# Rethinking Stakeholder Engagement: A Multidimensional Framework Inspired by Meta-Analysis of Food, Energy, and Water Research

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## Supplemental Materials Summary

The benefits for involving stakeholders in research projects are well established. We investigated recent papers related to food-energy-water systems to assess whether stakeholders were engaged, when they were engaged, which stakeholders were involved, the level of their involvement, whether the needs of stakeholders were considered, and whether stakeholder engagement was evaluated and monitored. Stakeholder engagement theory and research suggest that stakeholder engagement is effective only when it is considered as an integrated process, but our review suggests that this is not common practice. We developed a framework to assist scientists in engaging stakeholders in an integrated and thoughtful manner. Our framework includes six dimensions: 1. When should stakeholders be engaged and for how long? 2. Who should be engaged (identification and diversity)? 3. What role should stakeholders play? 4. How can researchers meet stakeholder needs? 5. What methods of engagement should be used? 6. How to evaluate and monitor the engagement?

We conducted two literature searches: an initial search in 2020 and a follow-up search in 2023 to capture literature published between 2020 and 2023. We conducted the searches in two different online databases, ScienceDirect and WorldCat, to ensure a comprehensive identification of relevant literature. We identified 177 publications from our initial search and 540 publications in our follow up search, resulting in a total of 717 publications. We then manually screened the papers and removed additional papers that did not meet the criteria above on reading the manuscript, resulting in 489 total papers for analysis.

This supplemental materials provides:

- A summary of the variables quantified from the literature reviews;
- Chi-square testing of whether a solution was proposed or not vs. 1) stakeholder engagement as well as 2) whether a computational model was used;
- Summary statistics graphs of the literature analysis; and
- Regression and odds ratio testing for a variety of factors

# Variable Summary

Below is a list of the categorical variables generated from the literature reviews

Table 1: Table T1: Variable Descriptions

| **Variable Name** | **Description** |
|---|---|
| Year | Year of citation |
| Solution Proposed | Was a solution proposed? |
| Solution Implemented | Was a solution implemented? |
| Stakeholder Type | What was the stakeholder type? Groups include: Farmers, Combined Government, Combined Coalition, Combined Industry, Migrants, Youth, Public, Univerity, and Experts |
| Stakeholder Engagment Scale - Ghodsvali | If a stakeholder was engaged, categorization of the engagement using the Ghodsvali scale. Groups include: Nominal, Instrumental, Representation, and Transformative |
| Stakeholder Engagment Scale - IAP2 | If a stakeholder was engaged, categorization of the engagement using the IAP2 scale. Groups include: Data Gathering, Inform, Consult, Involve, Collaborate, and Empower |
| Stakeholder Engagement Scale - Local | If a stakeholder was engaged, categorization of the engagement using a customized scale. Groups include: Researcher, Data Gathering, Inform, Perspectives, Planning, Identify, Envision, and Implement |

# Chi-Square Testing

## Chi Square Testing: solution proposed or not vs. vs. stakeholder engagement

Chi Square and Fishers Exact Test on contingency table with Solution/No Solution as the explanatory variable, and engaged stakeholder/did not engage stakeholder as the response variable.

**ChiSquare = 26: Fishers Exact Test Odds Ratio: 10: Not Independent**

Both chi square and fishers exact test were significant, with a chi square approximation of ~26, which is well above the critical value (3.84 with one degree of freedom). Fishers Exact Test returned an odds ratio of ~10. The alternative hypothesis: true odds ratio is not equal to 1, therefore the null hypothesis is rejected - the groups are not independent.

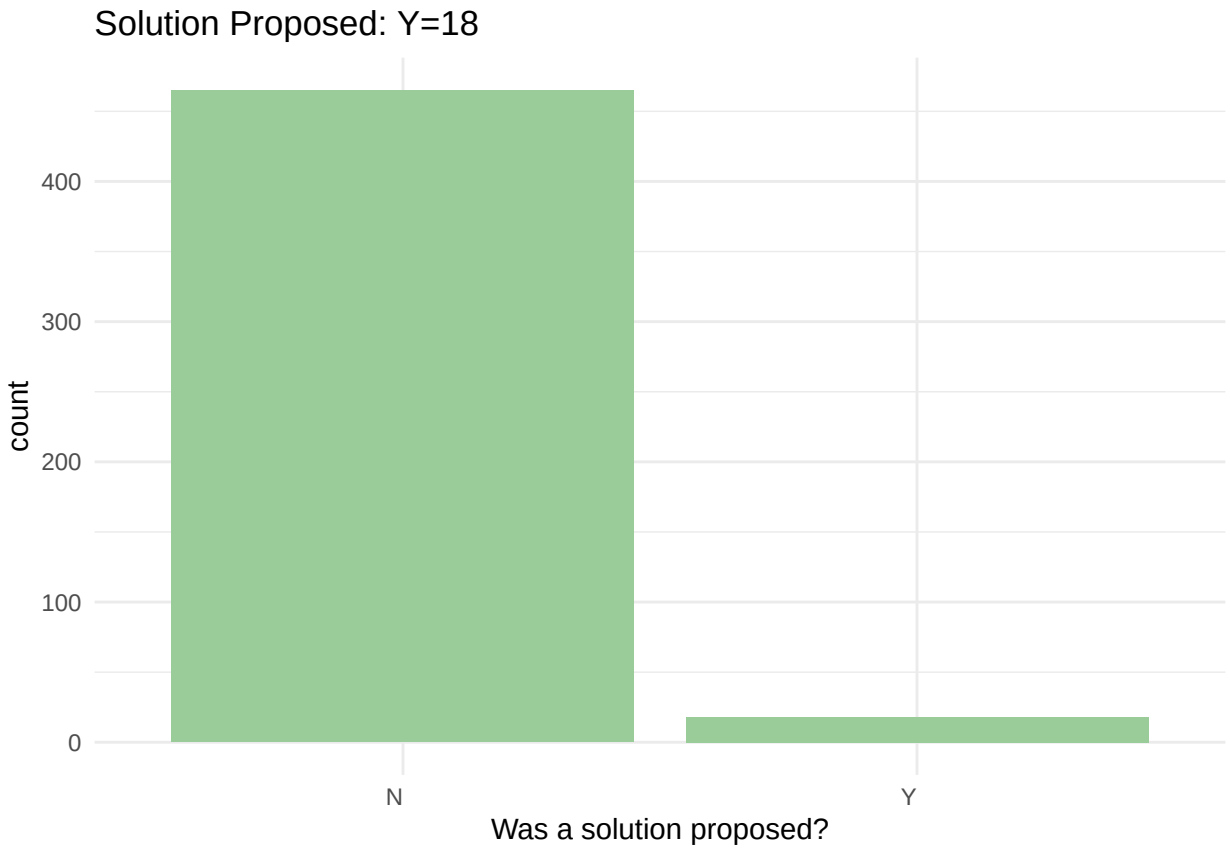
The Fishers Exact Test defaults to associating the odds ratio (which can represent effect size) with the first cell. In this instance "The odds of having a solution is 10 times that for an engaged stakeholder". You could flip the response and explanatory variables, but the odds ratio would stay the same.

For more info on this topic see: Kim HY. Statistical notes for clinical researchers: Chi-squared test and Fisher's exact test. Restor Dent Endod. 2017 May;42(2):152-155. doi: 10.5395/rde.2017.42.2.152. Epub 2017 Mar 30. PMID: 28503482; PMCID: PMC5426219.

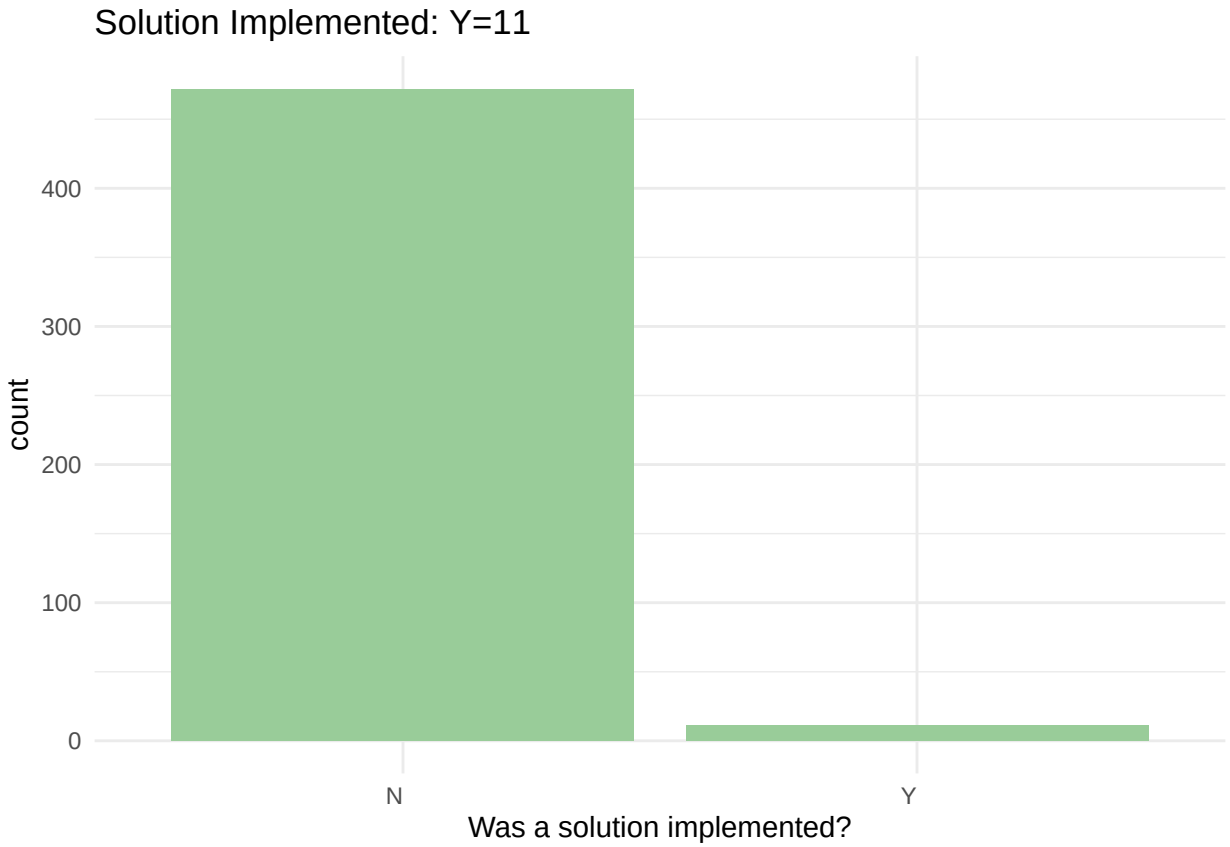
```
##          stakeholder
## solution  M  NM
##     [1,] 13   5
##     [2,] 95 370

## Number of cases in table: 483
## Number of factors: 2
## Test for independence of all factors:
##  Chisq = 26.776, df = 1, p-value = 2.285e-07
##  Chi-squared approximation may be incorrect

##
##  Fisher's Exact Test for Count Data
##
## data:  solution_stakeholder
## p-value = 5.864e-06
## alternative hypothesis: true odds ratio is not equal to 1
## 95 percent confidence interval:
##   3.266331 36.933516
## sample estimates:
## odds ratio
##   10.06035

##
## Barnard's Unconditional Test
##
##             Treatment I Treatment II
## Outcome I            13            5
## Outcome II           95          370
##
## Null hypothesis: Treatments have no effect on the outcomes
## Score statistic = -5.17455
## Nuisance parameter = 0.022 (One sided), 0.022 (Two sided)
## P-value = 2.48239e-06 (One sided), 2.48239e-06 (Two sided)
```

## Summary Statistics Graphs

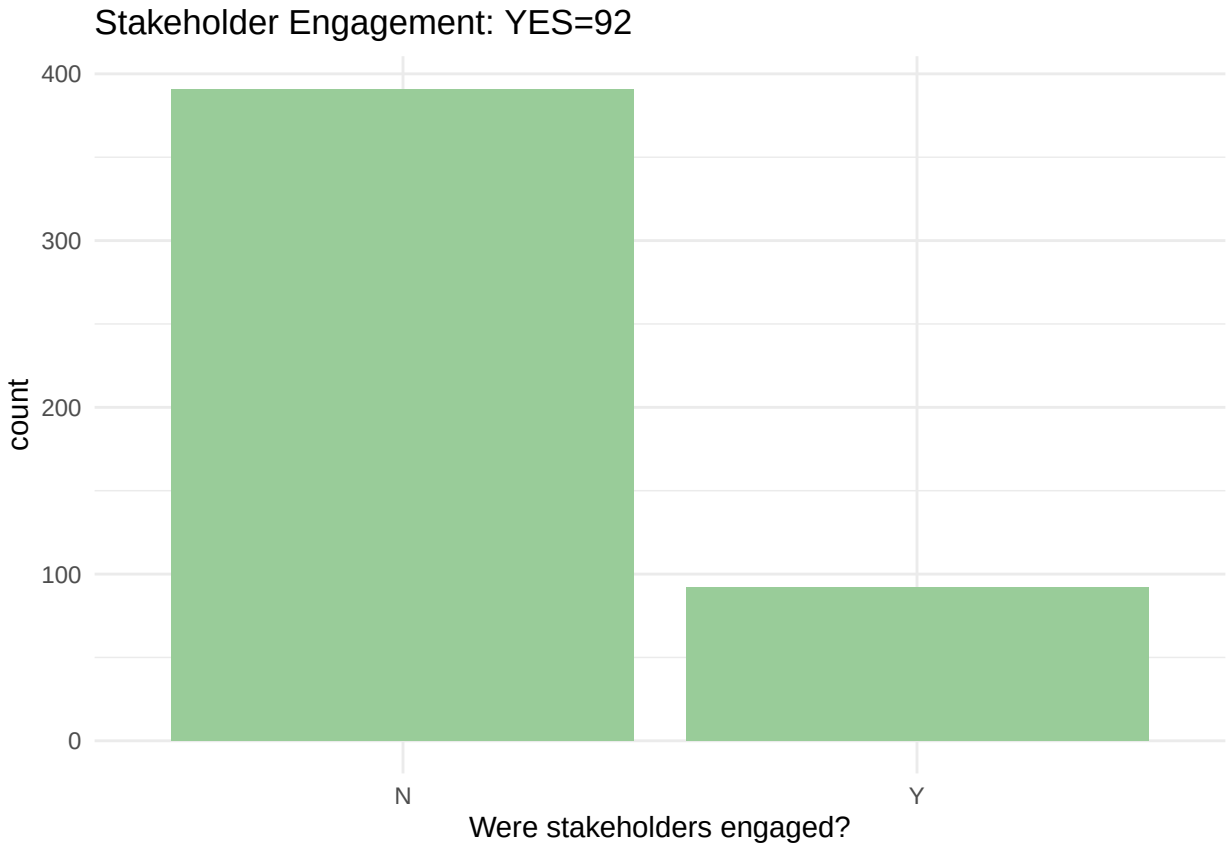
### Were solutions proposed in the set of all papers?



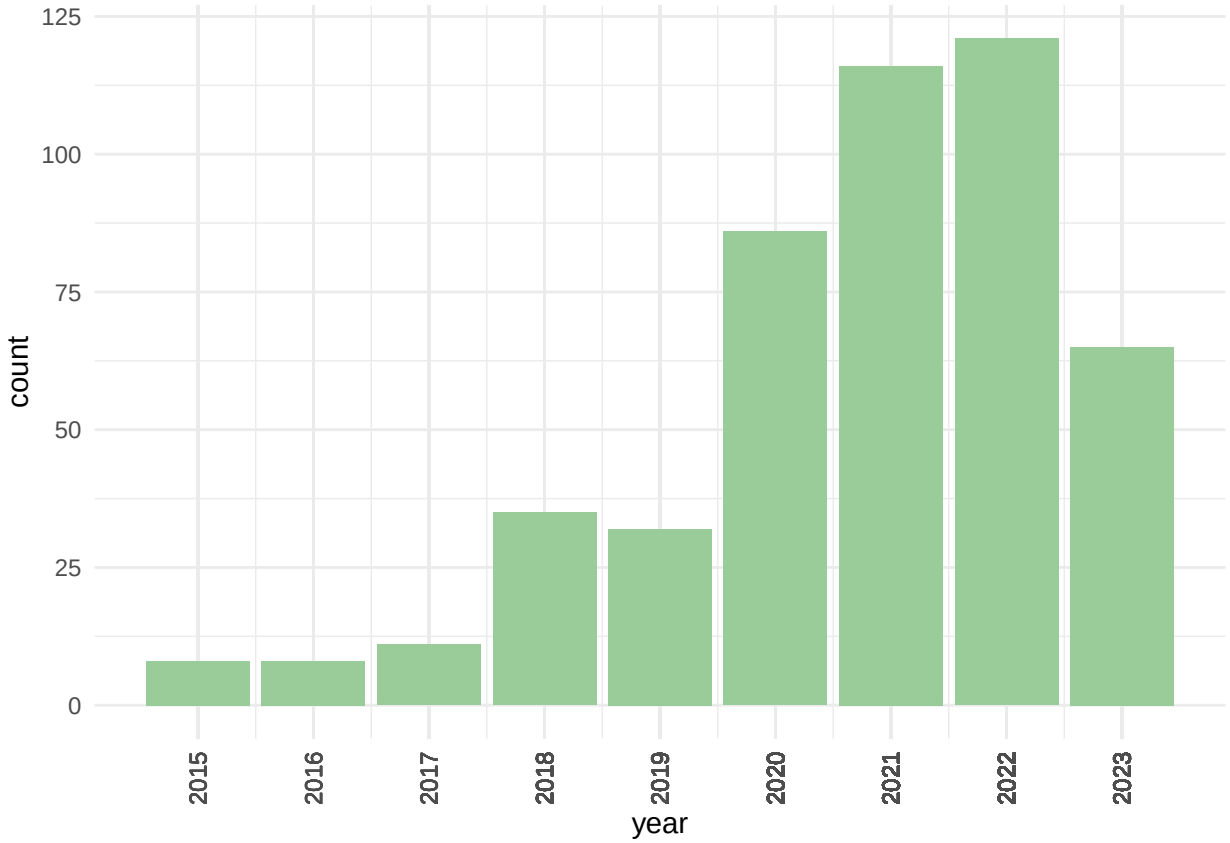
**Were solutions implemented in the set of all papers?**



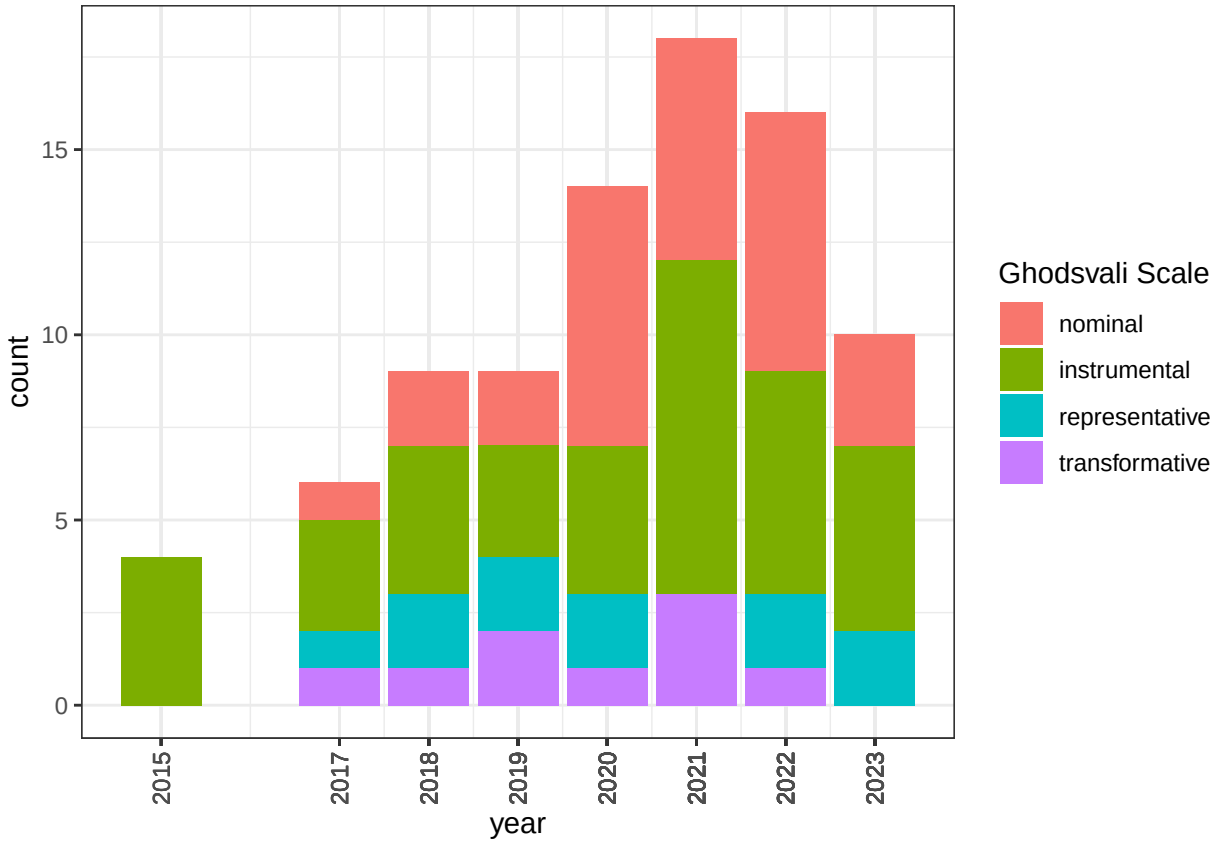
**Were stakeholders engaged?**



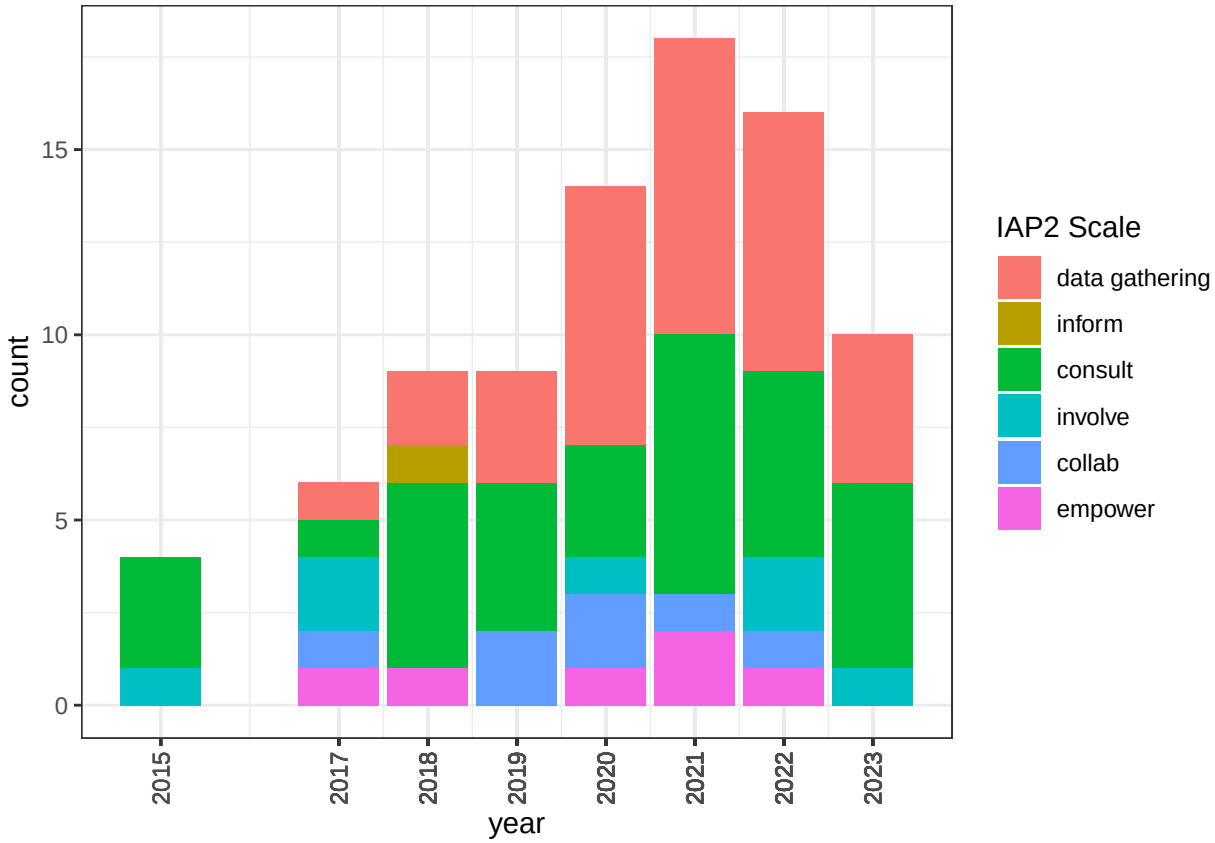
**All FEWS papers by year**



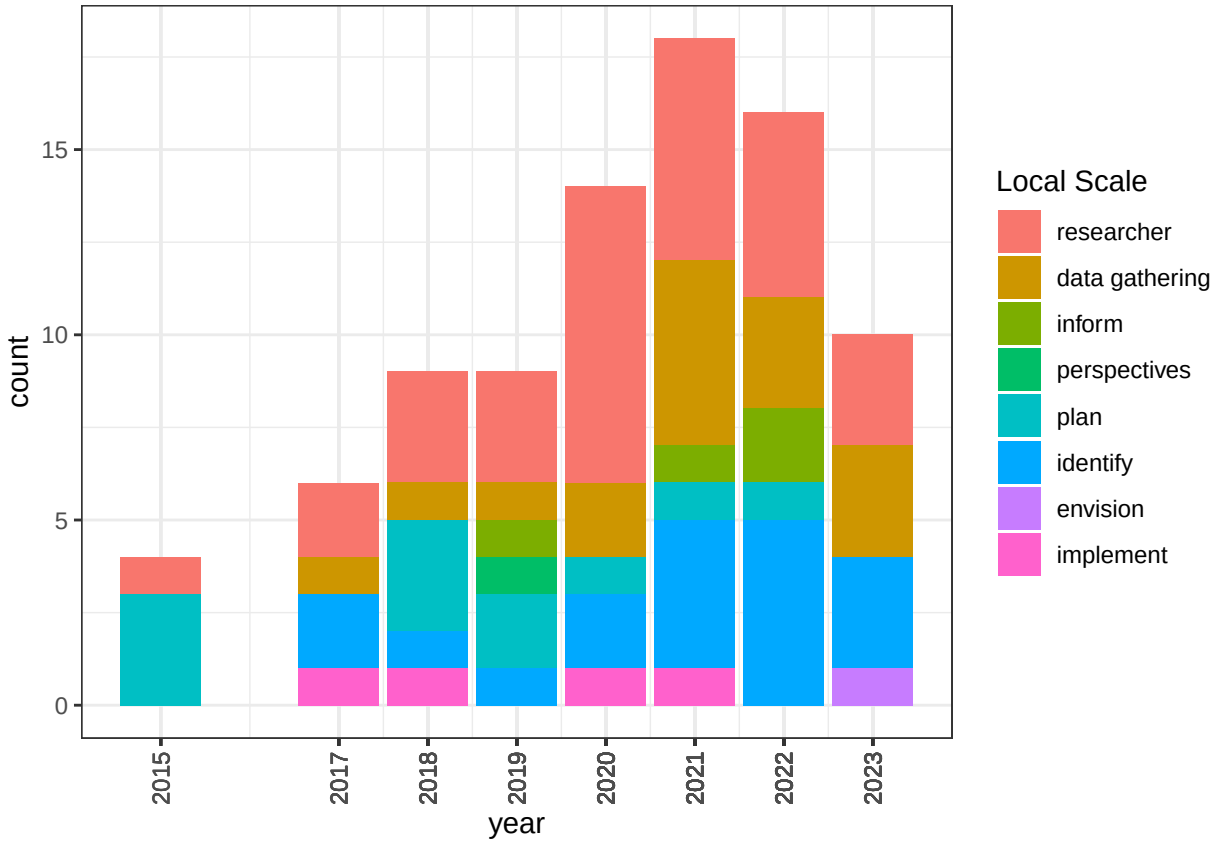
**Level of stakeholder engagement by year - Ghodsvali scale**



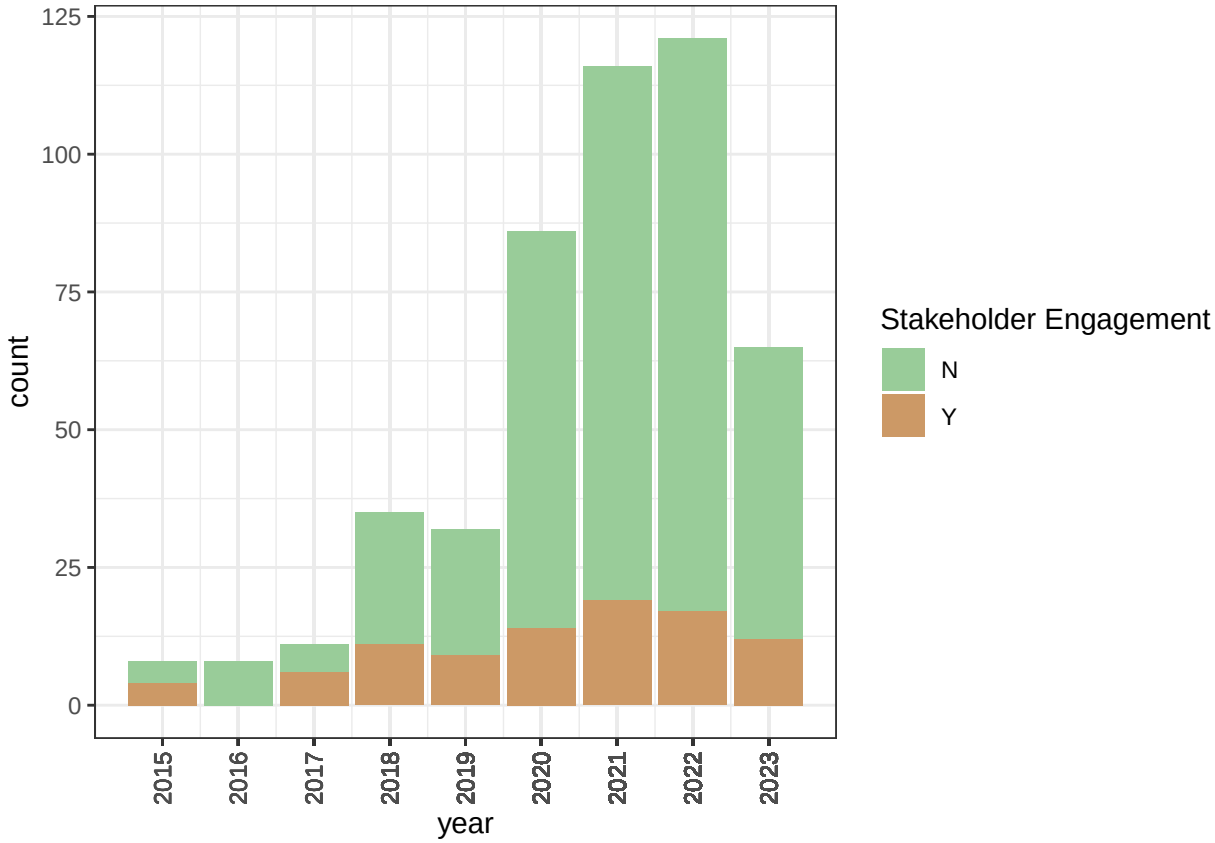
**Level of stakeholder engagement by year - IAP2 scale**



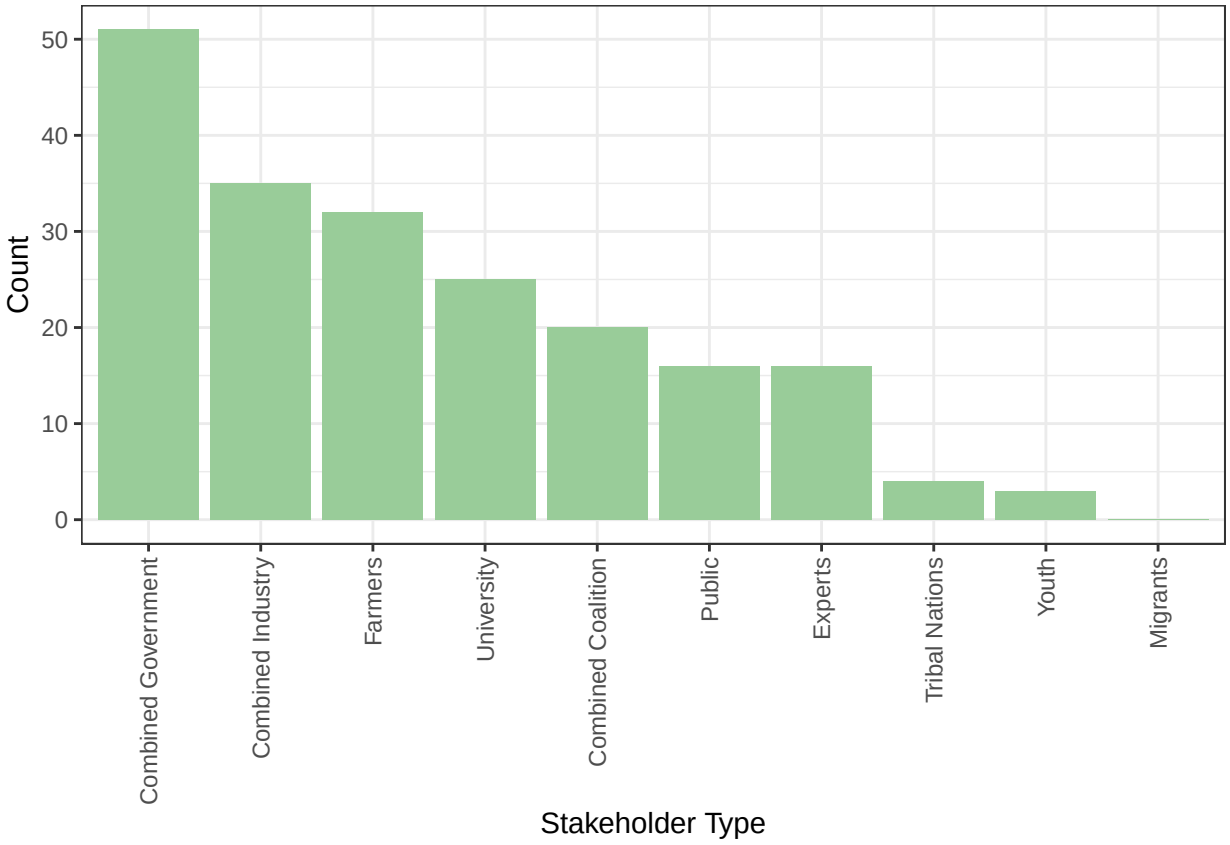
**Level of stakeholder engagement by year - Local scale**



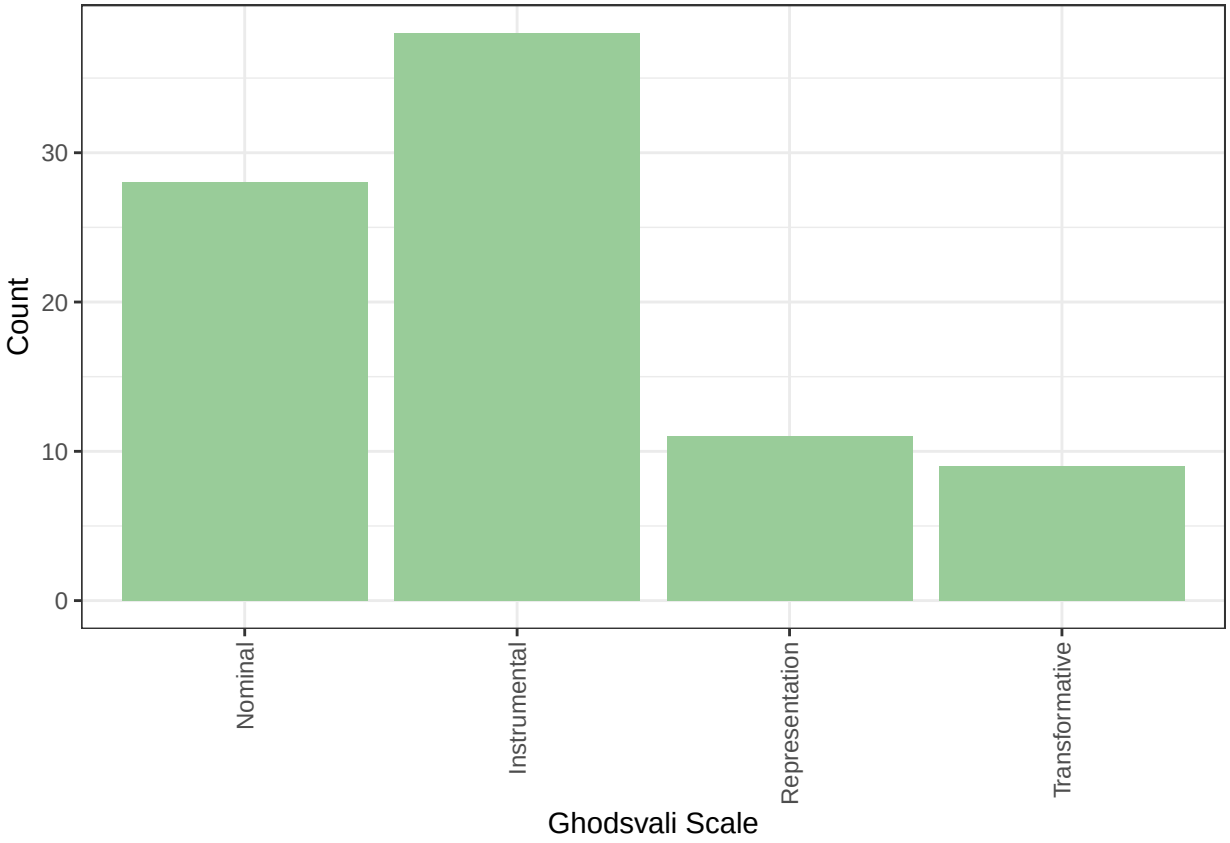
**Stakeholder engagement by year**



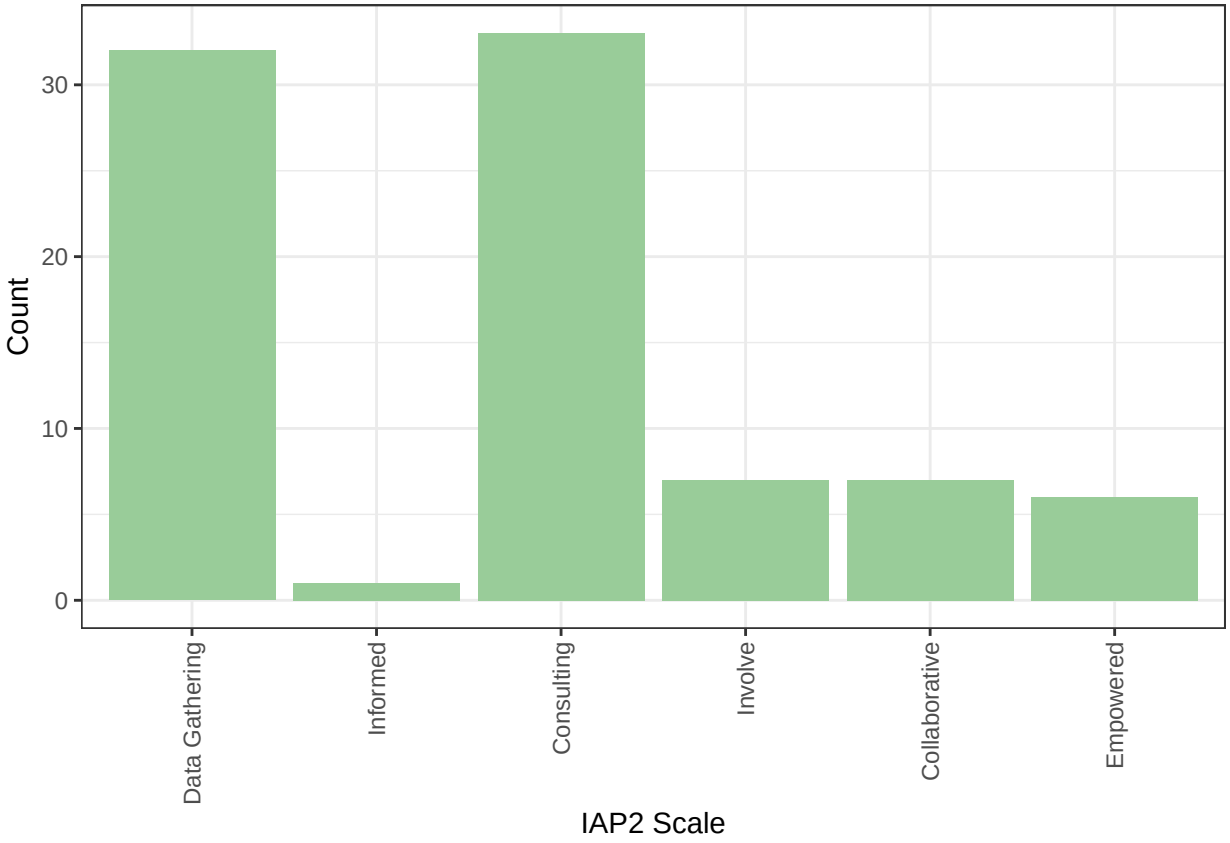
**Stakeholder types**



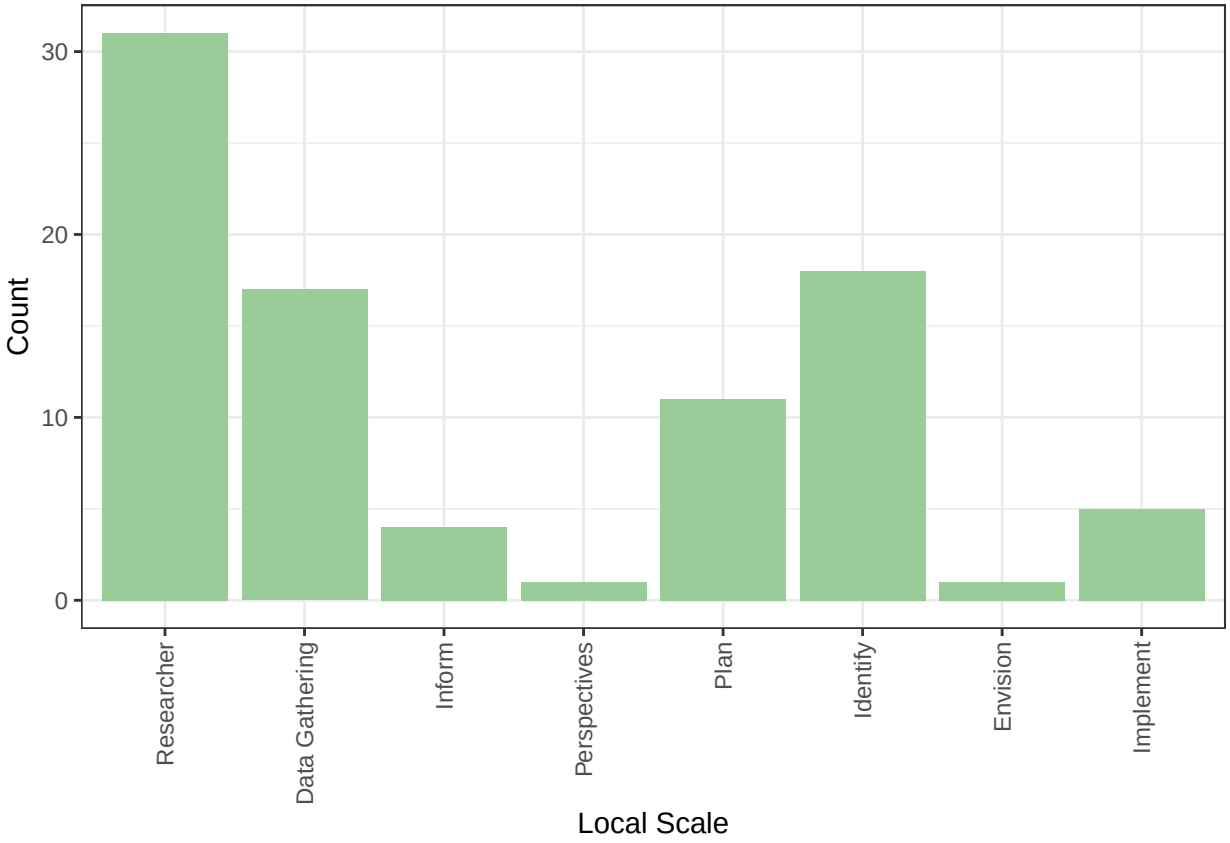
**Ghodsvali scale breakdown**



**IAP2 scale breakdown**



**Local scale breakdown**



# Regression Testing

## Ghodsvali scale regression

Ghodsvali scale regression testing on whether a solution was proposed or not

```
##
## Call:
## glm(formula = solution_proposed_YN ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, family = binomial,
##     data = crcdata)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.7344  -0.1423  -0.1423  -0.1423   3.0324
##
## Coefficients:
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)           -4.5875     0.5025  -9.129  < 2e-16 ***
## STE_G_nominal          1.2917     1.1356   1.137  0.25535
## STE_G_instrumental     2.1308     0.7839   2.718  0.00656 **
## STE_G_representation   3.6067     0.8431   4.278 1.89e-05 ***
## STE_G_transformative   5.8403     0.9463   6.172 6.74e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 153.748  on 482  degrees of freedom
## Residual deviance:  96.785  on 478  degrees of freedom
## AIC: 106.79
##
## Number of Fisher Scoring iterations: 7
```

## Ghodsvali scale odds

Odds of Ghodsvali scale predicting whether a solution was proposed or not

```
##
## Logistic regression predicting solution_proposed_YN : Y vs N
##
##                               crude OR(95%CI)        adj. OR(95%CI)
## STE_G_nominal: 1 vs 0         0.95 (0.12,7.44)       3.64 (0.39,33.7)
##
## STE_G_instrumental: 1 vs 0    2.46 (0.68,8.9)        8.42 (1.81,39.14)
##
## STE_G_representation: 1 vs 0  11.42 (2.75,47.41)     36.84 (7.06,192.33)
##
## STE_G_transformative: 1 vs 0  147.32 (27.42,791.53)  343.87 (53.82,2197.12)
##
##                               P(Wald's test) P(LR-test)
## STE_G_nominal: 1 vs 0         0.255          0.318
##
## STE_G_instrumental: 1 vs 0    0.007          0.015
##
## STE_G_representation: 1 vs 0  < 0.001        < 0.001
##
## STE_G_transformative: 1 vs 0  < 0.001        < 0.001
##
## Log-likelihood = -48.3926
## No. of observations = 483
## AIC value = 106.7851
```

## IAP2 scale regression

IAP2 scale regression testing on whether a solution was proposed or not

```
##
## Call:
## glm(formula = solution_proposed_YN ~ STE_IAP2_data_gathering +
##     STE_IAP2_inform + STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab +
##     STE_IAP2_empower, family = binomial, data = crcdata)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.0579  -0.1423  -0.1423  -0.1423   3.0324
##
## Coefficients:
##                           Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -4.5875     0.5025  -9.129  < 2e-16 ***
## STE_IAP2_data_gathering    1.1535     1.1335   1.018  0.30883
## STE_IAP2_inform          -12.9786  3956.1804  -0.003  0.99738
## STE_IAP2_consult           2.2849     0.7869   2.904  0.00369 **
## STE_IAP2_involve           2.7958     1.1913   2.347  0.01894 *
## STE_IAP2_collab            4.2998     0.9143   4.703 2.56e-06 ***
## STE_IAP2_empower          22.1536  1615.1039   0.014  0.98906
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 153.748  on 482  degrees of freedom
## Residual deviance:  89.049  on 476  degrees of freedom
## AIC: 103.05
##
## Number of Fisher Scoring iterations: 16
```

## IAP2 scale odds

Odds of IAP2 scale predicting whether a solution was proposed or not

```
##
## Logistic regression predicting solution_proposed_YN : Y vs N
##
##                                  crude OR(95%CI)       adj. OR(95%CI)
## STE_IAP2_data_gathering: 1 vs 0  0.82 (0.11,6.39)      3.17 (0.34,29.23)
##
## STE_IAP2_inform: 1 vs 0          0 (0,Inf)             0 (0,Inf)
##
## STE_IAP2_consult: 1 vs 0         2.9 (0.8,10.57)       9.82 (2.1,45.93)
##
## STE_IAP2_involve: 1 vs 0         4.5 (0.51,39.48)      16.37 (1.59,169.13)
##
## STE_IAP2_collab: 1 vs 0          23.05 (4.73,112.22)   73.69 (12.28,442.2)
##
## STE_IAP2_empower: 1 vs 0         1648611478.8 (0,Inf)  4180027810.8 (0,Inf)
##
##                                  P(Wald's test) P(LR-test)
## STE_IAP2_data_gathering: 1 vs 0  0.309          0.365
##
## STE_IAP2_inform: 1 vs 0          0.997          0.887
##
## STE_IAP2_consult: 1 vs 0         0.004          0.01
##
## STE_IAP2_involve: 1 vs 0         0.019          0.066
##
## STE_IAP2_collab: 1 vs 0          < 0.001        < 0.001
##
## STE_IAP2_empower: 1 vs 0         0.989          < 0.001
##
## Log-likelihood = -44.5245
## No. of observations = 483
## AIC value = 103.0489
```

## Local scale regression

Local scale regression predicting whether a solution was proposed or not

```
##
## Call:
## glm(formula = solution_proposed_YN ~ SC_researcher + SC_datagathering +
##     SC_inform + SC_perspectives + SC_plan + SC_identify + SC_envision +
##     SC_implement, family = binomial, data = crcdata)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.6729  -0.1552  -0.1552  -0.1552   3.0876
##
## Coefficients:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)         -4.4131     0.4571  -9.655  < 2e-16 ***
## SC_researcher       -0.3450     1.6328  -0.211    0.833
## SC_datagathering   -15.1350  2607.3229  -0.006    0.995
## SC_inform            4.4131     1.0995   4.014 5.98e-05 ***
## SC_perspectives    -15.1530 10754.0130  -0.001    0.999
## SC_plan            -15.1530  3242.4569  -0.005    0.996
## SC_identify          3.7199     0.6774   5.491 3.99e-08 ***
## SC_envision         23.9791 10754.0130   0.002    0.998
## SC_implement         5.8741     1.2436   4.723 2.32e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 153.748  on 482  degrees of freedom
## Residual deviance:  87.808  on 474  degrees of freedom
## AIC: 105.81
##
## Number of Fisher Scoring iterations: 18
```

## Local scale odds

Odds of Local scale predicting whether a solution was proposed or not

```
##
## Logistic regression predicting solution_proposed_YN : Y vs N
##
##                            crude OR(95%CI)        adj. OR(95%CI)
## SC_researcher: 1 vs 0      0.85 (0.11,6.63)       0.71 (0.03,17.38)
##
## SC_datagathering: 1 vs 0   0 (0,Inf)              0 (0,Inf)
##
## SC_inform: 1 vs 0          28.94 (3.83,218.65)    82.52 (9.56,711.99)
##
## SC_perspectives: 1 vs 0    0 (0,Inf)              0 (0,Inf)
##
## SC_plan: 1 vs 0            0 (0,Inf)              0 (0,Inf)
##
## SC_identify: 1 vs 0        18.87 (6.06,58.74)     41.26 (10.94,155.66)
##
## SC_envision: 1 vs 0        157493116.45 (0,Inf)   25942087197.62 (0,Inf)
##
## SC_implement: 1 vs 0       132.57 (13.9,1263.96)  355.7 (31.08,4070.47)
##
##                            P(Wald's test) P(LR-test)
## SC_researcher: 1 vs 0      0.833          0.828
##
## SC_datagathering: 1 vs 0   0.995          0.53
##
## SC_inform: 1 vs 0          < 0.001        < 0.001
##
## SC_perspectives: 1 vs 0    0.999          0.877
##
## SC_plan: 1 vs 0            0.996          0.609
##
## SC_identify: 1 vs 0        < 0.001        < 0.001
##
## SC_envision: 1 vs 0        0.998          0.003
##
## SC_implement: 1 vs 0       < 0.001        < 0.001
##
## Log-likelihood = -43.9038
## No. of observations = 483
## AIC value = 105.8077
```

### Engagement vs. solution - regression testing

Regression of whether stakeholder engagement (Y/N) predicts if a solution was proposed (Y/N)

```
##
## Call:
## glm(formula = solution_proposed_YN ~ S_stakeholder_engagment_YN,
##     family = binomial, data = crcdata)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -0.5746  -0.1434  -0.1434  -0.1434   3.0274
##
## Coefficients:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                   -4.5721     0.5026  -9.097  < 2e-16 ***
## S_stakeholder_engagment_YNY   2.8545     0.5804   4.918 8.73e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 153.75  on 482  degrees of freedom
## Residual deviance: 123.09  on 481  degrees of freedom
## AIC: 127.09
##
## Number of Fisher Scoring iterations: 7
```

```
##
## Logistic regression predicting solution_proposed_YN : Y vs N
##
##                                    OR(95%CI)           P(Wald's test)
## S_stakeholder_engagment_YN: Y vs N 17.37 (5.57,54.16)  < 0.001
##
##                                    P(LR-test)
## S_stakeholder_engagment_YN: Y vs N < 0.001
##
## Log-likelihood = -61.5436
## No. of observations = 483
## AIC value = 127.0872
```

### Engagement vs. solution - odds

Odds of whether stakeholder engagement (Y/N) predicts if a solution was proposed (Y/N)

```
##
## Logistic regression predicting solution_proposed_YN : Y vs N
##
##                                    OR(95%CI)           P(Wald's test)
## S_stakeholder_engagment_YN: Y vs N 17.37 (5.57,54.16)  < 0.001
##
##                                    P(LR-test)
## S_stakeholder_engagment_YN: Y vs N < 0.001
##
## Log-likelihood = -61.5436
## No. of observations = 483
## AIC value = 127.0872
```

## Diversity of stakeholders vs solution

Regression of whether Diversity of stakeholders predicts if a solution was proposed (Y/N). In order to represent diversity, we have used a simple ratio calcuation which sums the number of stakeholders involved divided by the total number of possible stakeholder options. A ratio which is closer to 1 has a greater level of stakeholder diversity.

```
##
## Call:
## glm(formula = solution_proposed_YN ~ ST_ratio, family = binomial,
##     data = crcdata)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.5724  -0.1831  -0.1831  -0.1831   2.8625
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -4.0803     0.3593 -11.356  < 2e-16 ***
## ST_ratio      7.4600     1.2966   5.754 8.73e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 153.75  on 482  degrees of freedom
## Residual deviance: 122.93  on 481  degrees of freedom
## AIC: 126.93
##
## Number of Fisher Scoring iterations: 6
```

### Diversity of stakeholders vs solution - odds

Odds whether Diversity of stakeholders predicts if a solution was proposed (Y/N). In order to represent diversity, we have used a simple ratio calcuation which sums the number of stakeholders involved divided by the total number of possible stakeholder options. A ratio which is closer to 1 has a greater level of stakeholder diversity.

```
##
## Logistic regression predicting solution_proposed_YN : Y vs N
##
##                        OR(95%CI)                  P(Wald's test) P(LR-test)
## ST_ratio (cont. var.) 1737.23 (136.84,22054.79)  < 0.001        < 0.001
##
## Log-likelihood = -61.4644
## No. of observations = 483
## AIC value = 126.9288
```

### Diversity of stakeholders vs solution - full predictors

```
##
## Call:
## glm(formula = solution_proposed_YN ~ ST_farmers + ST_combined_gov +
##     ST_combined_coalition + ST_combined_industry + ST_migrants +
##     ST_public + ST_university + ST_experts, family = binomial,
##     data = crcdata)
##
## Deviance Residuals:
##    Min      1Q  Median      3Q     Max
## -1.192  -0.133  -0.133  -0.133   3.077
##
## Coefficients: (1 not defined because of singularities)
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)            -4.7238     0.5061  -9.335  < 2e-16 ***
## ST_farmers              0.7624     0.7728   0.987    0.324
## ST_combined_gov         3.6496     0.7657   4.766 1.88e-06 ***
## ST_combined_coalition  -0.3592     0.7670  -0.468    0.640
## ST_combined_industry   -0.7594     0.7917  -0.959    0.337
## ST_migrants                NA         NA      NA       NA
## ST_public               0.7976     0.7840   1.017    0.309
## ST_university           0.3084     0.7376   0.418    0.676
## ST_experts              0.2885     0.8066   0.358    0.721
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 153.75  on 482  degrees of freedom
## Residual deviance: 102.40  on 475  degrees of freedom
## AIC: 118.4
##
## Number of Fisher Scoring iterations: 7
```

### Stakeholder type vs level of engagement (Ghodsvali) - regression testing

```
## Response ST_farmers :
##
## Call:
## lm(formula = ST_farmers ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.4444  0.0000  0.0000  0.0000  0.6786
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)          1.389e-16  1.025e-02   0.000        1
## STE_G_nominal        3.214e-01  3.995e-02   8.046 6.83e-15 ***
## STE_G_instrumental   3.947e-01  3.469e-02  11.378  < 2e-16 ***
## STE_G_representation 3.636e-01  6.245e-02   5.823 1.06e-08 ***
## STE_G_transformative 4.444e-01  6.887e-02   6.453 2.69e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2043 on 478 degrees of freedom
## Multiple R-squared:  0.3322, Adjusted R-squared:  0.3266
## F-statistic: 59.45 on 4 and 478 DF,  p-value: < 2.2e-16
##
##
## Response ST_combined_gov :
##
## Call:
## lm(formula = ST_combined_gov ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.9091  0.0000  0.0000  0.0000  0.7500
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -5.153e-16  8.805e-03   0.000        1
## STE_G_nominal         2.500e-01  3.430e-02   7.288 1.31e-12 ***
## STE_G_instrumental    6.579e-01  2.979e-02  22.084  < 2e-16 ***
## STE_G_representation  9.091e-01  5.362e-02  16.953  < 2e-16 ***
## STE_G_transformative  1.000e+00  5.914e-02  16.910  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1754 on 478 degrees of freedom
## Multiple R-squared:  0.6775, Adjusted R-squared:  0.6748
## F-statistic:   251 on 4 and 478 DF,  p-value: < 2.2e-16
##
##
## Response ST_tribal :
##
```

```
## Call:
## lm(formula = ST_tribal ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1071  0.0000  0.0000  0.0000  0.9737
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)           8.335e-17  4.387e-03   0.000   1.0000
## STE_G_nominal         1.071e-01  1.709e-02   6.269 8.14e-10 ***
## STE_G_instrumental    2.632e-02  1.484e-02   1.773   0.0769 .
## STE_G_representation -1.956e-17  2.672e-02   0.000   1.0000
## STE_G_transformative -1.957e-17  2.947e-02   0.000   1.0000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08741 on 478 degrees of freedom
## Multiple R-squared:  0.07931,    Adjusted R-squared:  0.07161
## F-statistic: 10.29 on 4 and 478 DF,  p-value: 5.285e-08
##
##
## Response ST_combined_coalition :
##
## Call:
## lm(formula = ST_combined_coalition ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.5556  0.0000  0.0000  0.0000  0.9286
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -3.997e-16  8.475e-03   0.000    1.000
## STE_G_nominal         7.143e-02  3.302e-02   2.163    0.031 *
## STE_G_instrumental    2.632e-01  2.867e-02   9.178  < 2e-16 ***
## STE_G_representation  2.727e-01  5.161e-02   5.284 1.92e-07 ***
## STE_G_transformative  5.556e-01  5.692e-02   9.760  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1689 on 478 degrees of freedom
## Multiple R-squared:  0.2891, Adjusted R-squared:  0.2831
## F-statistic: 48.59 on 4 and 478 DF,  p-value: < 2.2e-16
##
##
## Response ST_combined_industry :
##
## Call:
## lm(formula = ST_combined_industry ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
```

```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.63636 -0.00252 -0.00252 -0.00252  0.99748
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           0.002519   0.009635   0.261  0.79387
## STE_G_nominal         0.104624   0.037537   2.787  0.00553 **
## STE_G_instrumental    0.550113   0.032599  16.875  < 2e-16 ***
## STE_G_representation 0.633845   0.058679  10.802  < 2e-16 ***
## STE_G_transformative 0.330814   0.064713   5.112 4.62e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.192 on 478 degrees of freedom
## Multiple R-squared:  0.4574, Adjusted R-squared:  0.4528
## F-statistic: 100.7 on 4 and 478 DF,  p-value: < 2.2e-16
##
##
## Response ST_migrants :
##
## Call:
## lm(formula = ST_migrants ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##      0      0      0      0      0
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  0          0     NaN      NaN
## STE_G_nominal                0          0     NaN      NaN
## STE_G_instrumental           0          0     NaN      NaN
## STE_G_representation         0          0     NaN      NaN
## STE_G_transformative         0          0     NaN      NaN
##
## Residual standard error: 0 on 478 degrees of freedom
## Multiple R-squared:    NaN,  Adjusted R-squared:    NaN
## F-statistic:   NaN on 4 and 478 DF,  p-value: NA
##
##
## Response ST_youth :
##
## Call:
## lm(formula = ST_youth ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.05263  0.00000  0.00000  0.00000  0.96429
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)          -2.210e-17  3.881e-03   0.000   1.0000
## STE_G_nominal         3.571e-02  1.512e-02   2.362   0.0186 *
## STE_G_instrumental    5.263e-02  1.313e-02   4.008 7.11e-05 ***
## STE_G_representation -9.566e-22  2.364e-02   0.000   1.0000
## STE_G_transformative  3.849e-19  2.607e-02   0.000   1.0000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07734 on 478 degrees of freedom
## Multiple R-squared:  0.04104,    Adjusted R-squared:  0.03301
## F-statistic: 5.114 on 4 and 478 DF,  p-value: 0.0004836
##
##
## Response ST_public :
##
## Call:
## lm(formula = ST_public ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.2857  0.0000  0.0000  0.0000  0.9091
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)          1.743e-16  8.123e-03   0.000   1.0000
## STE_G_nominal        2.857e-01  3.165e-02   9.028  < 2e-16 ***
## STE_G_instrumental   1.316e-01  2.748e-02   4.788 2.25e-06 ***
## STE_G_representation 9.091e-02  4.947e-02   1.838   0.0667 .
## STE_G_transformative 2.222e-01  5.456e-02   4.073 5.43e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1618 on 478 degrees of freedom
## Multiple R-squared:  0.1906, Adjusted R-squared:  0.1839
## F-statistic: 28.14 on 4 and 478 DF,  p-value: < 2.2e-16
##
##
## Response ST_university :
##
## Call:
## lm(formula = ST_university ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.4444  0.0000  0.0000  0.0000  0.8929
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -4.395e-16  9.265e-03   0.000  1.00000
## STE_G_nominal         1.071e-01  3.609e-02   2.968  0.00314 **
## STE_G_instrumental    3.684e-01  3.135e-02  11.753  < 2e-16 ***
## STE_G_representation  3.636e-01  5.642e-02   6.445 2.83e-10 ***
```

```
## STE_G_transformative  4.444e-01  6.223e-02   7.142 3.44e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1846 on 478 degrees of freedom
## Multiple R-squared:  0.3129, Adjusted R-squared:  0.3072
## F-statistic: 54.42 on 4 and 478 DF,  p-value: < 2.2e-16
##
##
## Response ST_experts :
##
## Call:
## lm(formula = ST_experts ~ STE_G_nominal + STE_G_instrumental +
##     STE_G_representation + STE_G_transformative, data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.2368  0.0000  0.0000  0.0000  0.8889
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -2.513e-16  8.220e-03   0.000 1.000000
## STE_G_nominal         1.429e-01  3.202e-02   4.461 1.02e-05 ***
## STE_G_instrumental    2.368e-01  2.781e-02   8.516  < 2e-16 ***
## STE_G_representation  1.818e-01  5.006e-02   3.632 0.000312 ***
## STE_G_transformative  1.111e-01  5.521e-02   2.013 0.044724 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1638 on 478 degrees of freedom
## Multiple R-squared:  0.1712, Adjusted R-squared:  0.1642
## F-statistic: 24.68 on 4 and 478 DF,  p-value: < 2.2e-16
```

### Stakeholder type vs level of engagement (IAP2) - regression testing

```
## Response ST_farmers :
##
## Call:
## lm(formula = ST_farmers ~ STE_IAP2_data_gathering + STE_IAP2_inform +
##     STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab + STE_IAP2_empower,
##     data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.5000  0.0000  0.0000  0.0000  0.8571
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)             1.819e-16  1.008e-02   0.000 1.000000
## STE_IAP2_data_gathering 3.437e-01  3.689e-02   9.317  < 2e-16 ***
## STE_IAP2_inform         5.557e-17  2.010e-01   0.000 1.000000
## STE_IAP2_consult        4.545e-01  3.637e-02  12.497  < 2e-16 ***
## STE_IAP2_involve        1.429e-01  7.655e-02   1.866 0.062625 .
## STE_IAP2_collab         2.857e-01  7.655e-02   3.732 0.000213 ***
## STE_IAP2_empower        5.000e-01  8.258e-02   6.055 2.86e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2008 on 476 degrees of freedom
## Multiple R-squared:  0.3579, Adjusted R-squared:  0.3498
## F-statistic: 44.22 on 6 and 476 DF,  p-value: < 2.2e-16
##
##
## Response ST_combined_gov :
##
## Call:
## lm(formula = ST_combined_gov ~ STE_IAP2_data_gathering + STE_IAP2_inform +
##     STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab + STE_IAP2_empower,
##     data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.8571  0.0000  0.0000  0.0000  0.7188
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)             2.652e-16  8.808e-03   0.000        1
## STE_IAP2_data_gathering 2.812e-01  3.225e-02   8.721  < 2e-16 ***
## STE_IAP2_inform         1.000e+00  1.757e-01   5.691 2.21e-08 ***
## STE_IAP2_consult        6.667e-01  3.179e-02  20.969  < 2e-16 ***
## STE_IAP2_involve        8.571e-01  6.691e-02  12.810  < 2e-16 ***
## STE_IAP2_collab         1.000e+00  6.691e-02  14.945  < 2e-16 ***
## STE_IAP2_empower        1.000e+00  7.218e-02  13.854  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1755 on 476 degrees of freedom
```

```
## Multiple R-squared:  0.6786, Adjusted R-squared:  0.6746
## F-statistic: 167.5 on 6 and 476 DF,  p-value: < 2.2e-16
##
##
## Response ST_tribal :
##
## Call:
## lm(formula = ST_tribal ~ STE_IAP2_data_gathering + STE_IAP2_inform +
##     STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab + STE_IAP2_empower,
##     data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.09375  0.00000  0.00000  0.00000  0.96970
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)               5.809e-17  4.418e-03   0.000    1.000
## STE_IAP2_data_gathering  9.375e-02  1.618e-02   5.796 1.24e-08 ***
## STE_IAP2_inform         -9.986e-18  8.814e-02   0.000    1.000
## STE_IAP2_consult         3.030e-02  1.595e-02   1.900    0.058 .
## STE_IAP2_involve        -1.244e-17  3.356e-02   0.000    1.000
## STE_IAP2_collab         -2.114e-17  3.356e-02   0.000    1.000
## STE_IAP2_empower         1.784e-18  3.621e-02   0.000    1.000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08803 on 476 degrees of freedom
## Multiple R-squared:  0.07019,    Adjusted R-squared:  0.05847
## F-statistic: 5.989 on 6 and 476 DF,  p-value: 4.745e-06
##
##
## Response ST_combined_coalition :
##
## Call:
## lm(formula = ST_combined_coalition ~ STE_IAP2_data_gathering +
##     STE_IAP2_inform + STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab +
##     STE_IAP2_empower, data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.5714  0.0000  0.0000  0.0000  0.9375
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)              2.027e-16  8.352e-03   0.000   1.0000
## STE_IAP2_data_gathering 6.250e-02  3.058e-02   2.044   0.0415 *
## STE_IAP2_inform         1.250e-16  1.666e-01   0.000   1.0000
## STE_IAP2_consult        2.727e-01  3.015e-02   9.046  < 2e-16 ***
## STE_IAP2_involve        4.286e-01  6.345e-02   6.754 4.20e-11 ***
## STE_IAP2_collab         5.714e-01  6.345e-02   9.006  < 2e-16 ***
## STE_IAP2_empower        3.333e-01  6.845e-02   4.870 1.52e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 0.1664 on 476 degrees of freedom
## Multiple R-squared:  0.3124, Adjusted R-squared:  0.3037
## F-statistic: 36.05 on 6 and 476 DF,  p-value: < 2.2e-16
##
##
## Response ST_combined_industry :
##
## Call:
## lm(formula = ST_combined_industry ~ STE_IAP2_data_gathering +
##     STE_IAP2_inform + STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab +
##     STE_IAP2_empower, data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.71429 -0.00252 -0.00252 -0.00252  0.99748
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)               0.002519   0.009660   0.261  0.79439
## STE_IAP2_data_gathering   0.153731   0.035370   4.346 1.69e-05 ***
## STE_IAP2_inform          -0.002519   0.192716  -0.013  0.98958
## STE_IAP2_consult          0.573239   0.034870  16.439  < 2e-16 ***
## STE_IAP2_involve          0.711767   0.073387   9.699  < 2e-16 ***
## STE_IAP2_collab           0.283195   0.073387   3.859  0.00013 ***
## STE_IAP2_empower          0.497481   0.079169   6.284 7.47e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1925 on 476 degrees of freedom
## Multiple R-squared:  0.4568, Adjusted R-squared:   0.45
## F-statistic: 66.72 on 6 and 476 DF,  p-value: < 2.2e-16
##
##
## Response ST_migrants :
##
## Call:
## lm(formula = ST_migrants ~ STE_IAP2_data_gathering + STE_IAP2_inform +
##     STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab + STE_IAP2_empower,
##     data = crcdata)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##      0      0      0      0      0
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)                     0          0     NaN      NaN
## STE_IAP2_data_gathering         0          0     NaN      NaN
## STE_IAP2_inform                 0          0     NaN      NaN
## STE_IAP2_consult                0          0     NaN      NaN
## STE_IAP2_involve                0          0     NaN      NaN
## STE_IAP2_collab                 0          0     NaN      NaN
## STE_IAP2_empower                0          0     NaN      NaN
```

```
##
## Residual standard error: 0 on 476 degrees of freedom
## Multiple R-squared:    NaN,  Adjusted R-squared:    NaN
## F-statistic:   NaN on 6 and 476 DF,  p-value: NA
##
##
## Response ST_youth :
##
## Call:
## lm(formula = ST_youth ~ STE_IAP2_data_gathering + STE_IAP2_inform +
##     STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab + STE_IAP2_empower,
##     data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.06061  0.00000  0.00000  0.00000  0.96875
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)              -7.893e-18  3.882e-03   0.000   1.0000
## STE_IAP2_data_gathering  3.125e-02  1.421e-02   2.199   0.0284 *
## STE_IAP2_inform           1.216e-17  7.744e-02   0.000   1.0000
## STE_IAP2_consult          6.061e-02  1.401e-02   4.325 1.86e-05 ***
## STE_IAP2_involve          1.487e-18  2.949e-02   0.000   1.0000
## STE_IAP2_collab          -3.033e-17  2.949e-02   0.000   1.0000
## STE_IAP2_empower          5.797e-18  3.181e-02   0.000   1.0000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07734 on 476 degrees of freedom
## Multiple R-squared:  0.04489,    Adjusted R-squared:  0.03285
## F-statistic: 3.729 on 6 and 476 DF,  p-value: 0.001235
##
##
## Response ST_public :
##
## Call:
## lm(formula = ST_public ~ STE_IAP2_data_gathering + STE_IAP2_inform +
##     STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab + STE_IAP2_empower,
##     data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.3333  0.0000  0.0000  0.0000  0.8788
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)              1.162e-16  8.026e-03   0.000   1.0000
## STE_IAP2_data_gathering  2.812e-01  2.939e-02   9.570  < 2e-16 ***
## STE_IAP2_inform           2.084e-17  1.601e-01   0.000   1.0000
## STE_IAP2_consult          1.212e-01  2.897e-02   4.184 3.42e-05 ***
## STE_IAP2_involve          1.429e-01  6.098e-02   2.343   0.0196 *
## STE_IAP2_collab          -2.322e-15  6.098e-02   0.000   1.0000
## STE_IAP2_empower          3.333e-01  6.578e-02   5.067 5.78e-07 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1599 on 476 degrees of freedom
## Multiple R-squared:  0.213,  Adjusted R-squared:  0.2031
## F-statistic: 21.48 on 6 and 476 DF,  p-value: < 2.2e-16
##
##
## Response ST_university :
##
## Call:
## lm(formula = ST_university ~ STE_IAP2_data_gathering + STE_IAP2_inform +
##     STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab + STE_IAP2_empower,
##     data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.4286  0.0000  0.0000  0.0000  0.8750
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)             -6.441e-17  9.242e-03   0.000 1.000000
## STE_IAP2_data_gathering  1.250e-01  3.384e-02   3.694 0.000246 ***
## STE_IAP2_inform          1.389e-16  1.844e-01   0.000 1.000000
## STE_IAP2_consult         3.939e-01  3.336e-02  11.808  < 2e-16 ***
## STE_IAP2_involve         4.286e-01  7.021e-02   6.104 2.15e-09 ***
## STE_IAP2_collab          4.286e-01  7.021e-02   6.104 2.15e-09 ***
## STE_IAP2_empower         3.333e-01  7.574e-02   4.401 1.33e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1841 on 476 degrees of freedom
## Multiple R-squared:  0.3191, Adjusted R-squared:  0.3105
## F-statistic: 37.18 on 6 and 476 DF,  p-value: < 2.2e-16
##
##
## Response ST_experts :
##
## Call:
## lm(formula = ST_experts ~ STE_IAP2_data_gathering + STE_IAP2_inform +
##     STE_IAP2_consult + STE_IAP2_involve + STE_IAP2_collab + STE_IAP2_empower,
##     data = crcdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.2857  0.0000  0.0000  0.0000  0.8750
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)             -3.031e-17  8.078e-03   0.000   1.0000
## STE_IAP2_data_gathering  1.250e-01  2.958e-02   4.226 2.85e-05 ***
## STE_IAP2_inform         -3.821e-17  1.612e-01   0.000   1.0000
## STE_IAP2_consult         2.727e-01  2.916e-02   9.353  < 2e-16 ***
## STE_IAP2_involve         1.429e-01  6.137e-02   2.328   0.0203 *
```

```
## STE_IAP2_collab          2.857e-01  6.137e-02   4.656 4.19e-06 ***
## STE_IAP2_empower         2.252e-17  6.620e-02   0.000   1.0000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.161 on 476 degrees of freedom
## Multiple R-squared:  0.2029, Adjusted R-squared:  0.1928
## F-statistic: 20.19 on 6 and 476 DF,  p-value: < 2.2e-16
```

### Stakeholder type vs level of engagement (local) - regression testing

```
## Response ST_farmers :
##
## Call:
## lm(formula = ST_farmers ~ SC_researcher + SC_datagathering +
##     SC_inform + SC_perspectives + SC_plan + SC_identify + SC_envision +
##     SC_implement, data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.71652 -0.00334 -0.00334 -0.00334  0.73536
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.003339   0.010003   0.334 0.738686
## SC_researcher     0.261297   0.037237   7.017 7.87e-12 ***
## SC_datagathering  0.451879   0.049398   9.148  < 2e-16 ***
## SC_inform        -0.003339   0.100361  -0.033 0.973474
## SC_perspectives   0.996661   0.199972   4.984 8.75e-07 ***
## SC_plan           0.269388   0.061044   4.413 1.26e-05 ***
## SC_identify       0.441106   0.048126   9.166  < 2e-16 ***
## SC_envision       0.996661   0.199972   4.984 8.75e-07 ***
## SC_implement      0.344402   0.089975   3.828 0.000147 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1997 on 474 degrees of freedom
## Multiple R-squared:  0.3672, Adjusted R-squared:  0.3565
## F-statistic: 34.38 on 8 and 474 DF,  p-value: < 2.2e-16
##
##
## Response ST_combined_gov :
##
## Call:
## lm(formula = ST_combined_gov ~ SC_researcher + SC_datagathering +
##     SC_inform + SC_perspectives + SC_plan + SC_identify + SC_envision +
##     SC_implement, data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.83333 -0.00254 -0.00254 -0.00254  0.66920
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.002540   0.009348   0.272    0.786
## SC_researcher    0.376479   0.034799  10.819  < 2e-16 ***
## SC_datagathering 0.328255   0.046164   7.111 4.28e-12 ***
## SC_inform        0.997460   0.093790  10.635  < 2e-16 ***
## SC_perspectives  0.997460   0.186879   5.337 1.46e-07 ***
## SC_plan          0.633823   0.057047  11.111  < 2e-16 ***
## SC_identify      0.830793   0.044975  18.472  < 2e-16 ***
## SC_envision      0.997460   0.186879   5.337 1.46e-07 ***
## SC_implement     0.922164   0.084084  10.967  < 2e-16 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1866 on 474 degrees of freedom
## Multiple R-squared:  0.638,  Adjusted R-squared:  0.6319
## F-statistic: 104.4 on 8 and 474 DF,  p-value: < 2.2e-16
##
##
## Response ST_tribal :
##
## Call:
## lm(formula = ST_tribal ~ SC_researcher + SC_datagathering + SC_inform +
##     SC_perspectives + SC_plan + SC_identify + SC_envision + SC_implement,
##     data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.17478 -0.00056 -0.00056 -0.00056  0.93874
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.0005626  0.0043947   0.128 0.898194
## SC_researcher     0.0607016  0.0163595   3.710 0.000231 ***
## SC_datagathering  0.1135138  0.0217020   5.231 2.54e-07 ***
## SC_inform        -0.0005626  0.0440915  -0.013 0.989825
## SC_perspectives  -0.0005626  0.0878538  -0.006 0.994894
## SC_plan          -0.0005626  0.0268183  -0.021 0.983273
## SC_identify      -0.0005626  0.0211432  -0.027 0.978784
## SC_envision      -0.0005626  0.0878538  -0.006 0.994894
## SC_implement     -0.0127029  0.0395288  -0.321 0.748081
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08774 on 474 degrees of freedom
## Multiple R-squared:  0.08005,    Adjusted R-squared:  0.06453
## F-statistic: 5.156 on 8 and 474 DF,  p-value: 3.494e-06
##
##
## Response ST_combined_coalition :
##
## Call:
## lm(formula = ST_combined_coalition ~ SC_researcher + SC_datagathering +
##     SC_inform + SC_perspectives + SC_plan + SC_identify + SC_envision +
##     SC_implement, data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.38889 -0.00146 -0.00146 -0.00146  0.95208
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.001465   0.008570   0.171  0.86434
## SC_researcher     0.185377   0.031902   5.811 1.14e-08 ***
## SC_datagathering  0.046454   0.042321   1.098  0.27291
```

```
## SC_inform         0.248535   0.085982   2.891  0.00402 **
## SC_perspectives   0.998535   0.171322   5.828 1.04e-08 ***
## SC_plan           0.271262   0.052298   5.187 3.17e-07 ***
## SC_identify       0.387424   0.041231   9.396  < 2e-16 ***
## SC_envision      -0.001465   0.171322  -0.009  0.99318
## SC_implement      0.161460   0.077084   2.095  0.03674 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1711 on 474 degrees of freedom
## Multiple R-squared:  0.2761, Adjusted R-squared:  0.2639
## F-statistic:  22.6 on 8 and 474 DF,  p-value: < 2.2e-16
##
##
## Response ST_combined_industry :
##
## Call:
## lm(formula = ST_combined_industry ~ SC_researcher + SC_datagathering +
##     SC_inform + SC_perspectives + SC_plan + SC_identify + SC_envision +
##     SC_implement, data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.72222 -0.00501 -0.00501 -0.00501  0.99499
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.005006   0.009833   0.509    0.611
## SC_researcher     0.202319   0.036604   5.527 5.38e-08 ***
## SC_datagathering  0.218387   0.048558   4.497 8.66e-06 ***
## SC_inform         0.494994   0.098653   5.018 7.42e-07 ***
## SC_perspectives  -0.005006   0.196570  -0.025    0.980
## SC_plan           0.449539   0.060005   7.492 3.36e-13 ***
## SC_identify       0.717216   0.047307  15.161  < 2e-16 ***
## SC_envision       0.994994   0.196570   5.062 5.95e-07 ***
## SC_implement      0.354530   0.088444   4.009 7.10e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1963 on 474 degrees of freedom
## Multiple R-squared:  0.4372, Adjusted R-squared:  0.4277
## F-statistic: 46.03 on 8 and 474 DF,  p-value: < 2.2e-16
##
##
## Response ST_migrants :
##
## Call:
## lm(formula = ST_migrants ~ SC_researcher + SC_datagathering +
##     SC_inform + SC_perspectives + SC_plan + SC_identify + SC_envision +
##     SC_implement, data = crcdata)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##      0      0      0      0      0
```

```
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)              0          0     NaN      NaN
## SC_researcher            0          0     NaN      NaN
## SC_datagathering         0          0     NaN      NaN
## SC_inform                0          0     NaN      NaN
## SC_perspectives          0          0     NaN      NaN
## SC_plan                  0          0     NaN      NaN
## SC_identify              0          0     NaN      NaN
## SC_envision              0          0     NaN      NaN
## SC_implement             0          0     NaN      NaN
##
## Residual standard error: 0 on 474 degrees of freedom
## Multiple R-squared:    NaN,  Adjusted R-squared:    NaN
## F-statistic:   NaN on 8 and 474 DF,  p-value: NA
##
##
## Response ST_youth :
##
## Call:
## lm(formula = ST_youth ~ SC_researcher + SC_datagathering + SC_inform +
##     SC_perspectives + SC_plan + SC_identify + SC_envision + SC_implement,
##     data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.09091 -0.00014 -0.00014 -0.00014  0.96746
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)        0.0001421  0.0038639   0.037 0.970682
## SC_researcher      0.0323956  0.0143835   2.252 0.024762 *
## SC_datagathering -0.0020477  0.0190807  -0.107 0.914582
## SC_inform        -0.0001421  0.0387659  -0.004 0.997077
## SC_perspectives  -0.0001421  0.0772425  -0.002 0.998533
## SC_plan           0.0907670  0.0235791   3.849 0.000135 ***
## SC_identify       0.0554135  0.0185894   2.981 0.003022 **
## SC_envision      -0.0001421  0.0772425  -0.002 0.998533
## SC_implement     -0.0066212  0.0347544  -0.191 0.848988
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07715 on 474 degrees of freedom
## Multiple R-squared:  0.05379,    Adjusted R-squared:  0.03782
## F-statistic: 3.368 on 8 and 474 DF,  p-value: 0.0009066
##
##
## Response ST_public :
##
## Call:
## lm(formula = ST_public ~ SC_researcher + SC_datagathering + SC_inform +
##     SC_perspectives + SC_plan + SC_identify + SC_envision + SC_implement,
##     data = crcdata)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.59294 -0.00236 -0.00236 -0.00236  0.90909
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.002362   0.008159   0.289  0.77236
## SC_researcher     0.241171   0.030372   7.941 1.47e-14 ***
## SC_datagathering  0.101099   0.040290   2.509  0.01243 *
## SC_inform         0.247638   0.081857   3.025  0.00262 **
## SC_perspectives  -0.002362   0.163104  -0.014  0.98845
## SC_plan           0.088547   0.049789   1.778  0.07597 .
## SC_identify       0.108749   0.039253   2.770  0.00582 **
## SC_envision      -0.002362   0.163104  -0.014  0.98845
## SC_implement      0.349404   0.073387   4.761 2.56e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1629 on 474 degrees of freedom
## Multiple R-squared:  0.1869, Adjusted R-squared:  0.1732
## F-statistic: 13.62 on 8 and 474 DF,  p-value: < 2.2e-16
##
##
## Response ST_university :
##
## Call:
## lm(formula = ST_university ~ SC_researcher + SC_datagathering +
##     SC_inform + SC_perspectives + SC_plan + SC_identify + SC_envision +
##     SC_implement, data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.51355 -0.00207 -0.00207 -0.00207  0.85599
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.002075   0.009208   0.225  0.82185
## SC_researcher     0.141939   0.034279   4.141 4.10e-05 ***
## SC_datagathering  0.166047   0.045473   3.652  0.00029 ***
## SC_inform         0.497925   0.092387   5.390 1.12e-07 ***
## SC_perspectives  -0.002075   0.184084  -0.011  0.99101
## SC_plan           0.361562   0.056194   6.434 3.04e-10 ***
## SC_identify       0.442370   0.044302   9.985  < 2e-16 ***
## SC_envision       0.997925   0.184084   5.421 9.45e-08 ***
## SC_implement      0.369538   0.082827   4.462 1.02e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1839 on 474 degrees of freedom
## Multiple R-squared:  0.3241, Adjusted R-squared:  0.3127
## F-statistic: 28.41 on 8 and 474 DF,  p-value: < 2.2e-16
##
##
```

```
## Response ST_experts :
##
## Call:
## lm(formula = ST_experts ~ SC_researcher + SC_datagathering +
##     SC_inform + SC_perspectives + SC_plan + SC_identify + SC_envision +
##     SC_implement, data = crcdata)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.50000 -0.00099 -0.00099 -0.00099  0.89164
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.0009888  0.0077993   0.127  0.89917
## SC_researcher     0.1578885  0.0290334   5.438 8.64e-08 ***
## SC_datagathering  0.1073707  0.0385149   2.788  0.00552 **
## SC_inform         0.4990112  0.0782498   6.377 4.29e-10 ***
## SC_perspectives  -0.0009888  0.1559155  -0.006  0.99494
## SC_plan           0.4535566  0.0475948   9.530  < 2e-16 ***
## SC_identify       0.1101223  0.0375231   2.935  0.00350 **
## SC_envision      -0.0009888  0.1559155  -0.006  0.99494
## SC_implement     -0.0325665  0.0701524  -0.464  0.64270
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1557 on 474 degrees of freedom
## Multiple R-squared:  0.257,  Adjusted R-squared:  0.2445
## F-statistic:  20.5 on 8 and 474 DF,  p-value: < 2.2e-16
```

### Stakeholder type vs solution - regression testing

```
##
## Call:
## glm(formula = solution_proposed_YN ~ ST_farmers + ST_combined_gov +
##     ST_tribal + ST_combined_coalition + ST_combined_industry +
##     ST_migrants + ST_youth + ST_public + ST_university + ST_experts,
##     family = binomial, data = crcdata)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.2308  -0.1333  -0.1333  -0.1333   3.0748
##
## Coefficients: (1 not defined because of singularities)
##                         Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -4.7183     0.5068  -9.310  < 2e-16 ***
## ST_farmers                0.7904     0.7745   1.020    0.308
## ST_combined_gov           3.5784     0.7733   4.627  3.7e-06 ***
## ST_tribal               -14.4256  1810.3784  -0.008    0.994
## ST_combined_coalition    -0.2779     0.7639  -0.364    0.716
## ST_combined_industry     -0.6386     0.7963  -0.802    0.423
## ST_migrants                   NA         NA      NA       NA
## ST_youth                -15.6653  1939.1448  -0.008    0.994
## ST_public                 0.7992     0.7884   1.014    0.311
## ST_university             0.2918     0.7387   0.395    0.693
## ST_experts                0.4654     0.8261   0.563    0.573
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 153.75  on 482  degrees of freedom
## Residual deviance: 101.16  on 473  degrees of freedom
## AIC: 121.16
##
## Number of Fisher Scoring iterations: 16
```