSES	0.30159958	**0.7179466**	**0.51544737**	0.00000000
QUAL1	QUAL	0.40147330	**0.8602531**	**0.74003544**	0.00000000
QUAL2	QUAL	0.26194010	**0.6864366**	**0.47119514**	0.00000000
QUAL3	QUAL	0.29467413	**0.7101656**	**0.50433512**	0.00000000
QUAL4	QUAL	0.34297885	**0.7742713**	**0.59949597**	0.00000000
DRRELAREA1	DRRELAREA	0.22326949	**0.7392682**	**0.54651742**	0.00000000
DRRELAREA2	DRRELAREA	0.22820717	**0.7219880**	**0.52126667**	0.00000000
DRRELAREA3	DRRELAREA	0.23658608	**0.6824689**	**0.46576378**	0.00000000
DRRELAREA4	DRRELAREA	0.28993479	**0.7900188**	**0.62412963**	0.00000000
DRRELAREA5	DRRELAREA	0.22278888	**0.7475733**	**0.55886578**	0.00000000
DRRELAREA6	DRRELAREA	0.19953889	**0.5668748**	**0.32134705**	0.00000000
EVALRESP1	EVALRESP	0.23604765	**0.5527463**	**0.30552847**	0.00000000
EVALRESP2	EVALRESP	0.55143533	**0.8346194**	**0.69658954**	0.00000000
EVALRESP3	EVALRESP	0.50842656	**0.8050069**	**0.64803618**	0.00000000
STRATOR1	STRATOR	0.19424368	**0.8518098**	**0.72557988**	0.00000000
STRATOR2	STRATOR	0.22900262	**0.8722600**	**0.76083756**	0.00000000

name	block	weight	loading	communality	redundancy
STRATOR3	STRATOR	0.19968139	**0.8491360**	**0.72103203**	0.00000000
STRATOR4	STRATOR	0.14410503	**0.7029008**	**0.49406959**	0.00000000
STRATOR5	STRATOR	0.15774279	**0.7511193**	**0.56418019**	0.00000000
STRATOR6	STRATOR	0.17153582	**0.7968780**	**0.63501448**	0.00000000
STRATOR7	STRATOR	0.15567777	**0.6986645**	**0.48813204**	0.00000000
INVAREA1	INVAREA	0.16854396	**0.7187450**	**0.51659431**	0.27010341
INVAREA2	INVAREA	0.08356631	**0.4978693**	**0.24787381**	0.12960182
INVAREA3	INVAREA	0.13374281	**0.6778578**	**0.45949126**	0.24024685
INVAREA4	INVAREA	0.15376180	**0.6991967**	**0.48887608**	0.25561082
INVAREA5	INVAREA	0.09965844	**0.5505226**	**0.30307516**	0.15846407
INVAREA6	INVAREA	0.10062361	**0.6353782**	**0.40370547**	0.21107903
INVAREA7	INVAREA	0.15250288	**0.6728581**	**0.45273803**	0.23671590
INVAREA8	INVAREA	0.13311893	**0.6582953**	**0.43335270**	0.22658020
INVAREA9	INVAREA	0.12936865	**0.6993204**	**0.48904907**	0.25570127
INVAREA10	INVAREA	0.09172295	**0.5935868**	**0.35234533**	0.18422517
INVAREA11	INVAREA	0.11941694	**0.6504924**	**0.42314039**	0.22124065
INVAREA12	INVAREA	0.12442556	**0.5445824**	**0.29656999**	0.15506281
INVAREA13	INVAREA	0.07698566	**0.5155287**	**0.26576988**	0.13895885
TYPINF1	TYPINF	0.14664126	**0.7648874**	**0.58505266**	0.40939473
TYPINF2	TYPINF	0.17068802	**0.8298251**	**0.68860971**	0.48185951
TYPINF3	TYPINF	0.16097989	**0.8341564**	**0.69581686**	0.48690276
TYPINF4	TYPINF	0.15621486	**0.7983066**	**0.63729339**	0.44595055
TYPINF5	TYPINF	0.08386989	**0.5449305**	**0.29694930**	0.20779237
TYPINF6	TYPINF	0.16889903	**0.8403378**	**0.70616754**	0.49414572

name	block	weight	loading	communality	redundancy
TYPINF7	TYPINF	0.15123516	**0.8135730**	**0.66190096**	0.46316987
TYPINF8	TYPINF	0.13853863	**0.7898996**	**0.62394132**	0.43660735
TYPINF9	TYPINF	0.10362720	**0.6474852**	**0.41923704**	0.29336408
PARTN1	PARTN	0.10588553	**0.1937467**	**0.03753777**	0.01707702
PARTN2	PARTN	0.74594937	**0.7246391**	**0.52510184**	0.23888400
PARTN3	PARTN	0.42365197	**0.3375107**	**0.11391344**	0.05182252
PARTN4	PARTN	0.44688378	**0.6622614**	**0.43859020**	0.19952735
IAM	IAM	1.00000000	**1.0000000**	**1.00000000**	0.80815149

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:car':
##
##     recode
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

Remove those below the metric 0.7 and 0.5

Removing all indicators below the reliability threshold

```
subsets.approved<-model_pls1$outer_model%>%
  filter(loading >=0.7 & communality >=0.5)
```

Plotting the remaining indicators

```
options(repr.plot.width = 1, repr.plot.height = 0.75, repr.plot.res = 100)
formattable(subsets.approved, list(
    loading = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(colo
r = "green", font.weight = "bold"))),
   communality = formatter("span", style = x ~ ifelse(x < 0.5, style(color = "red", font.weight = "bold"), style(c
olor = "green", font.weight = "bold"))),
   redundancy=color_tile("white", "yellow")
))
```

name	block	weight	loading	communality	redundancy
ASSES1	ASSES	0.5693484	**0.9084924**	**0.8253584**	0.0000000
ASSES2	ASSES	0.3354102	**0.7937113**	**0.6299776**	0.0000000
ASSES3	ASSES	0.3015996	**0.7179466**	**0.5154474**	0.0000000
QUAL1	QUAL	0.4014733	**0.8602531**	**0.7400354**	0.0000000
QUAL3	QUAL	0.2946741	**0.7101656**	**0.5043351**	0.0000000
QUAL4	QUAL	0.3429788	**0.7742713**	**0.5994960**	0.0000000
DRRELAREA1	DRRELAREA	0.2232695	**0.7392682**	**0.5465174**	0.0000000
DRRELAREA2	DRRELAREA	0.2282072	**0.7219880**	**0.5212667**	0.0000000
DRRELAREA4	DRRELAREA	0.2899348	**0.7900188**	**0.6241296**	0.0000000
DRRELAREA5	DRRELAREA	0.2227889	**0.7475733**	**0.5588658**	0.0000000
EVALRESP2	EVALRESP	0.5514353	**0.8346194**	**0.6965895**	0.0000000
EVALRESP3	EVALRESP	0.5084266	**0.8050069**	**0.6480362**	0.0000000
STRATOR1	STRATOR	0.1942437	**0.8518098**	**0.7255799**	0.0000000
STRATOR2	STRATOR	0.2290026	**0.8722600**	**0.7608376**	0.0000000

name	block	weight	loading	communality	redundancy
STRATOR3	STRATOR	0.1996814	**0.8491360**	**0.7210320**	0.0000000
STRATOR5	STRATOR	0.1577428	**0.7511193**	**0.5641802**	0.0000000
STRATOR6	STRATOR	0.1715358	**0.7968780**	**0.6350145**	0.0000000
INVAREA1	INVAREA	0.1685440	**0.7187450**	**0.5165943**	0.2701034
TYPINF1	TYPINF	0.1466413	**0.7648874**	**0.5850527**	0.4093947
TYPINF2	TYPINF	0.1706880	**0.8298251**	**0.6886097**	0.4818595
TYPINF3	TYPINF	0.1609799	**0.8341564**	**0.6958169**	0.4869028
TYPINF4	TYPINF	0.1562149	**0.7983066**	**0.6372934**	0.4459506
TYPINF6	TYPINF	0.1688990	**0.8403378**	**0.7061675**	0.4941457
TYPINF7	TYPINF	0.1512352	**0.8135730**	**0.6619010**	0.4631699
TYPINF8	TYPINF	0.1385386	**0.7898996**	**0.6239413**	0.4366073
PARTN2	PARTN	0.7459494	**0.7246391**	**0.5251018**	0.2388840
IAM	IAM	1.0000000	**1.0000000**	**1.0000000**	0.8081515

Creating the new block of variables containing reliables indicators

```
block.indicators.novo <- list(
    c('ASSES1','ASSES2', 'ASSES3'), #ASSES
    c('QUAL1','QUAL3','QUAL4'), #QUAL
    c('DRRELAREA1', 'DRRELAREA2','DRRELAREA4','DRRELAREA5'),
    c("EVALRESP2", "EVALRESP3"),
    c('STRATOR1','STRATOR2','STRATOR3','STRATOR5','STRATOR6'),
    c('INVAREA1'),
    c('TYPINF1','TYPINF2','TYPINF3','TYPINF4','TYPINF6','TYPINF7','TYPINF8'),
    c("PARTN2"),
   c('IAM'))
### Escalando como numérico e nominal
scaled.novo <- list(
    rep("NOM",3), #ASSES
    c("NUM", "NOM","NUM"), #QUAL
    rep("NOM",4), #DRRELAREA
    rep("NOM",2), #EVALRESP
    rep("NOM",5), #STRATOR
    rep("NOM",1), #INVAREA
    rep("NOM",7), #TYPINF
    c("NOM"),#PARTN
    c("NUM") #IAM
    )
modes <- rep("A",9)
model_pls1.treatment2 = plspm(table,
                    path.matrix,
                    block.indicators.novo,
                    modes = modes,
                    scaling = scaled.novo,
                    scaled = TRUE,
                    scheme = "path",
                    tol = 1e-7, #tolerância
                    maxiter=300, #número de interações máximas
                    boot.val =TRUE, #com bootstrapping
                    br=100) #número de amostra bootstrapping
```

```
## Warning: Setting row names on a tibble is deprecated.
```

See again the LV Reliability

```
options(repr.plot.width = 1, repr.plot.height = 0.75, repr.plot.res = 100)
formattable(model_pls1.treatment2$unidim , list(
   C.alpha = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
   DG.rho = formatter("span", style = x ~ ifelse(x < 0.5, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
   eig.1st=color_tile("white", "yellow"),
   eig.2nd=color_tile("white", "purple")
))
```

	Mode	MVs	C.alpha	DG.rho	eig.1st	eig.2nd
ASSES	A	3	**0.7463813**	**0.8556498**	1.993188	0.5923898
QUAL	A	3	**0.7311546**	**0.8481344**	1.952246	0.5834945
DRRELAREA	A	4	**0.7890320**	**0.8635029**	2.451396	0.5933478
EVALRESP	A	2	**0.5856609**	**0.8283841**	1.414088	0.5859119
STRATOR	A	5	**0.8928571**	**0.9214190**	3.508126	0.5103422
INVAREA	A	1	**1.0000000**	**1.0000000**	1.000000	0.0000000
TYPINF	A	7	**0.9164128**	**0.9332816**	4.667357	0.5769790
PARTN	A	1	**1.0000000**	**1.0000000**	1.000000	0.0000000
IAM	A	1	**1.0000000**	**1.0000000**	1.000000	0.0000000

```
options(repr.plot.width = 1, repr.plot.height = 0.75, repr.plot.res = 100)
formattable(model_pls1.treatment2$outer_model, list(
    loading = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(colo
r = "green", font.weight = "bold"))),
   communality = formatter("span", style = x ~ ifelse(x < 0.5, style(color = "red", font.weight = "bold"), style(c
olor = "green", font.weight = "bold"))),
   redundancy=color_tile("white", "yellow")
))
```

name	block	weight	loading	communality	redundancy
ASSES1	ASSES	0.5693484	**0.9084924**	**0.8253584**	0.0000000

name	block	weight	loading	communality	redundancy
ASSES2	ASSES	0.3354102	**0.7937113**	**0.6299776**	0.0000000
ASSES3	ASSES	0.3015996	**0.7179466**	**0.5154474**	0.0000000
QUAL1	QUAL	0.4767963	**0.8570977**	**0.7346165**	0.0000000
QUAL3	QUAL	0.3499599	**0.7478610**	**0.5592961**	0.0000000
QUAL4	QUAL	0.4073274	**0.8092204**	**0.6548377**	0.0000000
DRRELAREA1	DRRELAREA	0.3051859	**0.7777597**	**0.6049101**	0.0000000
DRRELAREA2	DRRELAREA	0.2963412	**0.7552582**	**0.5704150**	0.0000000
DRRELAREA4	DRRELAREA	0.3839140	**0.7967093**	**0.6347456**	0.0000000
DRRELAREA5	DRRELAREA	0.2928219	**0.7955581**	**0.6329128**	0.0000000
EVALRESP2	EVALRESP	0.6185488	**0.8547055**	**0.7305215**	0.0000000
EVALRESP3	EVALRESP	0.5703056	**0.8264392**	**0.6830018**	0.0000000
STRATOR1	STRATOR	0.2457459	**0.8662186**	**0.7503347**	0.0000000
STRATOR2	STRATOR	0.2883471	**0.8889786**	**0.7902830**	0.0000000
STRATOR3	STRATOR	0.2509337	**0.8716361**	**0.7597494**	0.0000000
STRATOR5	STRATOR	0.1899966	**0.7457919**	**0.5562055**	0.0000000
STRATOR6	STRATOR	0.2116433	**0.8050109**	**0.6480425**	0.0000000
INVAREA1	INVAREA	1.0000000	**1.0000000**	**1.0000000**	0.3832536
TYPINF1	TYPINF	0.1638973	**0.7628134**	**0.5818843**	0.4204548
TYPINF2	TYPINF	0.1908030	**0.8427331**	**0.7101991**	0.5131719
TYPINF3	TYPINF	0.1802707	**0.8465381**	**0.7166267**	0.5178163
TYPINF4	TYPINF	0.1746466	**0.8114026**	**0.6583741**	0.4757245
TYPINF6	TYPINF	0.1889492	**0.8462052**	**0.7160632**	0.5174091
TYPINF7	TYPINF	0.1693599	**0.8190501**	**0.6708431**	0.4847342
TYPINF8	TYPINF	0.1549525	**0.7825762**	**0.6124255**	0.4425231

name	block	weight	loading	communality	redundancy
PARTN2	PARTN	1.0000000	**1.0000000**	**1.0000000**	0.2946736
IAM	IAM	1.0000000	**1.0000000**	**1.0000000**	0.8081901

See the whole model

```
summary(model_pls1.treatment2)
```

```
## PARTIAL LEAST SQUARES PATH MODELING (PLS-PM)
##
## ------------------------------------------------------
## MODEL SPECIFICATION
## 1   Number of Cases      1998
## 2   Latent Variables     9
## 3   Manifest Variables   27
## 4   Scale of Data        Standardized Data
## 5   Non-Metric PLS       TRUE
## 6   Weighting Scheme     path
## 7   Tolerance Crit       1e-07
## 8   Max Num Iters        300
## 9   Convergence Iters    4
## 10  Bootstrapping        TRUE
## 11  Bootstrap samples    100
##
## ------------------------------------------------------
## BLOCKS DEFINITION
##         Block         Type   Size   Mode
## 1       ASSES    Exogenous      3      A
## 2        QUAL    Exogenous      3      A
## 3   DRRELAREA    Exogenous      4      A
## 4    EVALRESP    Exogenous      2      A
## 5     STRATOR    Exogenous      5      A
## 6     INVAREA   Endogenous      1      A
## 7      TYPINF   Endogenous      7      A
## 8       PARTN   Endogenous      1      A
## 9         IAM   Endogenous      1      A
##
## ------------------------------------------------------
## BLOCKS UNIDIMENSIONALITY
##            Mode  MVs  C.alpha  DG.rho  eig.1st  eig.2nd
## ASSES         A    3    0.746   0.856     1.99    0.592
## QUAL          A    3    0.731   0.848     1.95    0.583
## DRRELAREA     A    4    0.789   0.864     2.45    0.593
## EVALRESP      A    2    0.586   0.828     1.41    0.586
## STRATOR       A    5    0.893   0.921     3.51    0.510
## INVAREA       A    1    1.000   1.000     1.00    0.000
## TYPINF        A    7    0.916   0.933     4.67    0.577
## PARTN         A    1    1.000   1.000     1.00    0.000
## IAM           A    1    1.000   1.000     1.00    0.000
```

```
##
## ------------------------------------------------------------
## OUTER MODEL
##                 weight  loading  communality  redundancy
## ASSES
##   1 ASSES1       0.569    0.908        0.825       0.000
##   1 ASSES2       0.335    0.794        0.630       0.000
##   1 ASSES3       0.302    0.718        0.515       0.000
## QUAL
##   2 QUAL1        0.477    0.857        0.735       0.000
##   2 QUAL3        0.350    0.748        0.559       0.000
##   2 QUAL4        0.407    0.809        0.655       0.000
## DRRELAREA
##   3 DRRELAREA1   0.305    0.778        0.605       0.000
##   3 DRRELAREA2   0.296    0.755        0.570       0.000
##   3 DRRELAREA4   0.384    0.797        0.635       0.000
##   3 DRRELAREA5   0.293    0.796        0.633       0.000
## EVALRESP
##   4 EVALRESP2    0.619    0.855        0.731       0.000
##   4 EVALRESP3    0.570    0.826        0.683       0.000
## STRATOR
##   5 STRATOR1     0.246    0.866        0.750       0.000
##   5 STRATOR2     0.288    0.889        0.790       0.000
##   5 STRATOR3     0.251    0.872        0.760       0.000
##   5 STRATOR5     0.190    0.746        0.556       0.000
##   5 STRATOR6     0.212    0.805        0.648       0.000
## INVAREA
##   6 INVAREA1     1.000    1.000        1.000       0.383
## TYPINF
##   7 TYPINF1      0.164    0.763        0.582       0.420
##   7 TYPINF2      0.191    0.843        0.710       0.513
##   7 TYPINF3      0.180    0.847        0.717       0.518
##   7 TYPINF4      0.175    0.811        0.658       0.476
##   7 TYPINF6      0.189    0.846        0.716       0.517
##   7 TYPINF7      0.169    0.819        0.671       0.485
##   7 TYPINF8      0.155    0.783        0.612       0.443
## PARTN
##   8 PARTN2       1.000    1.000        1.000       0.295
## IAM
##   9 IAM          1.000    1.000        1.000       0.808
##
```

```
## ------------------------------------------------------
## CROSSLOADINGS
##                  ASSES    QUAL  DRRELAREA  EVALRESP  STRATOR  INVAREA  TYPINF
## ASSES
##   1 ASSES1      0.9085  0.2852     0.2420    0.2947   0.2835    0.258   0.392
##   1 ASSES2      0.7937  0.1769     0.1706    0.3067   0.1843    0.181   0.296
##   1 ASSES3      0.7179  0.1281     0.1152    0.2446   0.1322    0.151   0.227
## QUAL
##   2 QUAL1       0.2266  0.8571     0.3985    0.0798   0.7359    0.522   0.703
##   2 QUAL3       0.2177  0.7479     0.3172    0.1114   0.5720    0.433   0.550
##   2 QUAL4       0.1869  0.8092     0.3579    0.0454   0.6625    0.460   0.614
## DRRELAREA
##   3 DRRELAREA1  0.1574  0.3268     0.7778    0.1222   0.3142    0.389   0.354
##   3 DRRELAREA2  0.1940  0.3161     0.7553    0.0796   0.3007    0.269   0.337
##   3 DRRELAREA4  0.2142  0.4203     0.7967    0.0983   0.4128    0.389   0.442
##   3 DRRELAREA5  0.1433  0.3143     0.7956    0.0412   0.2969    0.322   0.342
## EVALRESP
##   4 EVALRESP2   0.3148  0.0881     0.1072    0.8547   0.0688    0.127   0.144
##   4 EVALRESP3   0.2624  0.0720     0.0778    0.8264   0.0647    0.112   0.137
## STRATOR
##   5 STRATOR1    0.1943  0.7084     0.3774    0.0657   0.8662    0.547   0.706
##   5 STRATOR2    0.3853  0.7720     0.4416    0.1573   0.8890    0.633   0.848
##   5 STRATOR3    0.2133  0.7011     0.3323    0.0427   0.8716    0.542   0.730
##   5 STRATOR5    0.0872  0.5956     0.3092    0.0218   0.7458    0.379   0.571
##   5 STRATOR6    0.1614  0.6384     0.3223    0.0147   0.8050    0.445   0.617
## INVAREA
##   6 INVAREA1    0.2532  0.5879     0.4417    0.1422   0.6191    1.000   0.629
## TYPINF
##   7 TYPINF1     0.2319  0.5996     0.3531    0.0847   0.6482    0.459   0.763
##   7 TYPINF2     0.3402  0.6767     0.4254    0.1384   0.7410    0.550   0.843
##   7 TYPINF3     0.3618  0.6409     0.4247    0.1735   0.6988    0.545   0.847
##   7 TYPINF4     0.3506  0.6072     0.3947    0.1601   0.6729    0.527   0.811
##   7 TYPINF6     0.3173  0.7129     0.3709    0.1541   0.7480    0.541   0.846
##   7 TYPINF7     0.3295  0.6295     0.3793    0.1071   0.6705    0.487   0.819
##   7 TYPINF8     0.2956  0.5622     0.3807    0.1293   0.6082    0.476   0.783
## PARTN
##   8 PARTN2      0.1972  0.4985     0.3263    0.1241   0.5259    0.405   0.526
## IAM
##   9 IAM         0.2557  0.8127     0.4399    0.0822   0.8720    0.624   0.821
##                  PARTN     IAM
## ASSES
```

```
##   1 ASSES1      0.2133  0.2759
##   1 ASSES2      0.1560  0.1625
##   1 ASSES3      0.0775  0.1461
## QUAL
##   2 QUAL1       0.4012  0.7514
##   2 QUAL3       0.3689  0.5515
##   2 QUAL4       0.4373  0.6419
## DRRELAREA
##   3 DRRELAREA1  0.2494  0.3158
##   3 DRRELAREA2  0.2451  0.3117
##   3 DRRELAREA4  0.2839  0.4225
##   3 DRRELAREA5  0.2344  0.3038
## EVALRESP
##   4 EVALRESP2   0.1199  0.0718
##   4 EVALRESP3   0.0876  0.0662
## STRATOR
##   5 STRATOR1    0.4601  0.7387
##   5 STRATOR2    0.5381  0.8556
##   5 STRATOR3    0.4447  0.7723
##   5 STRATOR5    0.3284  0.5945
##   5 STRATOR6    0.3954  0.6472
## INVAREA
##   6 INVAREA1    0.4052  0.6242
## TYPINF
##   7 TYPINF1     0.3841  0.6225
##   7 TYPINF2     0.4548  0.7352
##   7 TYPINF3     0.4697  0.6919
##   7 TYPINF4     0.4084  0.6770
##   7 TYPINF6     0.4654  0.7233
##   7 TYPINF7     0.4204  0.6401
##   7 TYPINF8     0.3929  0.5847
## PARTN
##   8 PARTN2      1.0000  0.5192
## IAM
##   9 IAM         0.5192  1.0000
##
## ------------------------------------------------------------
## INNER MODEL
## $INVAREA
##              Estimate   Std. Error     t value    Pr(>|t|)
## Intercept   -1.08e-14       0.0176   -6.17e-13    1.00e+00
```

```
## STRATOR      6.19e-01       0.0176    3.52e+01   9.69e-212
##
## $TYPINF
##              Estimate   Std. Error     t value   Pr(>|t|)
## Intercept   -6.14e-15       0.0118   -5.21e-13   1.00e+00
## DRRELAREA    1.43e-01       0.0131    1.09e+01   5.67e-27
## STRATOR      7.79e-01       0.0131    5.96e+01   0.00e+00
##
## $PARTN
##              Estimate   Std. Error     t value   Pr(>|t|)
## Intercept   -1.09e-14       0.0188   -5.77e-13   1.00e+00
## DRRELAREA    1.01e-01       0.0215    4.70e+00   2.76e-06
## STRATOR      4.20e-01       0.0246    1.71e+01   2.56e-61
## INVAREA      1.00e-01       0.0247    4.06e+00   5.05e-05
##
## $IAM
##              Estimate   Std. Error     t value   Pr(>|t|)
## Intercept    1.56e-15      0.00982    1.59e-13   1.00e+00
## ASSES       -2.59e-02      0.01129   -2.30e+00   2.18e-02
## QUAL         2.17e-01      0.01820    1.19e+01   8.91e-32
## DRRELAREA    9.58e-03      0.01154    8.30e-01   4.06e-01
## EVALRESP    -1.72e-02      0.01054   -1.63e+00   1.04e-01
## STRATOR      4.54e-01      0.02134    2.13e+01   9.02e-91
## INVAREA      6.98e-02      0.01330    5.25e+00   1.68e-07
## TYPINF       2.17e-01      0.02064    1.05e+01   3.08e-25
## PARTN        3.36e-02      0.01187    2.83e+00   4.70e-03
##
## ------------------------------------------------------------
## CORRELATIONS BETWEEN LVs
##            ASSES    QUAL  DRRELAREA  EVALRESP  STRATOR  INVAREA  TYPINF  PARTN
## ASSES      1.000  0.2603      0.230    0.3444   0.2631    0.253   0.391  0.197
## QUAL       0.260  1.0000      0.447    0.0955   0.8209    0.588   0.777  0.498
## DRRELAREA  0.230  0.4468      1.000    0.1107   0.4304    0.442   0.478  0.326
## EVALRESP   0.344  0.0955      0.111    1.0000   0.0795    0.142   0.167  0.124
## STRATOR    0.263  0.8209      0.430    0.0795   1.0000    0.619   0.840  0.526
## INVAREA    0.253  0.5879      0.442    0.1422   0.6191    1.000   0.629  0.405
## TYPINF     0.391  0.7774      0.478    0.1668   0.8402    0.629   1.000  0.526
## PARTN      0.197  0.4985      0.326    0.1241   0.5259    0.405   0.526  1.000
## IAM        0.256  0.8127      0.440    0.0822   0.8720    0.624   0.821  0.519
##               IAM
## ASSES      0.2557
```

```
## QUAL       0.8127
## DRRELAREA  0.4399
## EVALRESP   0.0822
## STRATOR    0.8720
## INVAREA    0.6242
## TYPINF     0.8209
## PARTN      0.5192
## IAM        1.0000
##
## ----------------------------------------------------------
## SUMMARY INNER MODEL
##                  Type     R2  Block_Communality  Mean_Redundancy    AVE
## ASSES       Exogenous  0.000              0.657            0.000  0.657
## QUAL        Exogenous  0.000              0.650            0.000  0.650
## DRRELAREA   Exogenous  0.000              0.611            0.000  0.611
## EVALRESP    Exogenous  0.000              0.707            0.000  0.707
## STRATOR     Exogenous  0.000              0.701            0.000  0.701
## INVAREA    Endogenous  0.383              1.000            0.383  1.000
## TYPINF     Endogenous  0.723              0.667            0.482  0.667
## PARTN      Endogenous  0.295              1.000            0.295  1.000
## IAM        Endogenous  0.808              1.000            0.808  1.000
##
## ----------------------------------------------------------
## GOODNESS-OF-FIT
## [1]  0.6057
##
## ----------------------------------------------------------
## TOTAL EFFECTS
##             relationships    direct  indirect    total
## 1           ASSES -> QUAL   0.00000   0.00000   0.0000
## 2      ASSES -> DRRELAREA   0.00000   0.00000   0.0000
## 3       ASSES -> EVALRESP   0.00000   0.00000   0.0000
## 4        ASSES -> STRATOR   0.00000   0.00000   0.0000
## 5        ASSES -> INVAREA   0.00000   0.00000   0.0000
## 6         ASSES -> TYPINF   0.00000   0.00000   0.0000
## 7          ASSES -> PARTN   0.00000   0.00000   0.0000
## 8            ASSES -> IAM  -0.02592   0.00000  -0.0259
## 9       QUAL -> DRRELAREA   0.00000   0.00000   0.0000
## 10       QUAL -> EVALRESP   0.00000   0.00000   0.0000
## 11        QUAL -> STRATOR   0.00000   0.00000   0.0000
## 12        QUAL -> INVAREA   0.00000   0.00000   0.0000
```

```
## 13         QUAL -> TYPINF   0.00000   0.00000   0.0000
## 14          QUAL -> PARTN   0.00000   0.00000   0.0000
## 15            QUAL -> IAM   0.21726   0.00000   0.2173
## 16  DRRELAREA -> EVALRESP   0.00000   0.00000   0.0000
## 17   DRRELAREA -> STRATOR   0.00000   0.00000   0.0000
## 18   DRRELAREA -> INVAREA   0.00000   0.00000   0.0000
## 19    DRRELAREA -> TYPINF   0.14258   0.00000   0.1426
## 20     DRRELAREA -> PARTN   0.10111   0.00000   0.1011
## 21       DRRELAREA -> IAM   0.00958   0.03436   0.0439
## 22    EVALRESP -> STRATOR   0.00000   0.00000   0.0000
## 23    EVALRESP -> INVAREA   0.00000   0.00000   0.0000
## 24     EVALRESP -> TYPINF   0.00000   0.00000   0.0000
## 25      EVALRESP -> PARTN   0.00000   0.00000   0.0000
## 26        EVALRESP -> IAM  -0.01717   0.00000  -0.0172
## 27     STRATOR -> INVAREA   0.61907   0.00000   0.6191
## 28      STRATOR -> TYPINF   0.77887   0.00000   0.7789
## 29       STRATOR -> PARTN   0.42022   0.06215   0.4824
## 30         STRATOR -> IAM   0.45430   0.22858   0.6829
## 31      INVAREA -> TYPINF   0.00000   0.00000   0.0000
## 32       INVAREA -> PARTN   0.10040   0.00000   0.1004
## 33         INVAREA -> IAM   0.06983   0.00337   0.0732
## 34        TYPINF -> PARTN   0.00000   0.00000   0.0000
## 35          TYPINF -> IAM   0.21717   0.00000   0.2172
## 36           PARTN -> IAM   0.03359   0.00000   0.0336
##
## ------------------------------------------------------------
## BOOTSTRAP VALIDATION
## weights
##                       Original  Mean.Boot  Std.Error  perc.025  perc.975
## ASSES-ASSES1             0.569      0.568   1.84e-02     0.536     0.603
## ASSES-ASSES2             0.335      0.337   1.84e-02     0.304     0.367
## ASSES-ASSES3             0.302      0.301   1.87e-02     0.257     0.335
## QUAL-QUAL1               0.477      0.477   7.16e-03     0.463     0.490
## QUAL-QUAL3               0.350      0.351   6.93e-03     0.336     0.363
## QUAL-QUAL4               0.407      0.407   7.12e-03     0.394     0.419
## DRRELAREA-DRRELAREA1     0.305      0.306   7.39e-03     0.293     0.321
## DRRELAREA-DRRELAREA2     0.296      0.297   7.40e-03     0.286     0.311
## DRRELAREA-DRRELAREA4     0.384      0.385   1.03e-02     0.365     0.404
## DRRELAREA-DRRELAREA5     0.293      0.293   7.86e-03     0.279     0.308
## EVALRESP-EVALRESP2       0.619      0.617   5.49e-02     0.517     0.741
## EVALRESP-EVALRESP3       0.570      0.572   5.68e-02     0.436     0.683
```

```
## STRATOR-STRATOR1         0.246      0.245   2.82e-03     0.240     0.250
## STRATOR-STRATOR2         0.288      0.288   3.63e-03     0.282     0.295
## STRATOR-STRATOR3         0.251      0.251   3.15e-03     0.246     0.257
## STRATOR-STRATOR5         0.190      0.190   3.23e-03     0.183     0.196
## STRATOR-STRATOR6         0.212      0.212   2.44e-03     0.207     0.216
## INVAREA-INVAREA1         1.000      1.000   1.37e-16     1.000     1.000
## TYPINF-TYPINF1           0.164      0.164   2.46e-03     0.160     0.169
## TYPINF-TYPINF2           0.191      0.191   2.66e-03     0.187     0.196
## TYPINF-TYPINF3           0.180      0.181   2.70e-03     0.176     0.185
## TYPINF-TYPINF4           0.175      0.175   3.01e-03     0.169     0.180
## TYPINF-TYPINF6           0.189      0.189   2.69e-03     0.184     0.194
## TYPINF-TYPINF7           0.169      0.169   2.55e-03     0.165     0.174
## TYPINF-TYPINF8           0.155      0.155   2.85e-03     0.149     0.160
## PARTN-PARTN2             1.000      1.000   1.34e-16     1.000     1.000
## IAM-IAM                  1.000      1.000   6.60e-17     1.000     1.000
##
## loadings
##                       Original  Mean.Boot  Std.Error  perc.025  perc.975
## ASSES-ASSES1             0.908      0.908   5.97e-03     0.898     0.920
## ASSES-ASSES2             0.794      0.796   1.50e-02     0.766     0.824
## ASSES-ASSES3             0.718      0.717   2.29e-02     0.672     0.755
## QUAL-QUAL1               0.857      0.857   6.08e-03     0.845     0.868
## QUAL-QUAL3               0.748      0.748   1.25e-02     0.725     0.774
## QUAL-QUAL4               0.809      0.808   9.28e-03     0.790     0.825
## DRRELAREA-DRRELAREA1     0.778      0.778   1.30e-02     0.748     0.799
## DRRELAREA-DRRELAREA2     0.755      0.754   1.54e-02     0.724     0.785
## DRRELAREA-DRRELAREA4     0.797      0.795   1.05e-02     0.776     0.815
## DRRELAREA-DRRELAREA5     0.796      0.794   1.26e-02     0.771     0.817
## EVALRESP-EVALRESP2       0.855      0.851   3.35e-02     0.784     0.915
## EVALRESP-EVALRESP3       0.826      0.824   3.91e-02     0.731     0.882
## STRATOR-STRATOR1         0.866      0.866   7.15e-03     0.851     0.879
## STRATOR-STRATOR2         0.889      0.890   4.79e-03     0.880     0.898
## STRATOR-STRATOR3         0.872      0.872   7.03e-03     0.860     0.886
## STRATOR-STRATOR5         0.746      0.746   1.07e-02     0.726     0.767
## STRATOR-STRATOR6         0.805      0.805   9.96e-03     0.784     0.822
## INVAREA-INVAREA1         1.000      1.000   4.46e-17     1.000     1.000
## TYPINF-TYPINF1           0.763      0.763   1.09e-02     0.742     0.784
## TYPINF-TYPINF2           0.843      0.842   7.96e-03     0.826     0.856
## TYPINF-TYPINF3           0.847      0.846   8.06e-03     0.831     0.861
## TYPINF-TYPINF4           0.811      0.811   8.91e-03     0.795     0.828
## TYPINF-TYPINF6           0.846      0.846   7.50e-03     0.834     0.859
```

```
## TYPINF-TYPINF7           0.819      0.818   9.13e-03     0.801     0.832
## TYPINF-TYPINF8           0.783      0.781   1.13e-02     0.760     0.801
## PARTN-PARTN2             1.000      1.000   6.69e-17     1.000     1.000
## IAM-IAM                  1.000      1.000   4.46e-17     1.000     1.000
##
## paths
##                      Original  Mean.Boot  Std.Error  perc.025  perc.975
## ASSES -> IAM         -0.02592    -0.0259     0.0161  -0.05546   0.00445
## QUAL -> IAM           0.21726     0.2154     0.0239   0.17594   0.25935
## DRRELAREA -> TYPINF   0.14258     0.1412     0.0163   0.11051   0.17373
## DRRELAREA -> PARTN    0.10111     0.1000     0.0277   0.05108   0.15305
## DRRELAREA -> IAM      0.00958     0.0102     0.0156  -0.01817   0.04017
## EVALRESP -> IAM      -0.01717    -0.0166     0.0129  -0.04046   0.00512
## STRATOR -> INVAREA    0.61907     0.6179     0.0147   0.58697   0.64900
## STRATOR -> TYPINF     0.77887     0.7795     0.0113   0.75455   0.79974
## STRATOR -> PARTN      0.42022     0.4240     0.0259   0.37117   0.46842
## STRATOR -> IAM        0.45430     0.4577     0.0298   0.39736   0.50777
## INVAREA -> PARTN      0.10040     0.0947     0.0311   0.03731   0.15239
## INVAREA -> IAM        0.06983     0.0705     0.0177   0.04171   0.10413
## TYPINF -> IAM         0.21717     0.2150     0.0262   0.16746   0.26147
## PARTN -> IAM          0.03359     0.0332     0.0156   0.00386   0.06231
##
## rsq
##          Original  Mean.Boot  Std.Error  perc.025  perc.975
## INVAREA     0.383      0.382    0.01813     0.345     0.421
## TYPINF      0.723      0.722    0.01294     0.698     0.747
## PARTN       0.295      0.294    0.01687     0.262     0.329
## IAM         0.808      0.809    0.00812     0.793     0.823
##
## total.efs
##                      Original  Mean.Boot  Std.Error  perc.025  perc.975
## ASSES -> QUAL          0.0000     0.0000     0.0000   0.00000   0.00000
## ASSES -> DRRELAREA     0.0000     0.0000     0.0000   0.00000   0.00000
## ASSES -> EVALRESP      0.0000     0.0000     0.0000   0.00000   0.00000
## ASSES -> STRATOR       0.0000     0.0000     0.0000   0.00000   0.00000
## ASSES -> INVAREA       0.0000     0.0000     0.0000   0.00000   0.00000
## ASSES -> TYPINF        0.0000     0.0000     0.0000   0.00000   0.00000
## ASSES -> PARTN         0.0000     0.0000     0.0000   0.00000   0.00000
## ASSES -> IAM          -0.0259    -0.0259     0.0161  -0.05546   0.00445
## QUAL -> DRRELAREA      0.0000     0.0000     0.0000   0.00000   0.00000
## QUAL -> EVALRESP       0.0000     0.0000     0.0000   0.00000   0.00000
```

```
## QUAL -> STRATOR          0.0000     0.0000     0.0000   0.00000   0.00000
## QUAL -> INVAREA          0.0000     0.0000     0.0000   0.00000   0.00000
## QUAL -> TYPINF           0.0000     0.0000     0.0000   0.00000   0.00000
## QUAL -> PARTN            0.0000     0.0000     0.0000   0.00000   0.00000
## QUAL -> IAM              0.2173     0.2154     0.0239   0.17594   0.25935
## DRRELAREA -> EVALRESP    0.0000     0.0000     0.0000   0.00000   0.00000
## DRRELAREA -> STRATOR     0.0000     0.0000     0.0000   0.00000   0.00000
## DRRELAREA -> INVAREA     0.0000     0.0000     0.0000   0.00000   0.00000
## DRRELAREA -> TYPINF      0.1426     0.1412     0.0163   0.11051   0.17373
## DRRELAREA -> PARTN       0.1011     0.1000     0.0277   0.05108   0.15305
## DRRELAREA -> IAM         0.0439     0.0439     0.0168   0.01416   0.07469
## EVALRESP -> STRATOR      0.0000     0.0000     0.0000   0.00000   0.00000
## EVALRESP -> INVAREA      0.0000     0.0000     0.0000   0.00000   0.00000
## EVALRESP -> TYPINF       0.0000     0.0000     0.0000   0.00000   0.00000
## EVALRESP -> PARTN        0.0000     0.0000     0.0000   0.00000   0.00000
## EVALRESP -> IAM         -0.0172    -0.0166     0.0129  -0.04046   0.00512
## STRATOR -> INVAREA       0.6191     0.6179     0.0147   0.58697   0.64900
## STRATOR -> TYPINF        0.7789     0.7795     0.0113   0.75455   0.79974
## STRATOR -> PARTN         0.4824     0.4825     0.0200   0.44515   0.51541
## STRATOR -> IAM           0.6829     0.6847     0.0235   0.64458   0.72476
## INVAREA -> TYPINF        0.0000     0.0000     0.0000   0.00000   0.00000
## INVAREA -> PARTN         0.1004     0.0947     0.0311   0.03731   0.15239
## INVAREA -> IAM           0.0732     0.0736     0.0174   0.04508   0.10795
## TYPINF -> PARTN          0.0000     0.0000     0.0000   0.00000   0.00000
## TYPINF -> IAM            0.2172     0.2150     0.0262   0.16746   0.26147
## PARTN -> IAM             0.0336     0.0332     0.0156   0.00386   0.06231
```

Remove EVALRESP

```
block.indicators.treatment3 <- list(
    c('ASSES1','ASSES2', 'ASSES3'), #ASSES
    c('QUAL1','QUAL3','QUAL4'), #QUAL
    c('DRRELAREA1', 'DRRELAREA2','DRRELAREA4','DRRELAREA5'),

    c('STRATOR1','STRATOR2','STRATOR3','STRATOR5','STRATOR6'),
    c('INVAREA1'),
    c('TYPINF1','TYPINF2','TYPINF3','TYPINF4','TYPINF6','TYPINF7','TYPINF8'),
    c("PARTN2"),
   c('IAM'))
### Escalando como numérico e nominal
scaled.treatment3 <- list(
    rep("NOM",3), #ASSES
    c("NUM", "NOM","NUM"), #QUAL
    rep("NOM",4), #DRRELAREA

    rep("NOM",5), #STRATOR
    rep("NOM",1), #INVAREA
    rep("NOM",7), #TYPINF
    c("NOM"),#PARTN
    c("NUM") #IAM
    )
modes <- rep("A",8)
path.matrix.treatment3 <- matrix(0, nrow = 8, ncol = 8)
path.matrix.treatment3[8,]<-rep(1,8) # todas as variáveis explicam IAM
path.matrix.treatment3[8,8]<-0 # sem feeedback
path.matrix.treatment3[7,6]<-1 # effect from INVAREA to PARTN
path.matrix.treatment3[7,3]<-1 # effect from DRRELAREA to PARTN
path.matrix.treatment3[6,4]<-1 # effect from STRATOR to TYPINF
path.matrix.treatment3[7,4]<-1 # effect from STRATOR to PARTN
path.matrix.treatment3[6,3]<-1 # effect from DRRELAREA to TYPINF
colnames(path.matrix.treatment3)=rownames(path.matrix.treatment3)<-c("ASSES","QUAL","DRRELAREA", "STRATOR", "INVAR
EA", "TYPINF", "PARTN","IAM")
model_pls1.treatment3 = plspm(table,
                    path.matrix.treatment3,
                    block.indicators.treatment3,
                    modes = modes,
                    scaling = scaled.treatment3,
                    scaled = TRUE,
                    scheme = "path",
                    tol = 1e-7, #tolerância
```

```
                    maxiter=300, #número de interações máximas
                    boot.val =TRUE, #com bootstrapping
                    br=100) #número de amostra bootstrapping
```

```
## Warning: Setting row names on a tibble is deprecated.
```

Measure Again

```
options(repr.plot.width = 1, repr.plot.height = 0.75, repr.plot.res = 100)
formattable(model_pls1.treatment3$unidim , list(
   C.alpha = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
   DG.rho = formatter("span", style = x ~ ifelse(x < 0.5, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
   eig.1st=color_tile("white", "yellow"),
   eig.2nd=color_tile("white", "purple")
))
```

	Mode	MVs	C.alpha	DG.rho	eig.1st	eig.2nd
ASSES	A	3	**0.7463813**	**0.8556498**	1.993188	0.5923898
QUAL	A	3	**0.7311546**	**0.8481344**	1.952246	0.5834945
DRRELAREA	A	4	**0.7890320**	**0.8635029**	2.451396	0.5933478
STRATOR	A	5	**0.8928571**	**0.9214190**	3.508126	0.5103422
INVAREA	A	1	**1.0000000**	**1.0000000**	1.000000	0.0000000
TYPINF	A	7	**0.9164128**	**0.9332816**	4.667357	0.5769790
PARTN	A	1	**1.0000000**	**1.0000000**	1.000000	0.0000000
IAM	A	1	**1.0000000**	**1.0000000**	1.000000	0.0000000

Everything above is reliable.

```
options(repr.plot.width = 1, repr.plot.height = 0.75, repr.plot.res = 100)
formattable(model_pls1.treatment3$outer_model, list(
    loading = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(colo
r = "green", font.weight = "bold"))),
   communality = formatter("span", style = x ~ ifelse(x < 0.5, style(color = "red", font.weight = "bold"), style(c
olor = "green", font.weight = "bold"))),
   redundancy=color_tile("white", "yellow")
))
```

name	block	weight	loading	communality	redundancy
ASSES1	ASSES	0.5693484	**0.9084924**	**0.8253584**	0.0000000
ASSES2	ASSES	0.3354102	**0.7937113**	**0.6299776**	0.0000000
ASSES3	ASSES	0.3015996	**0.7179466**	**0.5154474**	0.0000000
QUAL1	QUAL	0.4767963	**0.8570977**	**0.7346165**	0.0000000
QUAL3	QUAL	0.3499599	**0.7478610**	**0.5592961**	0.0000000
QUAL4	QUAL	0.4073274	**0.8092204**	**0.6548377**	0.0000000
DRRELAREA1	DRRELAREA	0.3052010	**0.7777678**	**0.6049228**	0.0000000
DRRELAREA2	DRRELAREA	0.2963246	**0.7552487**	**0.5704005**	0.0000000
DRRELAREA4	DRRELAREA	0.3839160	**0.7967110**	**0.6347484**	0.0000000
DRRELAREA5	DRRELAREA	0.2928208	**0.7955570**	**0.6329110**	0.0000000
STRATOR1	STRATOR	0.2438702	**0.8655788**	**0.7492266**	0.0000000
STRATOR2	STRATOR	0.2869808	**0.8883276**	**0.7891259**	0.0000000
STRATOR3	STRATOR	0.2506567	**0.8714443**	**0.7594152**	0.0000000
STRATOR5	STRATOR	0.1929917	**0.7473742**	**0.5585682**	0.0000000
STRATOR6	STRATOR	0.2126909	**0.8054303**	**0.6487180**	0.0000000
INVAREA1	INVAREA	1.0000000	**1.0000000**	**1.0000000**	0.0000000
TYPINF1	TYPINF	0.1627305	**0.7621463**	**0.5808669**	0.4193585
TYPINF2	TYPINF	0.1899279	**0.8423544**	**0.7095609**	0.5122695

name	block	weight	loading	communality	redundancy
TYPINF3	TYPINF	0.1821443	**0.8471655**	**0.7176895**	0.5181379
TYPINF4	TYPINF	0.1733168	**0.8109038**	**0.6575650**	0.4747309
TYPINF6	TYPINF	0.1891127	**0.8462341**	**0.7161121**	0.5169991
TYPINF7	TYPINF	0.1697171	**0.8194016**	**0.6714190**	0.4847328
TYPINF8	TYPINF	0.1558314	**0.7831493**	**0.6133229**	0.4427901
PARTN2	PARTN	1.0000000	**1.0000000**	**1.0000000**	0.3062187
IAM	IAM	1.0000000	**1.0000000**	**1.0000000**	0.8077404

Everything above is reliable. # Measuring Cross-Loading

```
formattable(model_pls1.treatment3$crossloadings, list(
    ASSES = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
   QUAL = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color =
"green", font.weight = "bold"))),
  DRRELAREA = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(colo
r = "green", font.weight = "bold"))),
  STRATOR = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
  INVAREA = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color
= "green", font.weight = "bold"))),
  TYPINF = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color =
"green", font.weight = "bold"))),
  PARTN = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color =
"green", font.weight = "bold"))),
  IAM = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color = "g
reen", font.weight = "bold")))
))
```

name	block	ASSES	QUAL	DRRELAREA	STRATOR	INVAREA	TYPINF	PARTN	IAM
ASSES1	ASSES	**0.90849236**	**0.2852195**	**0.2419752**	**0.2829744**	**0.2583109**	**0.3919054**	**0.21334594**	**0.2758689**
ASSES2	ASSES	**0.79371128**	**0.1768697**	**0.1705911**	**0.1839673**	**0.1806873**	**0.2965377**	**0.15604331**	**0.1625178**

name	block	ASSES	QUAL	DRRELAREA	STRATOR	INVAREA	TYPINF	PARTN	IAM
ASSES3	ASSES	**0.71794664**	**0.1281046**	**0.1151612**	**0.1318004**	**0.1508421**	**0.2267980**	**0.07754997**	**0.1461354**
QUAL1	QUAL	**0.22656501**	**0.8570977**	**0.3984741**	**0.7358062**	**0.5220564**	**0.7026841**	**0.40123692**	**0.7513652**
QUAL3	QUAL	**0.21770399**	**0.7478610**	**0.3172436**	**0.5718926**	**0.4327512**	**0.5496998**	**0.36886638**	**0.5514885**
QUAL4	QUAL	**0.18691719**	**0.8092204**	**0.3579004**	**0.6623583**	**0.4602966**	**0.6135753**	**0.43730244**	**0.6418917**
DRRELAREA1	DRRELAREA	**0.15737647**	**0.3268242**	**0.7777678**	**0.3140785**	**0.3887224**	**0.3539015**	**0.24936463**	**0.3158245**
DRRELAREA2	DRRELAREA	**0.19404949**	**0.3160545**	**0.7552487**	**0.3007081**	**0.2690097**	**0.3369012**	**0.24505355**	**0.3117430**
DRRELAREA4	DRRELAREA	**0.21420450**	**0.4202856**	**0.7967110**	**0.4126577**	**0.3886660**	**0.4423204**	**0.28389268**	**0.4224778**
DRRELAREA5	DRRELAREA	**0.14325882**	**0.3143219**	**0.7955570**	**0.2967909**	**0.3215475**	**0.3421693**	**0.23435263**	**0.3037959**
STRATOR1	STRATOR	**0.19425206**	**0.7083836**	**0.3774364**	**0.8655788**	**0.5466475**	**0.7062582**	**0.46012338**	**0.7387467**
STRATOR2	STRATOR	**0.38531698**	**0.7720217**	**0.4416161**	**0.8883276**	**0.6332380**	**0.8474804**	**0.53810957**	**0.8555872**
STRATOR3	STRATOR	**0.21332791**	**0.7010861**	**0.3322671**	**0.8714443**	**0.5421386**	**0.7301321**	**0.44465175**	**0.7722884**
STRATOR5	STRATOR	**0.08718006**	**0.5956392**	**0.3091906**	**0.7473742**	**0.3788951**	**0.5710787**	**0.32838526**	**0.5944514**
STRATOR6	STRATOR	**0.16135382**	**0.6383505**	**0.3223442**	**0.8054303**	**0.4446936**	**0.6166277**	**0.39544504**	**0.6471823**
INVAREA1	INVAREA	**0.25316717**	**0.5878515**	**0.4417235**	**0.6186348**	**1.0000000**	**0.6288473**	**0.40521112**	**0.6241995**
TYPINF1	TYPINF	**0.23191187**	**0.5995909**	**0.3530823**	**0.6481835**	**0.4592227**	**0.7621463**	**0.38406808**	**0.6225309**
TYPINF2	TYPINF	**0.34016138**	**0.6767032**	**0.4253589**	**0.7406204**	**0.5501457**	**0.8423544**	**0.45476891**	**0.7351663**
TYPINF3	TYPINF	**0.36180463**	**0.6409032**	**0.4247035**	**0.6983824**	**0.5447907**	**0.8471655**	**0.46972523**	**0.6918666**
TYPINF4	TYPINF	**0.35061433**	**0.6072155**	**0.3947091**	**0.6726301**	**0.5267810**	**0.8109038**	**0.40840139**	**0.6769998**
TYPINF6	TYPINF	**0.31728345**	**0.7128932**	**0.3708609**	**0.7477891**	**0.5407062**	**0.8462341**	**0.46542493**	**0.7232953**
TYPINF7	TYPINF	**0.32945365**	**0.6294719**	**0.3793420**	**0.6701953**	**0.4872670**	**0.8194016**	**0.42041723**	**0.6401187**
TYPINF8	TYPINF	**0.29560914**	**0.5622277**	**0.3806947**	**0.6079318**	**0.4758172**	**0.7831493**	**0.39289287**	**0.5847492**
PARTN2	PARTN	**0.19719574**	**0.4985220**	**0.3263360**	**0.5255757**	**0.4052111**	**0.5258083**	**1.00000000**	**0.5191709**
IAM	IAM	**0.25565000**	**0.8127071**	**0.4399208**	**0.8716487**	**0.6241995**	**0.8208341**	**0.51917090**	**1.0000000**

There are a lot of indicators with issues. # Measuring AVE and R^2

```
model_pls1.treatment3$inner_summary
```

```
##                 Type        R2 Block_Communality Mean_Redundancy       AVE
## ASSES      Exogenous 0.0000000          0.6569278       0.0000000 0.6569278
## QUAL       Exogenous 0.0000000          0.6495834       0.0000000 0.6495834
## DRRELAREA  Exogenous 0.0000000          0.6107457       0.0000000 0.6107457
## STRATOR    Exogenous 0.0000000          0.7010108       0.0000000 0.7010108
## INVAREA    Exogenous 0.0000000          1.0000000       0.0000000 1.0000000
## TYPINF    Endogenous 0.7219528          0.6666480       0.4812884 0.6666480
## PARTN     Endogenous 0.3062187          1.0000000       0.3062187 1.0000000
## IAM       Endogenous 0.8077404          1.0000000       0.8077404 1.0000000
```

Creating a filter to eliminate all indicators with issues.

```
select.crossloading.is.invalid <- function(df, line, col){
  maximum.line<-df %>%
    slice(line) %>%
    select(c(3:dim(df)[2])) %>%
    as.numeric %>%
    max
  #print(paste("linha",maximum.line))
  value<-df[line, col]
  #print(value)
  df<-df%>%filter(block!=col)
  maximum.column<-max(df[,col])
  #print(paste("coluna",maximum.column))
  if (value >= maximum.line && value>=maximum.column){
    return(FALSE)
  }else{
    return(TRUE)
  }
}
```

```
data.frame.removed<-tibble(
  indexes = numeric())
columns<-model_pls1.treatment3$crossloadings %>%
  select(block) %>%
  unique
for (column in columns$block){
  indicators<-model_pls1.treatment3$crossloadings %>%
    filter(block==column) %>%
    select("name")
  for (var in indicators$name){
    print(column)
    line<-which(apply(model_pls1.treatment3$crossloadings, 1, function(x) any(grep(var, x))))
    invalid<-select.crossloading.is.invalid(model_pls1.treatment3$crossloadings,
                              line,
                              column)
    #print(invalid)
      #print("####################")
      if (invalid){
        data.frame.removed<-data.frame.removed %>%
          add_row(indexes=line)
      }
  }
}
```

```
## [1] "ASSES"
## [1] "ASSES"
## [1] "ASSES"
## [1] "QUAL"
## [1] "QUAL"
## [1] "QUAL"
## [1] "DRRELAREA"
## [1] "DRRELAREA"
## [1] "DRRELAREA"
## [1] "DRRELAREA"
## [1] "STRATOR"
## [1] "STRATOR"
## [1] "STRATOR"
## [1] "STRATOR"
## [1] "STRATOR"
## [1] "INVAREA"
## [1] "TYPINF"
## [1] "TYPINF"
## [1] "TYPINF"
## [1] "TYPINF"
## [1] "TYPINF"
## [1] "TYPINF"
## [1] "TYPINF"
## [1] "PARTN"
## [1] "IAM"
```

```
indexes<-seq(1,dim(model_pls1.treatment3$crossloading)[1])
indexes <- indexes[which(!indexes %in% data.frame.removed$indexes)]
final.variables<-model_pls1.treatment3$crossloadings %>%
  slice(indexes)
```

Plot the output of cross-loadings

```
# load ggplot2 and reshape
library(ggplot2)
```

```
##
## Attaching package: 'ggplot2'
```

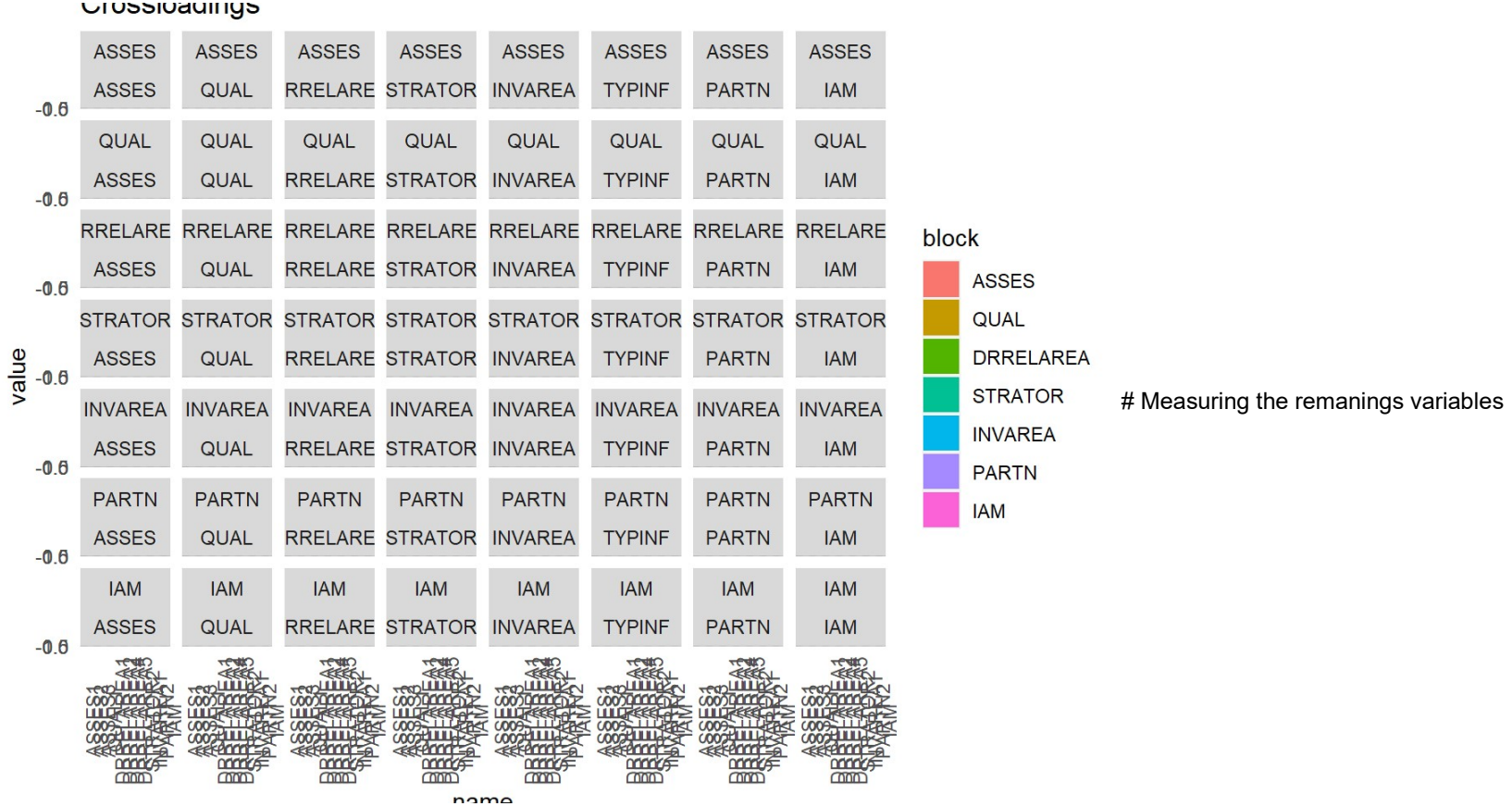
```
## The following object is masked from 'package:plspm':
##
##     alpha
```

```
library(reshape)
```

```
##
## Attaching package: 'reshape'
```

```
## The following object is masked from 'package:dplyr':
##
##     rename
```

```
# reshape crossloadings data.frame for ggplot
xloads = melt(final.variables, id.vars = c("name", "block"),
variable_name = "LV")
# bar-charts of crossloadings by block
ggplot(data = xloads,
aes(x = name, y = value, fill = block)) +
geom_hline(yintercept = 0, color = "gray75") +
geom_hline(yintercept = c(-0.5, 0.5), color = "gray70", linetype = 2) +
geom_bar(stat = 'identity', position = 'dodge') +
facet_wrap(block ~ LV) +
theme(axis.text.x = element_text(angle = 90),
line = element_blank()) +
ggtitle("Crossloadings")
```



after cross-loadings filtering # Bootstrapping # Final Model # Structural Model Validation beginning

```
block.indicators.final <- list(
    c('ASSES1','ASSES2', 'ASSES3'),
    c('QUAL1'),
    c('DRRELAREA1','DRRELAREA2','DRRELAREA4','DRRELAREA5'),

    c('STRATOR2'),
    c('INVAREA1'),
    c("PARTN2"),
   c('IAM'))
### Escalando como numérico e nominal
scaled.final <-list(
    rep("NOM",3), #ASSES
    c("NOM"), #QUAL
    rep("NOM",4), #DRRELAREA

    rep("NOM",1), #STRATOR
    rep("NOM",1), #INVAREA
    rep("NOM",1), #PARTN
    c("NUM") #IAM
    )
modes <- rep("A",7)
path.matrix.final <- matrix(0, nrow = 7, ncol = 7)
path.matrix.final[7,]<-rep(1,7) # todas as variáveis explicam IAM
path.matrix.final[7,7]<-0 # sem feeedback
path.matrix.final[6,3]<-1 # effect from DRRELAREA to PARTN
path.matrix.final[6,4]<-1 # effect from STRATOR to PARTN
colnames(path.matrix.final)=rownames(path.matrix.final)<-c("ASSES","QUAL","DRRELAREA", "STRATOR", "INVAREA", "PART
N", "IAM")
model_pls1.final = plspm(table,
                    path.matrix.final,
                    block.indicators.final,
                    modes = modes,
                    scaling = scaled.final,
                    scaled = TRUE,
                    scheme = "path",
                    tol = 1e-7, #tolerância
                    maxiter=300, #número de interações máximas
                    boot.val =TRUE, #com bootstrapping
                    br=5000) #número de amostra bootstrapping
```

```
## Warning: Setting row names on a tibble is deprecated.
```

Summary whole model

```
summary(model_pls1.final)
```

```
## PARTIAL LEAST SQUARES PATH MODELING (PLS-PM)
##
## ------------------------------------------------------
## MODEL SPECIFICATION
## 1   Number of Cases      1998
## 2   Latent Variables     7
## 3   Manifest Variables   12
## 4   Scale of Data        Standardized Data
## 5   Non-Metric PLS       TRUE
## 6   Weighting Scheme     path
## 7   Tolerance Crit       1e-07
## 8   Max Num Iters        300
## 9   Convergence Iters    3
## 10  Bootstrapping        TRUE
## 11  Bootstrap samples    5000
##
## ------------------------------------------------------
## BLOCKS DEFINITION
##         Block         Type   Size   Mode
## 1       ASSES    Exogenous      3      A
## 2        QUAL    Exogenous      1      A
## 3   DRRELAREA    Exogenous      4      A
## 4     STRATOR    Exogenous      1      A
## 5     INVAREA    Exogenous      1      A
## 6       PARTN   Endogenous      1      A
## 7         IAM   Endogenous      1      A
##
## ------------------------------------------------------
## BLOCKS UNIDIMENSIONALITY
##            Mode  MVs  C.alpha  DG.rho  eig.1st  eig.2nd
## ASSES         A    3    0.746   0.856     1.99    0.592
## QUAL          A    1    1.000   1.000     1.00    0.000
## DRRELAREA     A    4    0.789   0.864     2.45    0.593
## STRATOR       A    1    1.000   1.000     1.00    0.000
## INVAREA       A    1    1.000   1.000     1.00    0.000
## PARTN         A    1    1.000   1.000     1.00    0.000
## IAM           A    1    1.000   1.000     1.00    0.000
##
## ------------------------------------------------------
## OUTER MODEL
##                 weight  loading  communality  redundancy
```

```
## ASSES
##   1 ASSES1       0.569    0.908        0.825       0.000
##   1 ASSES2       0.335    0.794        0.630       0.000
##   1 ASSES3       0.302    0.718        0.515       0.000
## QUAL
##   2 QUAL1        1.000    1.000        1.000       0.000
## DRRELAREA
##   3 DRRELAREA1   0.304    0.777        0.604       0.000
##   3 DRRELAREA2   0.300    0.757        0.573       0.000
##   3 DRRELAREA4   0.384    0.797        0.635       0.000
##   3 DRRELAREA5   0.290    0.794        0.631       0.000
## STRATOR
##   4 STRATOR2     1.000    1.000        1.000       0.000
## INVAREA
##   5 INVAREA1     1.000    1.000        1.000       0.000
## PARTN
##   6 PARTN2       1.000    1.000        1.000       0.299
## IAM
##   7 IAM          1.000    1.000        1.000       0.846
##
## -----------------------------------------------------------
## CROSSLOADINGS
##                ASSES   QUAL  DRRELAREA  STRATOR  INVAREA   PARTN    IAM
## ASSES
##   1 ASSES1      0.908  0.421      0.242    0.395    0.258  0.2133  0.276
##   1 ASSES2      0.794  0.303      0.171    0.279    0.181  0.1560  0.163
##   1 ASSES3      0.718  0.238      0.115    0.222    0.151  0.0775  0.146
## QUAL
##   2 QUAL1       0.413  1.000      0.494    0.913    0.678  0.5566  0.908
## DRRELAREA
##   3 DRRELAREA1  0.157  0.365      0.777    0.326    0.389  0.2494  0.316
##   3 DRRELAREA2  0.194  0.352      0.757    0.323    0.269  0.2451  0.312
##   3 DRRELAREA4  0.214  0.466      0.797    0.402    0.389  0.2839  0.422
##   3 DRRELAREA5  0.143  0.339      0.794    0.314    0.322  0.2344  0.304
## STRATOR
##   4 STRATOR2    0.385  0.913      0.442    1.000    0.633  0.5381  0.856
## INVAREA
##   5 INVAREA1    0.253  0.678      0.442    0.633    1.000  0.4052  0.624
## PARTN
##   6 PARTN2      0.197  0.557      0.326    0.538    0.405  1.0000  0.519
## IAM
```

```
##   7 IAM         0.256  0.908      0.440    0.856    0.624  0.5192  1.000
##
## ------------------------------------------------------------
## INNER MODEL
## $PARTN
##              Estimate   Std. Error     t value    Pr(>|t|)
## Intercept   -7.68e-15       0.0187   -4.10e-13    1.00e+00
## DRRELAREA    1.10e-01       0.0209    5.28e+00    1.46e-07
## STRATOR      4.89e-01       0.0209    2.34e+01   1.92e-107
##
## $IAM
##              Estimate   Std. Error     t value    Pr(>|t|)
## Intercept   -2.13e-15      0.00878   -2.42e-13    1.00e+00
## ASSES       -1.45e-01      0.00967   -1.50e+01    2.10e-48
## QUAL         8.15e-01      0.02376    3.43e+01   3.27e-203
## DRRELAREA   -5.04e-03      0.01028   -4.90e-01    6.24e-01
## STRATOR      1.63e-01      0.02170    7.51e+00    9.04e-14
## INVAREA      4.32e-03      0.01216    3.56e-01    7.22e-01
## PARTN        6.17e-03      0.01066    5.79e-01    5.62e-01
##
## ------------------------------------------------------------
## CORRELATIONS BETWEEN LVs
##            ASSES   QUAL  DRRELAREA  STRATOR  INVAREA  PARTN    IAM
## ASSES      1.000  0.413      0.230    0.385    0.253  0.197  0.256
## QUAL       0.413  1.000      0.494    0.913    0.678  0.557  0.908
## DRRELAREA  0.230  0.494      1.000    0.442    0.442  0.326  0.440
## STRATOR    0.385  0.913      0.442    1.000    0.633  0.538  0.856
## INVAREA    0.253  0.678      0.442    0.633    1.000  0.405  0.624
## PARTN      0.197  0.557      0.326    0.538    0.405  1.000  0.519
## IAM        0.256  0.908      0.440    0.856    0.624  0.519  1.000
##
## ------------------------------------------------------------
## SUMMARY INNER MODEL
##                 Type     R2  Block_Communality  Mean_Redundancy    AVE
## ASSES       Exogenous  0.000              0.657            0.000  0.657
## QUAL        Exogenous  0.000              1.000            0.000  1.000
## DRRELAREA   Exogenous  0.000              0.611            0.000  0.611
## STRATOR     Exogenous  0.000              1.000            0.000  1.000
## INVAREA     Exogenous  0.000              1.000            0.000  1.000
## PARTN      Endogenous  0.299              1.000            0.299  1.000
## IAM        Endogenous  0.846              1.000            0.846  1.000
```

```
##
## ------------------------------------------------------------
## GOODNESS-OF-FIT
## [1]  0.601
##
## ------------------------------------------------------------
## TOTAL EFFECTS
##            relationships    direct  indirect     total
## 1           ASSES -> QUAL   0.00000  0.000000   0.00000
## 2      ASSES -> DRRELAREA   0.00000  0.000000   0.00000
## 3        ASSES -> STRATOR   0.00000  0.000000   0.00000
## 4        ASSES -> INVAREA   0.00000  0.000000   0.00000
## 5          ASSES -> PARTN   0.00000  0.000000   0.00000
## 6            ASSES -> IAM  -0.14534  0.000000  -0.14534
## 7       QUAL -> DRRELAREA   0.00000  0.000000   0.00000
## 8         QUAL -> STRATOR   0.00000  0.000000   0.00000
## 9         QUAL -> INVAREA   0.00000  0.000000   0.00000
## 10          QUAL -> PARTN   0.00000  0.000000   0.00000
## 11            QUAL -> IAM   0.81544  0.000000   0.81544
## 12  DRRELAREA -> STRATOR   0.00000  0.000000   0.00000
## 13  DRRELAREA -> INVAREA   0.00000  0.000000   0.00000
## 14    DRRELAREA -> PARTN   0.11023  0.000000   0.11023
## 15      DRRELAREA -> IAM  -0.00504  0.000681  -0.00436
## 16    STRATOR -> INVAREA   0.00000  0.000000   0.00000
## 17      STRATOR -> PARTN   0.48942  0.000000   0.48942
## 18        STRATOR -> IAM   0.16294  0.003022   0.16596
## 19      INVAREA -> PARTN   0.00000  0.000000   0.00000
## 20        INVAREA -> IAM   0.00432  0.000000   0.00432
## 21          PARTN -> IAM   0.00617  0.000000   0.00617
##
## ------------------------------------------------------------
## BOOTSTRAP VALIDATION
## weights
##                       Original  Mean.Boot  Std.Error  perc.025  perc.975
## ASSES-ASSES1             0.569      0.570   1.87e-02     0.534     0.608
## ASSES-ASSES2             0.335      0.335   1.71e-02     0.300     0.368
## ASSES-ASSES3             0.302      0.301   1.81e-02     0.265     0.336
## QUAL-QUAL1               1.000      1.000   8.75e-17     1.000     1.000
## DRRELAREA-DRRELAREA1     0.304      0.304   9.87e-03     0.285     0.324
## DRRELAREA-DRRELAREA2     0.300      0.300   9.89e-03     0.280     0.319
## DRRELAREA-DRRELAREA4     0.384      0.385   1.29e-02     0.360     0.410
```

```
## DRRELAREA-DRRELAREA5     0.290      0.290   9.34e-03     0.271     0.308
## STRATOR-STRATOR2         1.000      1.000   1.34e-16     1.000     1.000
## INVAREA-INVAREA1         1.000      1.000   9.40e-17     1.000     1.000
## PARTN-PARTN2             1.000      1.000   1.30e-16     1.000     1.000
## IAM-IAM                  1.000      1.000   7.11e-17     1.000     1.000
##
## loadings
##                       Original  Mean.Boot  Std.Error  perc.025  perc.975
## ASSES-ASSES1             0.908      0.909   6.37e-03     0.896     0.921
## ASSES-ASSES2             0.794      0.793   1.64e-02     0.760     0.824
## ASSES-ASSES3             0.718      0.717   2.03e-02     0.674     0.754
## QUAL-QUAL1               1.000      1.000   5.82e-17     1.000     1.000
## DRRELAREA-DRRELAREA1     0.777      0.777   1.44e-02     0.747     0.804
## DRRELAREA-DRRELAREA2     0.757      0.757   1.53e-02     0.725     0.786
## DRRELAREA-DRRELAREA4     0.797      0.797   1.19e-02     0.773     0.819
## DRRELAREA-DRRELAREA5     0.794      0.794   1.38e-02     0.765     0.820
## STRATOR-STRATOR2         1.000      1.000   5.67e-17     1.000     1.000
## INVAREA-INVAREA1         1.000      1.000   6.18e-17     1.000     1.000
## PARTN-PARTN2             1.000      1.000   5.80e-17     1.000     1.000
## IAM-IAM                  1.000      1.000   5.39e-17     1.000     1.000
##
## paths
##                     Original  Mean.Boot  Std.Error  perc.025  perc.975
## ASSES -> IAM        -0.14534   -0.14094     0.0119   -0.1646   -0.1184
## QUAL -> IAM          0.81544    0.82046     0.0300    0.7620    0.8781
## DRRELAREA -> PARTN   0.11023    0.10996     0.0272    0.0565    0.1626
## DRRELAREA -> IAM    -0.00504   -0.00431     0.0134   -0.0306    0.0218
## STRATOR -> PARTN     0.48942    0.48980     0.0207    0.4494    0.5304
## STRATOR -> IAM       0.16294    0.15832     0.0287    0.1024    0.2150
## INVAREA -> IAM       0.00432    0.00458     0.0151   -0.0247    0.0334
## PARTN -> IAM         0.00617    0.00534     0.0133   -0.0202    0.0315
##
## rsq
##        Original  Mean.Boot  Std.Error  perc.025  perc.975
## PARTN     0.299      0.300    0.01614     0.268     0.332
## IAM       0.846      0.851    0.00735     0.837     0.865
##
## total.efs
##                      Original  Mean.Boot  Std.Error  perc.025  perc.975
## ASSES -> QUAL         0.00000    0.00000     0.0000    0.0000    0.0000
## ASSES -> DRRELAREA    0.00000    0.00000     0.0000    0.0000    0.0000
```

```
## ASSES -> STRATOR       0.00000    0.00000     0.0000    0.0000    0.0000
## ASSES -> INVAREA       0.00000    0.00000     0.0000    0.0000    0.0000
## ASSES -> PARTN         0.00000    0.00000     0.0000    0.0000    0.0000
## ASSES -> IAM          -0.14534   -0.14094     0.0119   -0.1646   -0.1184
## QUAL -> DRRELAREA      0.00000    0.00000     0.0000    0.0000    0.0000
## QUAL -> STRATOR        0.00000    0.00000     0.0000    0.0000    0.0000
## QUAL -> INVAREA        0.00000    0.00000     0.0000    0.0000    0.0000
## QUAL -> PARTN          0.00000    0.00000     0.0000    0.0000    0.0000
## QUAL -> IAM            0.81544    0.82046     0.0300    0.7620    0.8781
## DRRELAREA -> STRATOR   0.00000    0.00000     0.0000    0.0000    0.0000
## DRRELAREA -> INVAREA   0.00000    0.00000     0.0000    0.0000    0.0000
## DRRELAREA -> PARTN     0.11023    0.10996     0.0272    0.0565    0.1626
## DRRELAREA -> IAM      -0.00436   -0.00372     0.0134   -0.0297    0.0221
## STRATOR -> INVAREA     0.00000    0.00000     0.0000    0.0000    0.0000
## STRATOR -> PARTN       0.48942    0.48980     0.0207    0.4494    0.5304
## STRATOR -> IAM         0.16596    0.16092     0.0290    0.1044    0.2176
## INVAREA -> PARTN       0.00000    0.00000     0.0000    0.0000    0.0000
## INVAREA -> IAM         0.00432    0.00458     0.0151   -0.0247    0.0334
## PARTN -> IAM           0.00617    0.00534     0.0133   -0.0202    0.0315
```

Fornell-Lacker Criterion

```
# Fornell-Lacker - validade discriminante
# sqrt of AVE
sqrt(model_pls1.final$inner_summary$AVE)
```

```
## [1] 0.8105108 1.0000000 0.7814684 1.0000000 1.0000000 1.0000000 1.0000000
```

Coefficient of Determination

```
model_pls1.final$inner_summary[, "R2", drop = FALSE]
```

```
##                  R2
## ASSES     0.0000000
## QUAL      0.0000000
## DRRELAREA 0.0000000
## STRATOR   0.0000000
## INVAREA   0.0000000
## PARTN     0.2993411
## IAM       0.8464210
```

Outer Model

```
options(repr.plot.width = 1, repr.plot.height = 0.75, repr.plot.res = 100)
formattable(model_pls1.final$outer_model, list(
loading = formatter("span", style = x ~ ifelse(x < 0.7, style(color = "red", font.weight = "bold"), style(color =
"green", font.weight = "bold"))),
communality = formatter("span", style = x ~ ifelse(x < 0.5, style(color = "red", font.weight = "bold"), style(colo
r = "green", font.weight = "bold"))),
redundancy=color_tile("white", "yellow")
))
```

name	block	weight	loading	communality	redundancy
ASSES1	ASSES	0.5693484	**0.9084924**	**0.8253584**	0.0000000
ASSES2	ASSES	0.3354102	**0.7937113**	**0.6299776**	0.0000000
ASSES3	ASSES	0.3015996	**0.7179466**	**0.5154474**	0.0000000
QUAL1	QUAL	1.0000000	**1.0000000**	**1.0000000**	0.0000000
DRRELAREA1	DRRELAREA	0.3041415	**0.7770406**	**0.6037921**	0.0000000
DRRELAREA2	DRRELAREA	0.2997206	**0.7569246**	**0.5729348**	0.0000000
DRRELAREA4	DRRELAREA	0.3844680	**0.7969075**	**0.6350615**	0.0000000
DRRELAREA5	DRRELAREA	0.2900736	**0.7943445**	**0.6309832**	0.0000000
STRATOR2	STRATOR	1.0000000	**1.0000000**	**1.0000000**	0.0000000
INVAREA1	INVAREA	1.0000000	**1.0000000**	**1.0000000**	0.0000000

name	block	weight	loading	communality	redundancy
PARTN2	PARTN	1.0000000	**1.0000000**	**1.0000000**	0.2993411
IAM	IAM	1.0000000	**1.0000000**	**1.0000000**	0.8464210

Inner Summary

```
model_pls1.final$inner_summary
```

```
##                 Type        R2 Block_Communality Mean_Redundancy       AVE
## ASSES      Exogenous 0.0000000          0.6569278       0.0000000 0.6569278
## QUAL       Exogenous 0.0000000          1.0000000       0.0000000 1.0000000
## DRRELAREA  Exogenous 0.0000000          0.6106929       0.0000000 0.6106929
## STRATOR    Exogenous 0.0000000          1.0000000       0.0000000 1.0000000
## INVAREA    Exogenous 0.0000000          1.0000000       0.0000000 1.0000000
## PARTN     Endogenous 0.2993411          1.0000000       0.2993411 1.0000000
## IAM       Endogenous 0.8464210          1.0000000       0.8464210 1.0000000
```

Effects

```
model_pls1.final$effects
```

```
##           relationships       direct     indirect        total
## 1         ASSES -> QUAL  0.000000000 0.0000000000  0.000000000
## 2    ASSES -> DRRELAREA  0.000000000 0.0000000000  0.000000000
## 3      ASSES -> STRATOR  0.000000000 0.0000000000  0.000000000
## 4      ASSES -> INVAREA  0.000000000 0.0000000000  0.000000000
## 5        ASSES -> PARTN  0.000000000 0.0000000000  0.000000000
## 6          ASSES -> IAM -0.145341258 0.0000000000 -0.145341258
## 7     QUAL -> DRRELAREA  0.000000000 0.0000000000  0.000000000
## 8       QUAL -> STRATOR  0.000000000 0.0000000000  0.000000000
## 9       QUAL -> INVAREA  0.000000000 0.0000000000  0.000000000
## 10        QUAL -> PARTN  0.000000000 0.0000000000  0.000000000
## 11          QUAL -> IAM  0.815441920 0.0000000000  0.815441920
## 12 DRRELAREA -> STRATOR  0.000000000 0.0000000000  0.000000000
## 13 DRRELAREA -> INVAREA  0.000000000 0.0000000000  0.000000000
## 14   DRRELAREA -> PARTN  0.110226548 0.0000000000  0.110226548
## 15     DRRELAREA -> IAM -0.005040801 0.0006805696 -0.004360232
## 16   STRATOR -> INVAREA  0.000000000 0.0000000000  0.000000000
## 17     STRATOR -> PARTN  0.489419400 0.0000000000  0.489419400
## 18       STRATOR -> IAM  0.162938735 0.0030218123  0.165960548
## 19     INVAREA -> PARTN  0.000000000 0.0000000000  0.000000000
## 20       INVAREA -> IAM  0.004324685 0.0000000000  0.004324685
## 21         PARTN -> IAM  0.006174280 0.0000000000  0.006174280
```

```
library("parameters")
```

```
##
## Attaching package: 'parameters'
```

```
## The following object is masked from 'package:plspm':
##
##     get_scores
```

```
model_pls1.final$effects[c(6,11, 14,15,17,18,20,21),]
```

```
##         relationships       direct     indirect        total
## 6        ASSES -> IAM -0.145341258 0.0000000000 -0.145341258
## 11        QUAL -> IAM  0.815441920 0.0000000000  0.815441920
## 14 DRRELAREA -> PARTN  0.110226548 0.0000000000  0.110226548
## 15   DRRELAREA -> IAM -0.005040801 0.0006805696 -0.004360232
## 17   STRATOR -> PARTN  0.489419400 0.0000000000  0.489419400
## 18     STRATOR -> IAM  0.162938735 0.0030218123  0.165960548
## 20     INVAREA -> IAM  0.004324685 0.0000000000  0.004324685
## 21       PARTN -> IAM  0.006174280 0.0000000000  0.006174280
```

Filtering by the relevant effects (above or equal 0.1) - IAM

```
model_pls1.final.relevants<-model_pls1.final$effects[c(6,11, 14,15,17,18,20,21),] %>% filter(abs(total)>=0.1)
model_pls1.final.relevants
```

```
##        relationships     direct    indirect      total
## 1       ASSES -> IAM -0.1453413 0.000000000 -0.1453413
## 2        QUAL -> IAM  0.8154419 0.000000000  0.8154419
## 3 DRRELAREA -> PARTN  0.1102265 0.000000000  0.1102265
## 4   STRATOR -> PARTN  0.4894194 0.000000000  0.4894194
## 5     STRATOR -> IAM  0.1629387 0.003021812  0.1659605
```

SIZE EFFECTS

```
model.filtered<-model_pls1.final$scores %>% as.data.frame %>%select(ASSES, QUAL, STRATOR, IAM)
model <- aov(IAM~., data=model.filtered)
eta_squared(model)
```

```
## # Effect Size for ANOVA (Type I)
##
## Parameter | Eta2 (partial) |       95% CI
## -----------------------------------------
## ASSES     |           0.30 | [0.22, 1.00]
## QUAL      |           0.83 | [0.83, 1.00]
## STRATOR   |           0.03 | [0.02, 1.00]
##
## - One-sided CIs: upper bound fixed at [1.00].
```

The size effects is big for QUAL, moderate for ASSES and small for STRATOR

```
options(es.use_symbols = TRUE)
m <- lm(IAM~., data = model.filtered)
parameters::model_parameters(anova(m))
```

```
## Parameter | Sum_Squares |   df | Mean_Square |        F |      p
## ------------------------------------------------------------------
## ASSES     |      130.58 |    1 |      130.58 |   848.30 | < .001
## QUAL      |     1551.49 |    1 |     1551.49 | 10078.83 | < .001
## STRATOR   |        8.98 |    1 |        8.98 |    58.33 | < .001
## Residuals |      306.95 | 1994 |        0.15 |          |
##
## Anova Table (Type 1 tests)
```

```
cohens_f_squared(anova(m))
```

```
## # Effect Size for ANOVA (Type I)
##
## Parameter | Cohen's f² (partial) |      95% CI
## ---------------------------------------------
## ASSES     |                 0.43 | [0.28, Inf]
## QUAL      |                 5.05 | [4.75, Inf]
## STRATOR   |                 0.03 | [0.02, Inf]
##
## - One-sided CIs: upper bound fixed at [Inf].
```

Filtering by the relevant effects (above or equal 0.1) - PARTN

```
model_pls1.final.relevants<-model_pls1.final$effects[c(6,11, 14,15,17,18,20,21),] %>% filter(abs(total)>=0.1)
model_pls1.final.relevants<-model_pls1.final.relevants[c(3,4),]
model_pls1.final.relevants
```

```
##        relationships    direct indirect     total
## 3 DRRELAREA -> PARTN 0.1102265        0 0.1102265
## 4   STRATOR -> PARTN 0.4894194        0 0.4894194
```

```
model.filtered<-model_pls1.final$scores %>% as.data.frame %>%select(DRRELAREA, STRATOR, PARTN)
model <- aov(PARTN~., data=model.filtered)
eta_squared(model)
```

```
## # Effect Size for ANOVA (Type I)
##
## Parameter | η² (partial) |       95% CI
## -----------------------------------------
## DRRELAREA |         0.13 | [0.11, 1.00]
## STRATOR   |         0.22 | [0.19, 1.00]
##
## - One-sided CIs: upper bound fixed at [1.00].
```

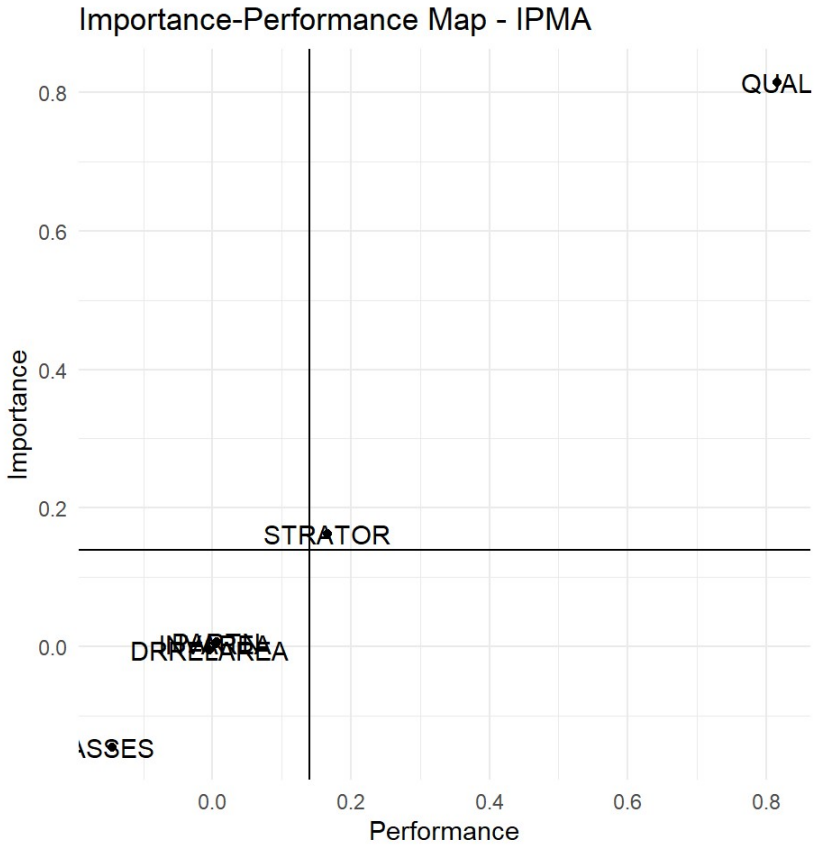
```
options(es.use_symbols = TRUE)
m <- lm(PARTN~., data = model.filtered)
parameters::model_parameters(anova(m))
```

```
## Parameter | Sum_Squares |   df | Mean_Square |      F |      p
## ------------------------------------------------------------------
## DRRELAREA |      212.88 |    1 |      212.88 | 303.38 | < .001
## STRATOR   |      385.20 |    1 |      385.20 | 548.94 | < .001
## Residuals |     1399.92 | 1995 |        0.70 |        |
##
## Anova Table (Type 1 tests)
```

```
cohens_f_squared(anova(m))
```

```
## # Effect Size for ANOVA (Type I)
##
## Parameter | Cohen's f² (partial) |      95% CI
## ---------------------------------------------
## DRRELAREA |                 0.15 | [0.12, Inf]
## STRATOR   |                 0.28 | [0.24, Inf]
##
## - One-sided CIs: upper bound fixed at [Inf].
```

```
betas<-model_pls1.final$path_coefs[c(7),c(1,2,3,4,5,6)]
efeitos<-model_pls1.final$effects[c(6,11,15,18,20,21),]$total
df<-data.frame(betas, efeitos)
colnames(df)<-c("BETAS","EFFECTS")
p<-ggplot(df, aes(x=efeitos, y=betas)) +
  geom_point() +
  #lims(x=c(0.67517,0.67517),y=c(-0.44522,0.44522)) +
  theme_minimal() +
  coord_fixed() +
  geom_vline(xintercept = mean(df$EFFECTS)) + geom_hline(yintercept = mean(df$BETAS)) +
    geom_text(label=rownames(df))   +
     labs(title = "Importance-Performance Map - IPMA", x = "Performance", y = "Importance")
p
```




```
#png("ipma.png")
#print(p)
#dev.off()
```

Validation - GOF

```
model_pls1.final$gof
```

```
## [1] 0.6010042
```

Validation Confidence Interval - Weights

```
model_pls1.final$boot$weights
```

```
##                       Original Mean.Boot    Std.Error  perc.025  perc.975
## ASSES-ASSES1         0.5693484 0.5698416 1.871381e-02 0.5343596 0.6075953
## ASSES-ASSES2         0.3354102 0.3349561 1.709040e-02 0.3002999 0.3675793
## ASSES-ASSES3         0.3015996 0.3013130 1.808570e-02 0.2647579 0.3359075
## QUAL-QUAL1           1.0000000 1.0000000 8.745599e-17 1.0000000 1.0000000
## DRRELAREA-DRRELAREA1 0.3041415 0.3042077 9.868110e-03 0.2847093 0.3236293
## DRRELAREA-DRRELAREA2 0.2997206 0.2995389 9.892314e-03 0.2804977 0.3190141
## DRRELAREA-DRRELAREA4 0.3844680 0.3847203 1.285039e-02 0.3599865 0.4104167
## DRRELAREA-DRRELAREA5 0.2900736 0.2899502 9.337532e-03 0.2713435 0.3077108
## STRATOR-STRATOR2     1.0000000 1.0000000 1.344284e-16 1.0000000 1.0000000
## INVAREA-INVAREA1     1.0000000 1.0000000 9.395290e-17 1.0000000 1.0000000
## PARTN-PARTN2         1.0000000 1.0000000 1.295527e-16 1.0000000 1.0000000
## IAM-IAM              1.0000000 1.0000000 7.111341e-17 1.0000000 1.0000000
```

Validation Confidence Interval - Loadings

```
model_pls1.final$boot$loadings
```

```
##                       Original Mean.Boot    Std.Error  perc.025  perc.975
## ASSES-ASSES1         0.9084924 0.9085593 6.369650e-03 0.8957175 0.9206777
## ASSES-ASSES2         0.7937113 0.7932106 1.640288e-02 0.7599385 0.8238039
## ASSES-ASSES3         0.7179466 0.7172630 2.034959e-02 0.6742307 0.7539655
## QUAL-QUAL1           1.0000000 1.0000000 5.816286e-17 1.0000000 1.0000000
## DRRELAREA-DRRELAREA1 0.7770406 0.7769479 1.435384e-02 0.7470613 0.8038818
## DRRELAREA-DRRELAREA2 0.7569246 0.7565481 1.534835e-02 0.7249850 0.7856066
## DRRELAREA-DRRELAREA4 0.7969075 0.7969819 1.186731e-02 0.7730395 0.8190754
## DRRELAREA-DRRELAREA5 0.7943445 0.7940308 1.380031e-02 0.7652170 0.8199849
## STRATOR-STRATOR2     1.0000000 1.0000000 5.670319e-17 1.0000000 1.0000000
## INVAREA-INVAREA1     1.0000000 1.0000000 6.178089e-17 1.0000000 1.0000000
## PARTN-PARTN2         1.0000000 1.0000000 5.799304e-17 1.0000000 1.0000000
## IAM-IAM              1.0000000 1.0000000 5.393984e-17 1.0000000 1.0000000
```

Validation Confidence Interval - Path Coefficients

```
model_pls1.final$boot$paths
```

```
##                       Original    Mean.Boot  Std.Error    perc.025    perc.975
## ASSES -> IAM       -0.145341258 -0.140935956 0.01192455 -0.16459489 -0.11838075
## QUAL -> IAM         0.815441920  0.820456752 0.03001524  0.76199942  0.87811468
## DRRELAREA -> PARTN  0.110226548  0.109959935 0.02715567  0.05650061  0.16262777
## DRRELAREA -> IAM   -0.005040801 -0.004313222 0.01342199 -0.03056267  0.02182170
## STRATOR -> PARTN    0.489419400  0.489795866 0.02067527  0.44942585  0.53036597
## STRATOR -> IAM      0.162938735  0.158317570 0.02871890  0.10244978  0.21499850
## INVAREA -> IAM      0.004324685  0.004575303 0.01509831 -0.02470674  0.03337340
## PARTN -> IAM        0.006174280  0.005336246 0.01331439 -0.02023317  0.03145911
```

Validation Confidence Interval - R^2

```
model_pls1.final$boot$rsq
```

```
##        Original Mean.Boot   Std.Error  perc.025  perc.975
## PARTN 0.2993411 0.3003613 0.016144378 0.2684049 0.3321141
## IAM   0.8464210 0.8512747 0.007349294 0.8365825 0.8654128
```

Validation Confidence Interval - Effects

```
model_pls1.final$boot$total.efs[c(6,11,14,15,17,18,20,21),]
```

```
##                       Original    Mean.Boot  Std.Error    perc.025    perc.975
## ASSES -> IAM       -0.145341258 -0.140935956 0.01192455 -0.16459489 -0.11838075
## QUAL -> IAM         0.815441920  0.820456752 0.03001524  0.76199942  0.87811468
## DRRELAREA -> PARTN  0.110226548  0.109959935 0.02715567  0.05650061  0.16262777
## DRRELAREA -> IAM   -0.004360232 -0.003718664 0.01340343 -0.02967786  0.02212906
## STRATOR -> PARTN    0.489419400  0.489795866 0.02067527  0.44942585  0.53036597
## STRATOR -> IAM      0.165960548  0.160924697 0.02898838  0.10437917  0.21758103
## INVAREA -> IAM      0.004324685  0.004575303 0.01509831 -0.02470674  0.03337340
## PARTN -> IAM        0.006174280  0.005336246 0.01331439 -0.02023317  0.03145911
```

Validation Confidence Interval - Hypotheses Final

```
formattable(model_pls1.final$boot$total.efs[c(6,11,14,15,17,18,20,21),], list(
  Mean.Boot = formatter("span",
    style = x ~ style(color = ifelse(abs(x)<0.1, "red", "green")),
    x ~ icontext(ifelse(abs(x)<0.1, "remove", "ok"), ifelse(abs(x)<0.1, "Reject", "Accept")))
))
```

	Original	Mean.Boot	Std.Error	perc.025	perc.975
ASSES -> IAM	-0.145341258	✔ Accept	0.01192455	-0.16459489	-0.11838075
QUAL -> IAM	0.815441920	✔ Accept	0.03001524	0.76199942	0.87811468
DRRELAREA -> PARTN	0.110226548	✔ Accept	0.02715567	0.05650061	0.16262777
DRRELAREA -> IAM	-0.004360232	✖ Reject	0.01340343	-0.02967786	0.02212906
STRATOR -> PARTN	0.489419400	✔ Accept	0.02067527	0.44942585	0.53036597
STRATOR -> IAM	0.165960548	✔ Accept	0.02898838	0.10437917	0.21758103
INVAREA -> IAM	0.004324685	✖ Reject	0.01509831	-0.02470674	0.03337340
PARTN -> IAM	0.006174280	✖ Reject	0.01331439	-0.02023317	0.03145911

```
model_pls1.final$inner_model
```

```
## $PARTN
##                Estimate Std. Error       t value      Pr(>|t|)
## Intercept -7.675465e-15 0.01874053 -4.095650e-13  1.000000e+00
## DRRELAREA  1.102265e-01 0.02088898  5.276779e+00  1.457524e-07
## STRATOR    4.894194e-01 0.02088898  2.342954e+01 1.920697e-107
##
## $IAM
##                Estimate  Std. Error       t value      Pr(>|t|)
## Intercept -2.125679e-15 0.008782745 -2.420289e-13  1.000000e+00
## ASSES     -1.453413e-01 0.009674446 -1.502321e+01  2.095766e-48
## QUAL       8.154419e-01 0.023757831  3.432308e+01 3.266939e-203
## DRRELAREA -5.040801e-03 0.010282927 -4.902107e-01  6.240388e-01
## STRATOR    1.629387e-01 0.021703335  7.507544e+00  9.036221e-14
## INVAREA    4.324685e-03 0.012158653  3.556879e-01  7.221120e-01
## PARTN      6.174280e-03 0.010658194  5.792989e-01  5.624530e-01
```

```
model_pls1.final$outer_model[,c(1,2,3)]
```

```
##          name     block    weight
## 1      ASSES1     ASSES 0.5693484
## 2      ASSES2     ASSES 0.3354102
## 3      ASSES3     ASSES 0.3015996
## 4       QUAL1      QUAL 1.0000000
## 5  DRRELAREA1 DRRELAREA 0.3041415
## 6  DRRELAREA2 DRRELAREA 0.2997206
## 7  DRRELAREA4 DRRELAREA 0.3844680
## 8  DRRELAREA5 DRRELAREA 0.2900736
## 9    STRATOR2   STRATOR 1.0000000
## 10   INVAREA1   INVAREA 1.0000000
## 11     PARTN2     PARTN 1.0000000
## 12        IAM       IAM 1.0000000
```

The Final Equation

Equantion 1:

$PARTN = -7.675465e-15 * (0.3041415 * DRRELAREA1 + 0.2997206 * DRRELAREA2 + 0.3844680 * DRRELAREA4 + 0.2900736 * D$

PLS-PM Equation PARTN:

$PARTN = -2.334427e-15 * DRRELAREA1 - 2.300495e-15 * DRRELAREA2 - 2.950971e-15 * DRRELAREA4 - 2.22645e-15 * l$

PLS-PM Equation

IAM:$-2.125679e-15-1.453413e-01*(0.5693484*ASSES1+0.3354102*ASSES2+0.3015996*ASSES3)+8.154419e-01*QUAL1$ -

Simplifying:

$IAM=-2.125679e-15-0.08274984*ASSES1-0.04874895*ASSES2-0.04383488*ASSES3+8.154419e-01*QUAL1+1.629387\epsilon$

Residual Analysis IAM

```
iam.model<-lm(IAM~ASSES+QUAL+STRATOR,data=as.data.frame(model_pls1.final$scores))
h <- hist(iam.model$residuals, plot = FALSE)

plot(h, xaxt = "n", xlab = "Residuals IAM", ylab = "Frequency",
     main = "", col = "pink")
```