# Developed countries online survey on fundamental research

*4 Jan 2018*

**Introduction**
We developed and ran a quantitative online survey to query researchers about their perceptions of, and experiences with, funding for fundamental research. An important aim of the survey was to provide an understanding researcher's personal experiences and outlook on the research funding landscape. We had an excellent response to the survey, with over xxxx researchers completing it, suggesting that fundamental research funding is a high priority topic for researchers. Herein, we detail the survey questions and results.

**Methods**
Online Survey
The survey was open to researchers from all disciplines (e.g. science, social sciences, humanities, engineering, medicine) and career stages, with the proviso that they had some experience applying for research funding. The survey gathered detailed information in four major areas: 1) the types of research the scholars conduct (fundamental, use-inspired, applied), 2) the extent of external partnerships in their research, 3) their grant success rates, and 4) how important they perceive fundamental research is to the federal government and its future prospects in . The survey also enquired how each of these factors have changed over time for the researchers. Finally, the survey gathered basic information from each respondent about gender, discipline, career stage and the year their PhD was obtained. The full survey is provided in Appendix 2.

The online survey was open from the end of May through xxxxxxx , and ran on the Fluid Surveys platform (fluidsurveys.com). Note that the survey was open to researchers from any country in the world because it is was run as part of a global survey through the Global Young Academy. To disseminate the survey to researchers, we gathered email addresses from university websites for as many faculty members as possible and emailed individual researchers directly. We also shared the survey broadly on social media, as well as through the Global Young Academy network, on scientific list serves, and through personal connections.

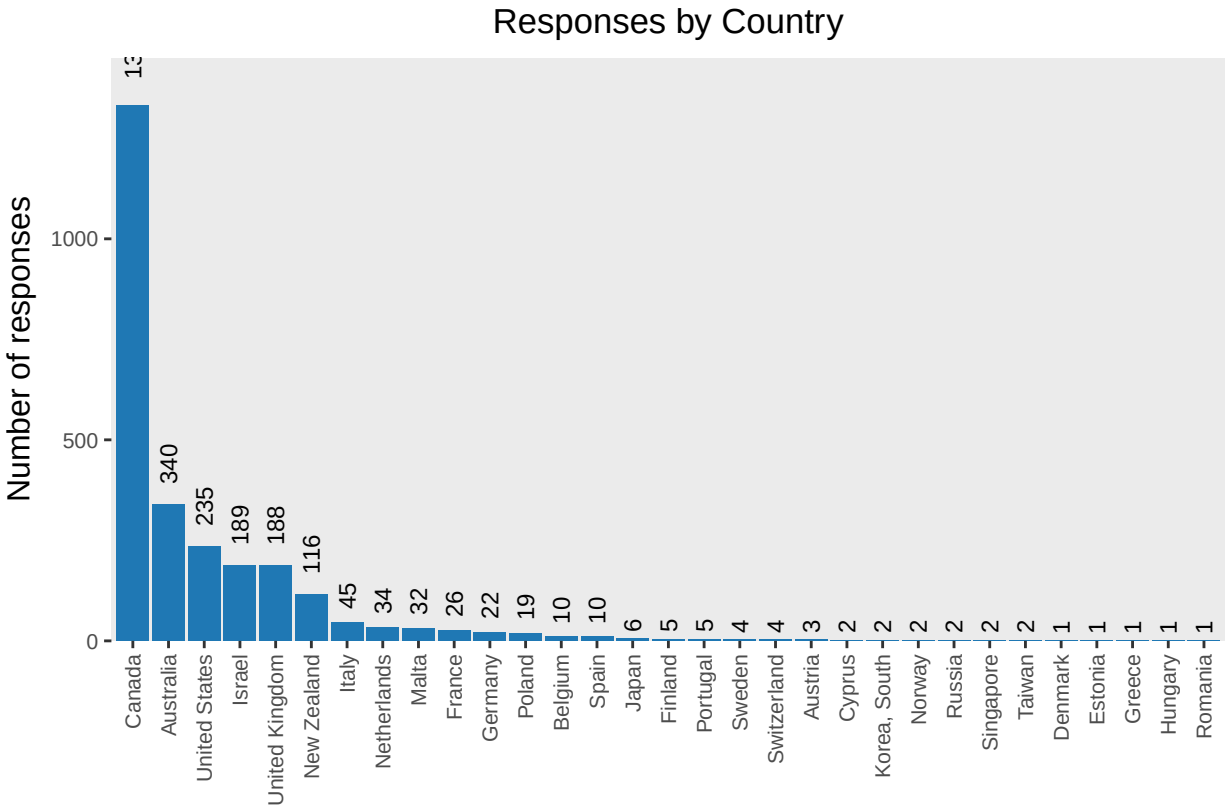
Survey Data Analysis

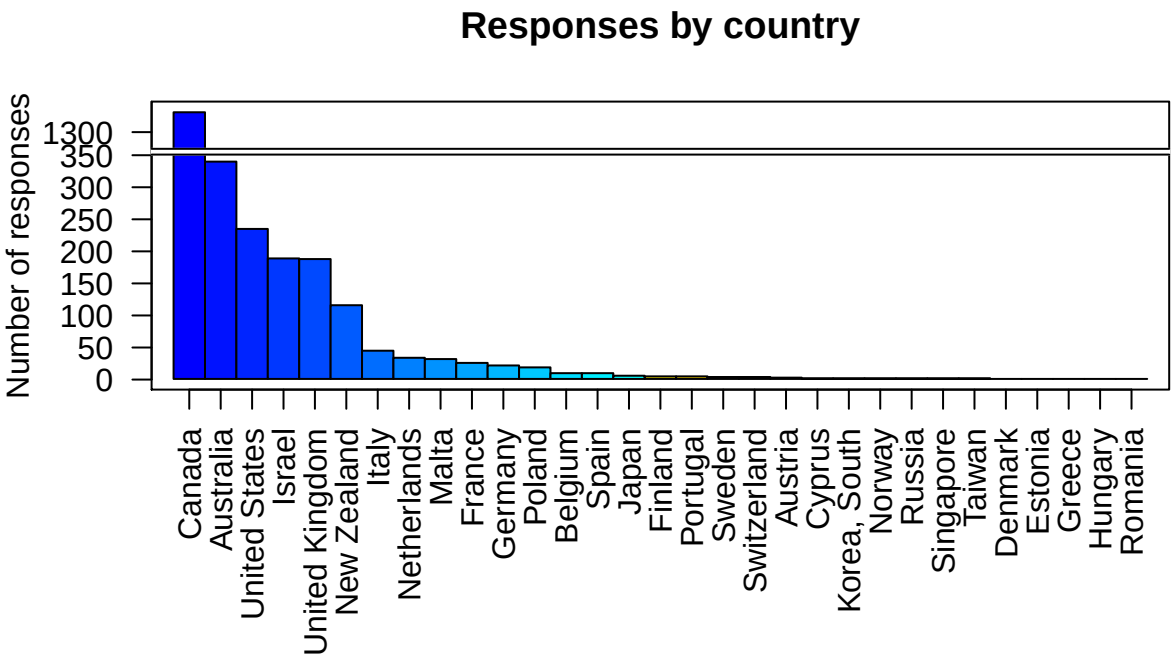
**Note that numbers not all the same because respondents did not always answer every question**

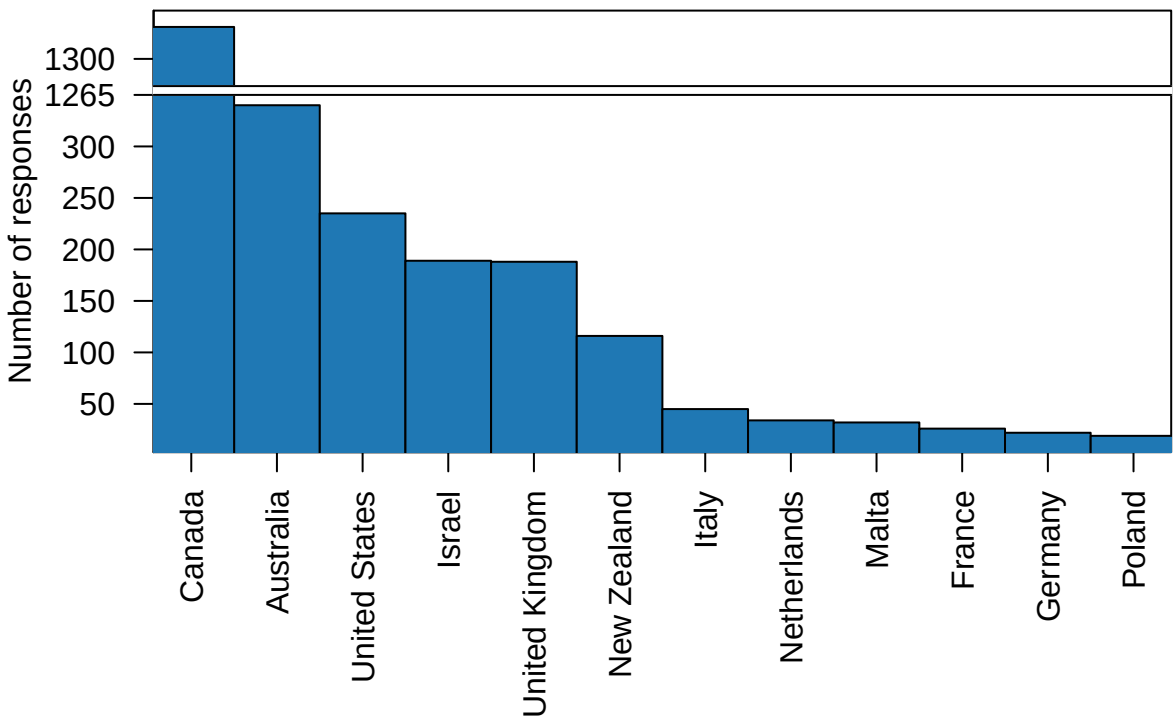
```
## null device
##           1
```

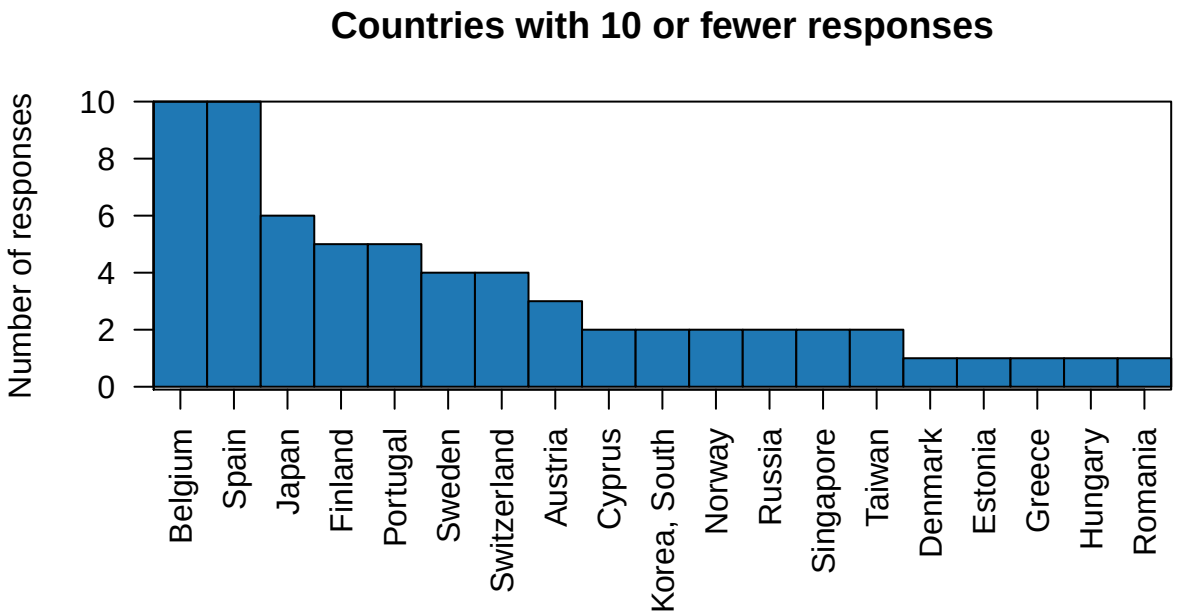
**Results**
In total, 2641 researchers from developed countries completed the online survey. Of these, almost xxxxx were male (72%) and xxxxx were female (28%); xxxx proportion either did not input their gender or selected other. xxxx of the survey respondents (92%) were either senior academics (64%), defined as those researchers with more than ten years experience applying for research grants since completion of their PhD, or early career academics (28%) (Figure 4.1). xxxxx also came from post-doctoral researchers (5%), non-academic researchers (2%), or those who did not indicate their career stage (0.4%).

Researchers from many different disciplines were represented in the survey. Almost xxxx percent of responses came from either the natural or physical sciences (Figure 4.2). The remaining responses were spread amongst the medical and life sciences (23%), engineering (10%), interdisciplinary research (6%), and social sciences and humanities (8%).


Responses by Country
Number of responses
1000
500
0
13
340
235
189
188
116
45
34
32
26
22
19
10
10
6
5
5
4
4
3
2
2
2
2
2
2
1
1
1
1
1
Canada
Australia
United States
Israel
United Kingdom
New Zealand
Italy
Netherlands
Malta
France
Germany
Poland
Belgium
Spain
Japan
Finland
Portugal
Sweden
Switzerland
Austria
Cyprus
Korea, South
Norway
Russia
Singapore
Taiwan
Denmark
Estonia
Greece
Hungary
Romania


Responses by country
Number of responses
1300
350
300
250
200
150
100
50
0
Canada
Australia
United States
Israel
United Kingdom
New Zealand
Italy
Netherlands
Malta
France
Germany
Poland
Belgium
Spain
Japan
Finland
Portugal
Sweden
Switzerland
Austria
Cyprus
Korea, South
Norway
Russia
Singapore
Taiwan
Denmark
Estonia
Greece
Hungary
Romania


Countries with greater than 10 responses
Number of responses
1300
1265
300
250
200
150
100
50
Canada
Australia
United States
Israel
United Kingdom
New Zealand
Italy
Netherlands
Malta
France
Germany
Poland


Countries with 10 or fewer responses
Number of responses
0
2
4
6
8
10
Belgium
Spain
Japan
Finland
Portugal
Sweden
Switzerland
Austria
Cyprus
Korea, South
Norway
Russia
Singapore
Taiwan
Denmark
Estonia
Greece
Hungary
Romania

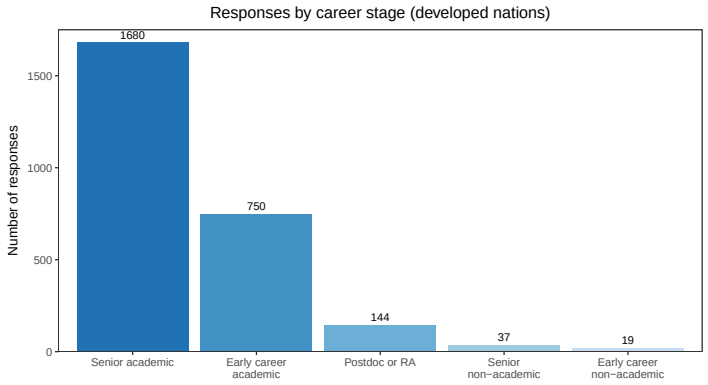
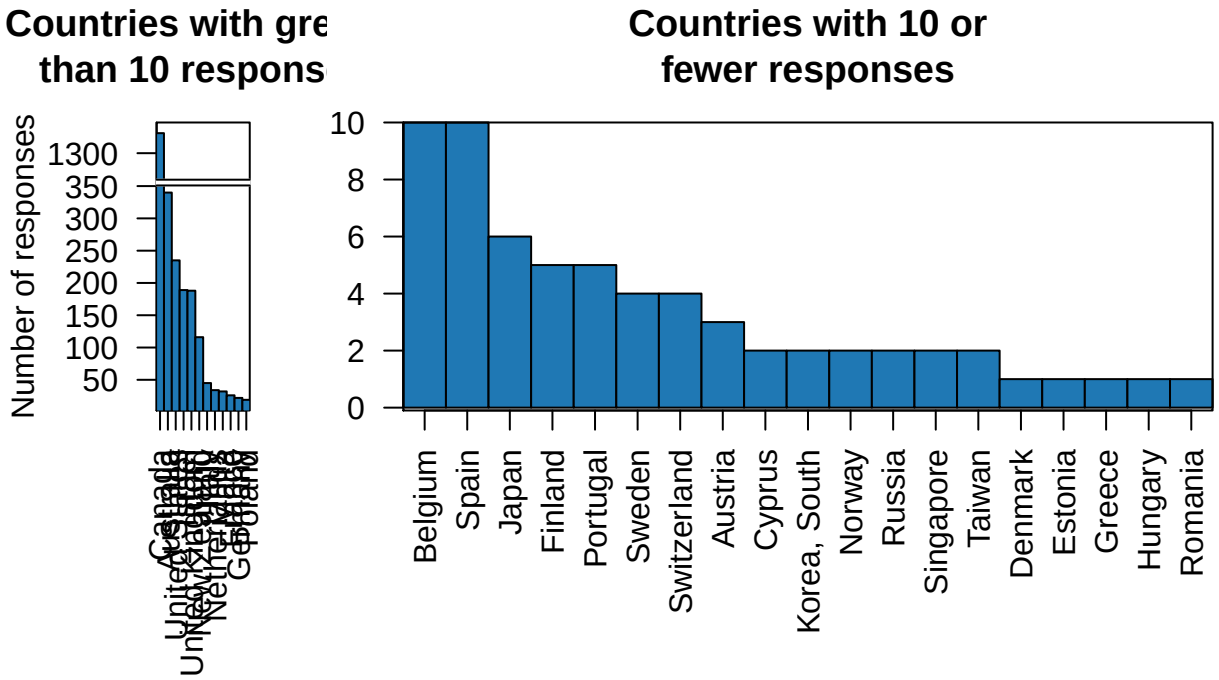



Figure 1: Figure 4.1 Number of survey respondents from developed nations by career stage




```
## null device
##           1
```

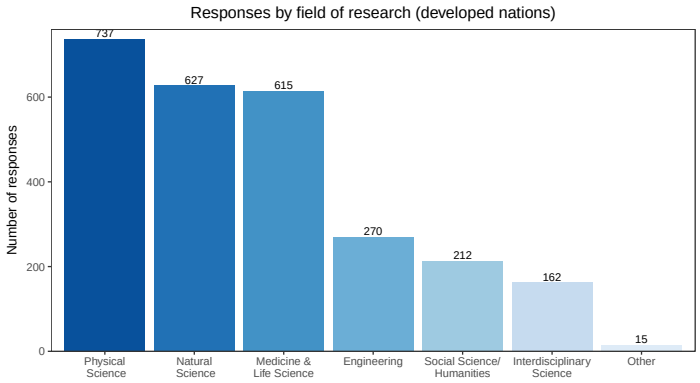



Figure 2: Figure 4.2 survey responses by field of research

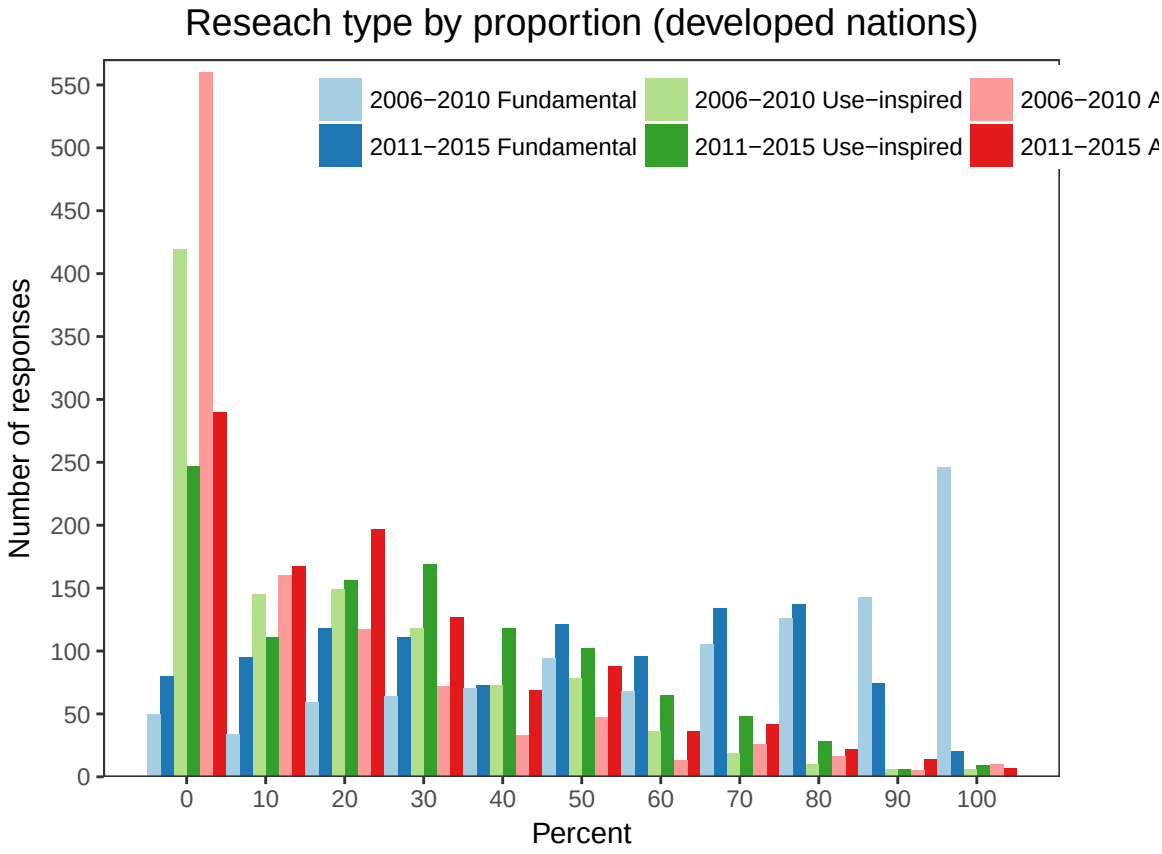



Figure 3: Figure 4.3 Respondents type of research describe in proportal amounts of fundamental, use-inspired and applied research. Reseachers were questioned about the percentage of funding allocated to Fundamental, Use-inspired or Applied research in the past and in their current research.

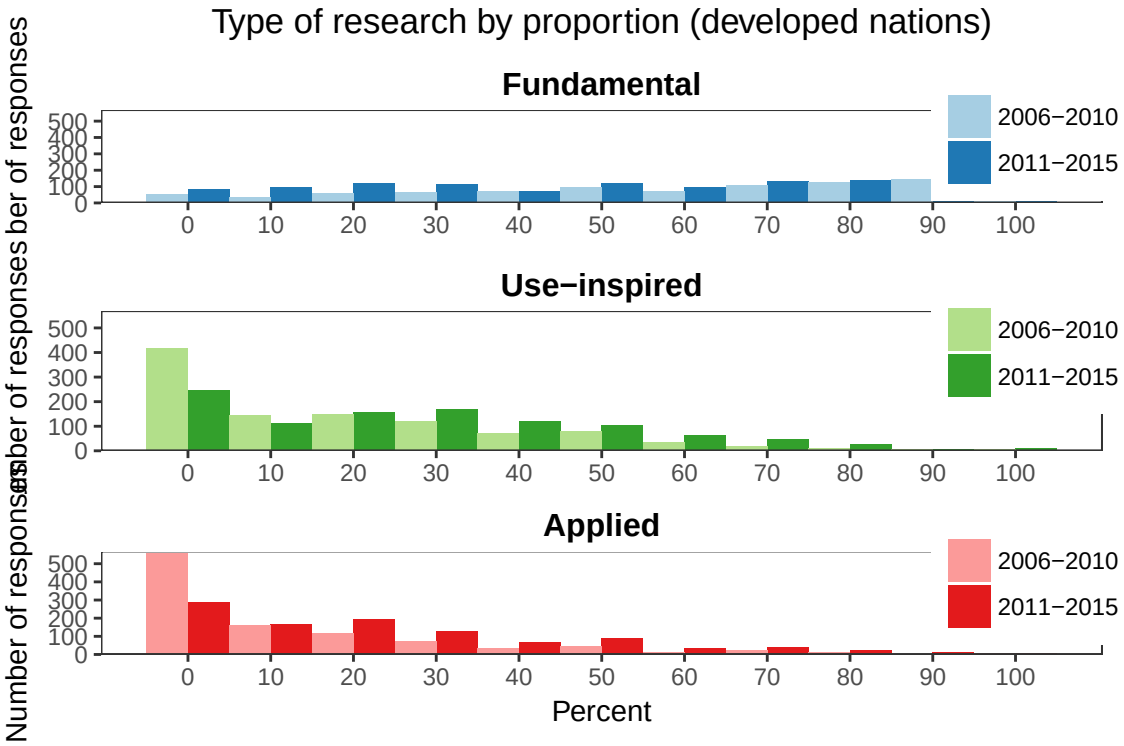



Figure 4: Figure 4.3 (different layout) Respondents type of research describe in proportal amounts of fundamental, use-inspired and applied research. Reseachers were questioned about the percentage of funding allocated to Fundamental, Use-inspired or Applied research in the past and in their current research.

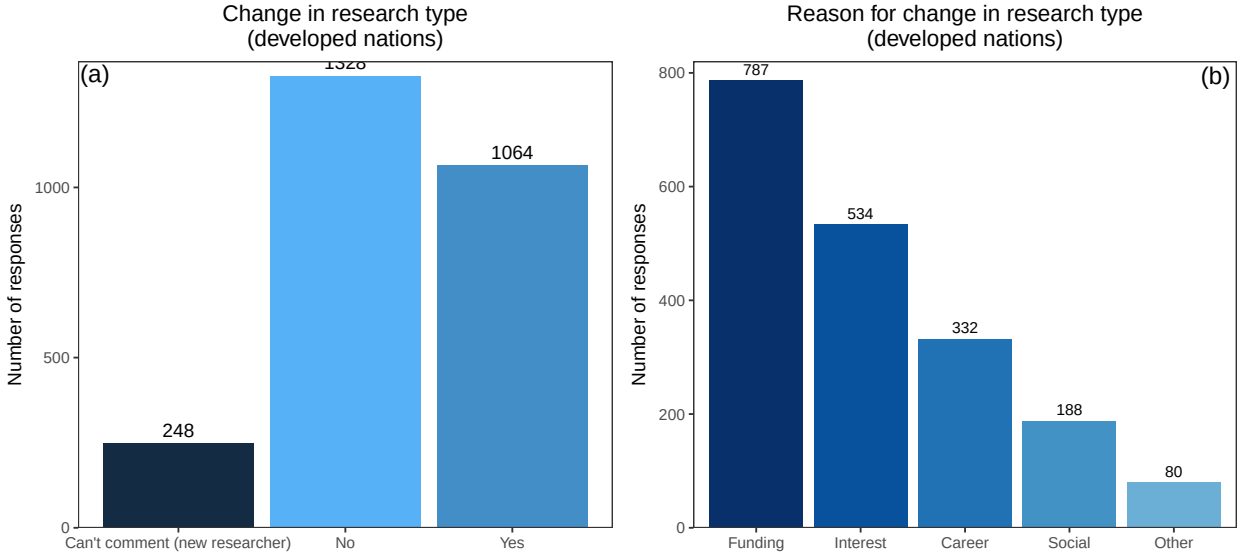
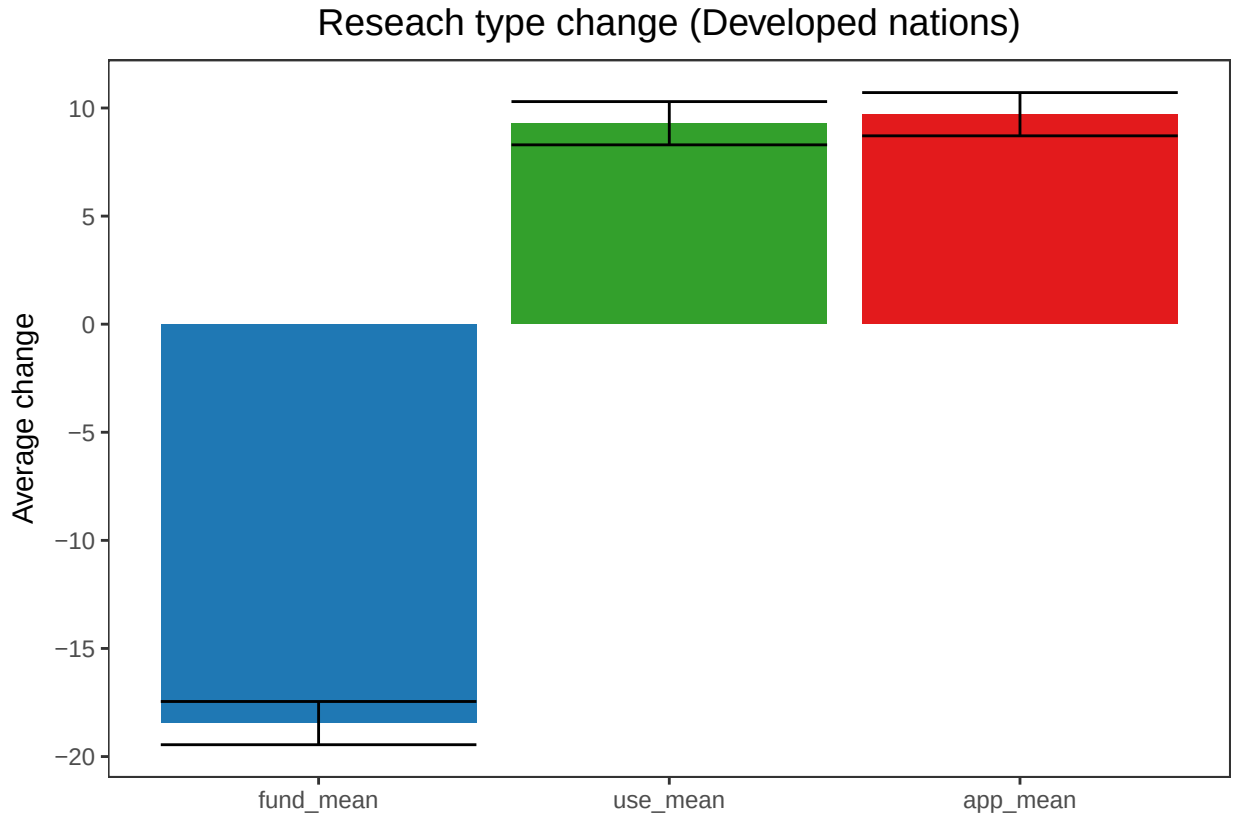



Figure 5: Figure 4.4a&b Change in research type proportions and the reasons. Researchers were asked to answer yes, no, or can't comment on if their type of research had changed in the last 10 years and to select what reasons for the change applied to them.




```
##        majority_past gender
## 1           app.past     93
## 2 fund.app.half.past     16
## 3          fund.past    798
## 4 fund.use.half.past     32
## 5  use.app.half.past      6
## 6           use.past    114
```

```
##       major.research gender
## 1           app.past     93
## 2 fund.app.half.past     16
## 3          fund.past    798
## 4 fund.use.half.past     32
## 5  use.app.half.past      6
## 6           use.past    114
```

```
##       major.research gender         color
## 1           app.past     93 darkturquoise
## 2 fund.app.half.past     16 darkturquoise
## 3          fund.past    798 darkturquoise
## 4 fund.use.half.past     32 darkturquoise
## 5  use.app.half.past      6 darkturquoise
## 6           use.past    114 darkturquoise
```

```
##        majority_current gender
## 1           app.current    157
## 2 fund.app.half.current     32
## 3          fund.current    613
```

```
## 4 fund.use.half.current     32
## 5  use.app.half.current     14
## 6           use.current    211
```

```
##          major.research gender
## 1           app.current    157
## 2 fund.app.half.current     32
## 3          fund.current    613
## 4 fund.use.half.current     32
## 5  use.app.half.current     14
## 6           use.current    211
```

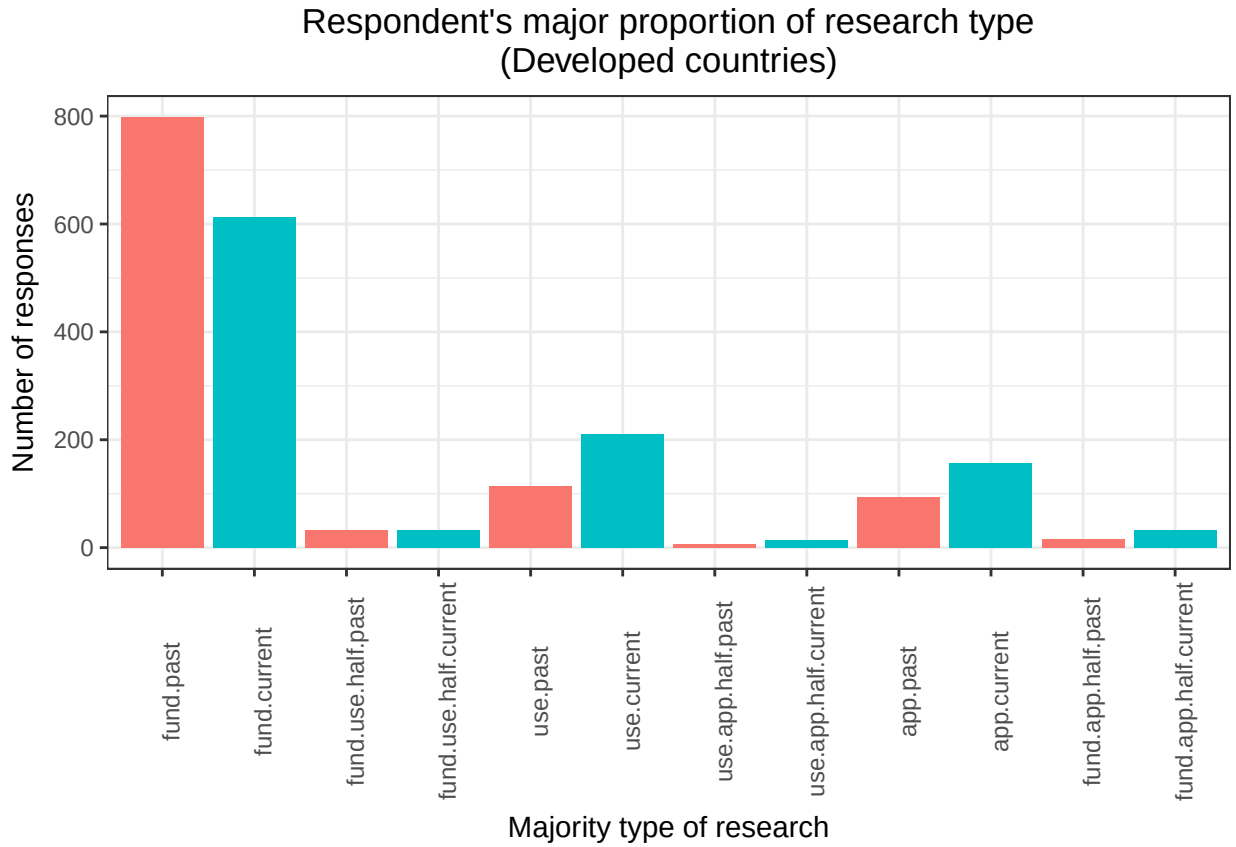
```
##          major.research gender         color
## 1           app.current    157 paleturquoise
## 2 fund.app.half.current     32 paleturquoise
## 3          fund.current    613 paleturquoise
## 4 fund.use.half.current     32 paleturquoise
## 5  use.app.half.current     14 paleturquoise
## 6           use.current    211 paleturquoise
```

```
## Joining, by = c("major.research", "gender", "color")
```

```
##           major.research gender         color
## 1               app.past     93 darkturquoise
## 2     fund.app.half.past     16 darkturquoise
## 3              fund.past    798 darkturquoise
## 4     fund.use.half.past     32 darkturquoise
## 5      use.app.half.past      6 darkturquoise
## 6               use.past    114 darkturquoise
## 7            app.current    157 paleturquoise
## 8  fund.app.half.current     32 paleturquoise
## 9           fund.current    613 paleturquoise
## 10 fund.use.half.current     32 paleturquoise
## 11  use.app.half.current     14 paleturquoise
## 12           use.current    211 paleturquoise
```

```
##  chr [1:12] "app.past" "fund.app.half.past" "fund.past" ...
```

```
##  [1] "app.current"           "app.past"
##  [3] "fund.app.half.current" "fund.app.half.past"
##  [5] "fund.current"          "fund.past"
##  [7] "fund.use.half.current" "fund.use.half.past"
##  [9] "use.app.half.current"  "use.app.half.past"
## [11] "use.current"           "use.past"
```




```
##           Location         nation id     Country   Country_work gender
## 1 British Columbia         Canada  5      Canada       Barbados  Other
## 2 British Columbia         Canada  6      Canada     Antarctica Female
## 3      Netherlands         Russia 10 Netherlands         Russia   Male
## 4      Netherlands        Germany 11 Netherlands        Germany Female
## 5      Netherlands United Kingdom 12 Netherlands United Kingdom   Male
## 6                         Australia 16                 Australia Female
##                                                                                what_parti
## 1  Non-academic researcher conducting or managing research in industry or government with >10 years e
## 2 Early career academic researcher with <10 years experience applying for research grants since compl
## 3                            Senior academic researcher with >10 years of experience applying for res
## 4                            Senior academic researcher with >10 years of experience applying for res
## 5                            Senior academic researcher with >10 years of experience applying for res
## 6                            Senior academic researcher with >10 years of experience applying for res
##                                                 field_research
## 1                                                Natural Science
## 2                                                Natural Science
## 3                                     Medicine and Life Science
## 4                                  Social Science / Humanities
## 5 Physical Science (eg. math, physics, chemistry, computer science)
## 6                                     Medicine and Life Science
##   total_research percent_Applied_Research_current
## 1             70                              100
## 2            100                                0
## 3            100                                0
## 4            100                                0
```

```
## 5            100                                10
## 6            100                                 0
##   percent_Applied_Research_past percent_Fundamental_Research_past
## 1                            70                                 0
## 2                             0                               100
## 3                             0                               100
## 4                             0                                80
## 5                             0                                90
## 6                             0                               100
##   percent_fundemental_research_current
## 1                                    0
## 2                                  100
## 3                                   70
## 4                                   70
## 5                                   70
## 6                                   80
##   percent_Use_inspired_Research_current percent_Use_inspired_Research_past
## 1                                     0                                  0
## 2                                     0                                  0
## 3                                    30                                  0
## 4                                    20                                 20
## 5                                    20                                 10
## 6                                    20                                  0
##   changed majority_current majority_past curr_past.app curr_past.use
## 1     Yes      app.current      app.past            30             0
## 2     Yes     fund.current     fund.past             0             0
## 3     Yes     fund.current     fund.past             0            30
## 4     Yes     fund.current     fund.past             0             0
## 5     Yes     fund.current     fund.past            10            10
## 6     Yes     fund.current     fund.past             0            20
##   curr_past.fund app_mean   app_sd use_mean   use_sd fund_mean  fund_sd
## 1              0  9.71254 20.79904 9.295627 19.92397  -18.4529 23.44755
## 2              0  9.71254 20.79904 9.295627 19.92397  -18.4529 23.44755
## 3            -30  9.71254 20.79904 9.295627 19.92397  -18.4529 23.44755
## 4            -10  9.71254 20.79904 9.295627 19.92397  -18.4529 23.44755
## 5            -20  9.71254 20.79904 9.295627 19.92397  -18.4529 23.44755
## 6            -20  9.71254 20.79904 9.295627 19.92397  -18.4529 23.44755
```

```
##           Location         nation id     Country   Country_work gender
## 1 British Columbia         Canada  5      Canada       Barbados  Other
## 2 British Columbia         Canada  6      Canada     Antarctica Female
## 3      Netherlands         Russia 10 Netherlands         Russia   Male
## 4      Netherlands        Germany 11 Netherlands        Germany Female
## 5      Netherlands United Kingdom 12 Netherlands United Kingdom   Male
## 6                       Australia 16                  Australia Female
##                                                                                                                what_parti
## 1  Non-academic researcher conducting or managing research in industry or government with >10 years
## 2 Early career academic researcher with <10 years experience applying for research grants since compl
## 3                            Senior academic researcher with >10 years of experience applying for re
## 4                            Senior academic researcher with >10 years of experience applying for re
## 5                            Senior academic researcher with >10 years of experience applying for re
## 6                            Senior academic researcher with >10 years of experience applying for re
##                                           field_research
## 1                                         Natural Science
```

```
## 2                                                 Natural Science
## 3                                       Medicine and Life Science
## 4                                    Social Science / Humanities
## 5 Physical Science (eg. math, physics, chemistry, computer science)
## 6                                       Medicine and Life Science
##   total_research percent_Applied_Research_current
## 1             70                              100
## 2            100                                0
## 3            100                                0
## 4            100                                0
## 5            100                               10
## 6            100                                0
##   percent_Applied_Research_past percent_Fundamental_Research_past
## 1                            70                                 0
## 2                             0                               100
## 3                             0                               100
## 4                             0                                80
## 5                             0                                90
## 6                             0                               100
##   percent_fundemental_research_current
## 1                                    0
## 2                                  100
## 3                                   70
## 4                                   70
## 5                                   70
## 6                                   80
##   percent_Use_inspired_Research_current percent_Use_inspired_Research_past
## 1                                     0                                  0
## 2                                     0                                  0
## 3                                    30                                  0
## 4                                    20                                 20
## 5                                    20                                 10
## 6                                    20                                  0
##   changed             time         what
## 1     Yes majority_current  app.current
## 2     Yes majority_current fund.current
## 3     Yes majority_current fund.current
## 4     Yes majority_current fund.current
## 5     Yes majority_current fund.current
## 6     Yes majority_current fund.current
```

```
## going to subset for those responses that had a 25%+ decrease in Fundamental and then look too see wha
# use res.port.dev
#head(res.port.devp)

#get rid of columns that we dont need so it is easier to work with
colnames(res.port.devp)
```

```
##  [1] "Location"
##  [2] "nation"
##  [3] "id"
##  [4] "Country"
##  [5] "Country_work"
##  [6] "gender"
##  [7] "what_participant_group"
```

```
##  [8] "field_research"
##  [9] "total_research"
## [10] "percent_Applied_Research_current"
## [11] "percent_Applied_Research_past"
## [12] "percent_Fundamental_Research_past"
## [13] "percent_fundemental_research_current"
## [14] "percent_Use_inspired_Research_current"
## [15] "percent_Use_inspired_Research_past"
## [16] "changed"
## [17] "majority_current"
## [18] "majority_past"
## [19] "curr_past.app"
## [20] "curr_past.use"
## [21] "curr_past.fund"
## [22] "app_mean"
## [23] "app_sd"
## [24] "use_mean"
## [25] "use_sd"
## [26] "fund_mean"
## [27] "fund_sd"
```

```
res.port.devp$"app_mean" <- NULL
res.port.devp$"app_sd"  <- NULL
res.port.devp$"use_mean"  <- NULL
res.port.devp$"use_sd"  <- NULL
res.port.devp$"fund_mean"  <- NULL
res.port.devp$"fund_sd"  <- NULL
res.port.devp$"changed"  <- NULL
res.port.devp$"majority_current"  <- NULL
res.port.devp$"majority_past"  <- NULL
res.port.devp$"Country_work"  <- NULL
res.port.devp$"Country"  <- NULL
res.port.devp$"Location"  <- NULL
res.port.devp$"app.use.fund.past"  <- NULL
res.port.devp$"app.use.fund.past"  <- NULL

#head(res.port.devp)

#now select for the ones that had 25% + decrease in Fundamental
#str(res.port.devp)
#dim(res.port.devp)
fund.dec <- res.port.devp[(res.port.devp$curr_past.fund <= -25),]
#dim(fund.dec)  # only 353 had a 25% decrease in fundamental
#head(fund.dec)


#now read in data that has the view on change and why
n.gbl.devp<-survey[survey$nation%in% developed,]
#head(n.gbl.devp)
#colnames(n.gbl.devp)
fund.dec.view.change <- n.gbl.devp[,c(12:18, 74, 77:79)]
fund.dec.view.change<-fund.dec.view.change[!fund.dec.view.change$view_change_of_type=="",]
fund.dec.view.change<-droplevels(fund.dec.view.change)
#head(fund.dec.view.change)
```

```
#now select for just the ones that had a decrease in fund as above
#dim(fund.dec.view.change)
fund.dec.view.change <- fund.dec.view.change[fund.dec.view.change$id %in% fund.dec$id,]
#dim(fund.dec.view.change)
#head(fund.dec.view.change)
#dim(fund.dec.view.change)
#dim(fund.dec.view.change)
# they both have 353 rows

#now follow the same code to make the figure as in the next code chunk (figure 4.5)
fund.dec.view<-aggregate(gender~ view_change_of_type, fund.dec.view.change, length)
#fund.dec.view
# change order of the levels
fund.dec.view$view_change_of_type<-factor(fund.dec.view$view_change_of_type,
                                          levels(fund.dec.view$view_change_of_type)[c(5,3,1,2,4)])

myColors5<-(brewer.pal(9, "Blues"))
myColors5<-myColors5[c(4,4,4,4,4,4)]

pdf(file="figures/developed/4.5.2_ViewFieldChange_FundDecrease.pdf", width = 11, height= 7)

ggplot(fund.dec.view, aes(x=view_change_of_type, y=gender, fill=view_change_of_type)) + geom_bar(stat='
  theme(aspect.ratio=3/4, axis.text.x = element_text(angle=0, vjust=0.5, size=9), axis.text.y = element_
  theme(panel.grid.major = element_blank(),legend.text=element_text(size = 9), panel.grid.minor = eleme

dev.off()
```

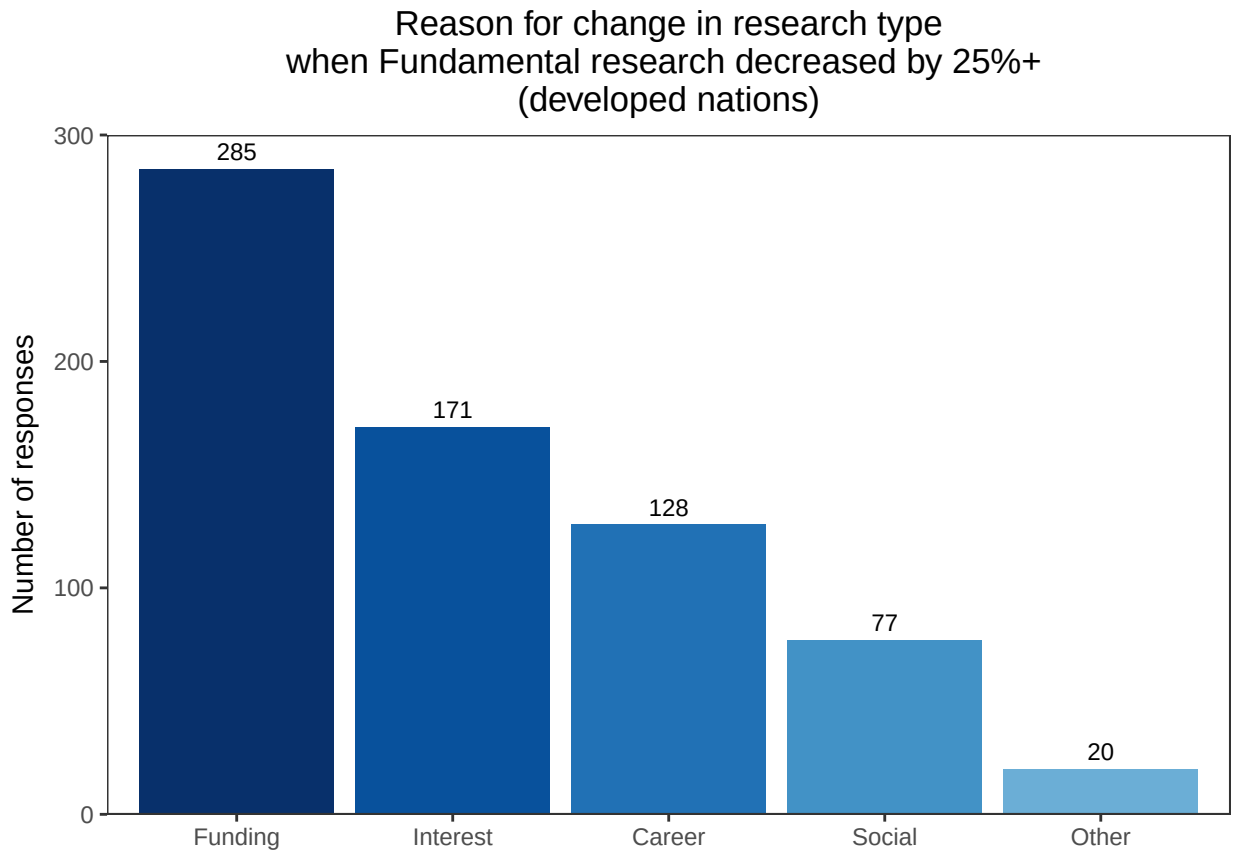
```
## pdf
##   2
```

```
#### now look at why they changed
####reason for change
fund.dec.change<-subset(fund.dec.view.change, select=c("nation", "gender", "Main_reason_change_interest_
                                          "Main_reason_change_Career_related","Main_reason_change_Funding_

# switch to long format
require(tidyr)
fund.dec.change.long<-gather(fund.dec.change, reason.change.fund.dec, yes, -nation, -gender)
# using table to count cases of each category
sum.fund.dec<-data.frame(table(fund.dec.change.long$reason.change.fund.dec, fund.dec.change.long$yes))
#remove non-response
sum.fund.dec<-sum.fund.dec[!sum.fund.dec$Var1=="",]
sum.fund.dec
```

```
##                                 Var1 Var2 Freq
## 1   Main_reason_change_Career_related    1  128
## 2  Main_reason_change_Funding_related    1  285
## 3 Main_reason_change_interest_related    1  171
## 4            Main_reason_change_Other    1   20
## 5 Main_reason_change_Socially_related    1   77
```

```
sum.fund.dec$Var1<-revalue(sum.fund.dec$Var1, c("Main_reason_change_Career_related" = "Career", "Main_r
# change order of the levels
sum.fund.dec$Var1<-factor(sum.fund.dec$Var1,levels(sum.fund.dec$Var1)[c(2,3,1,5,4)])
```

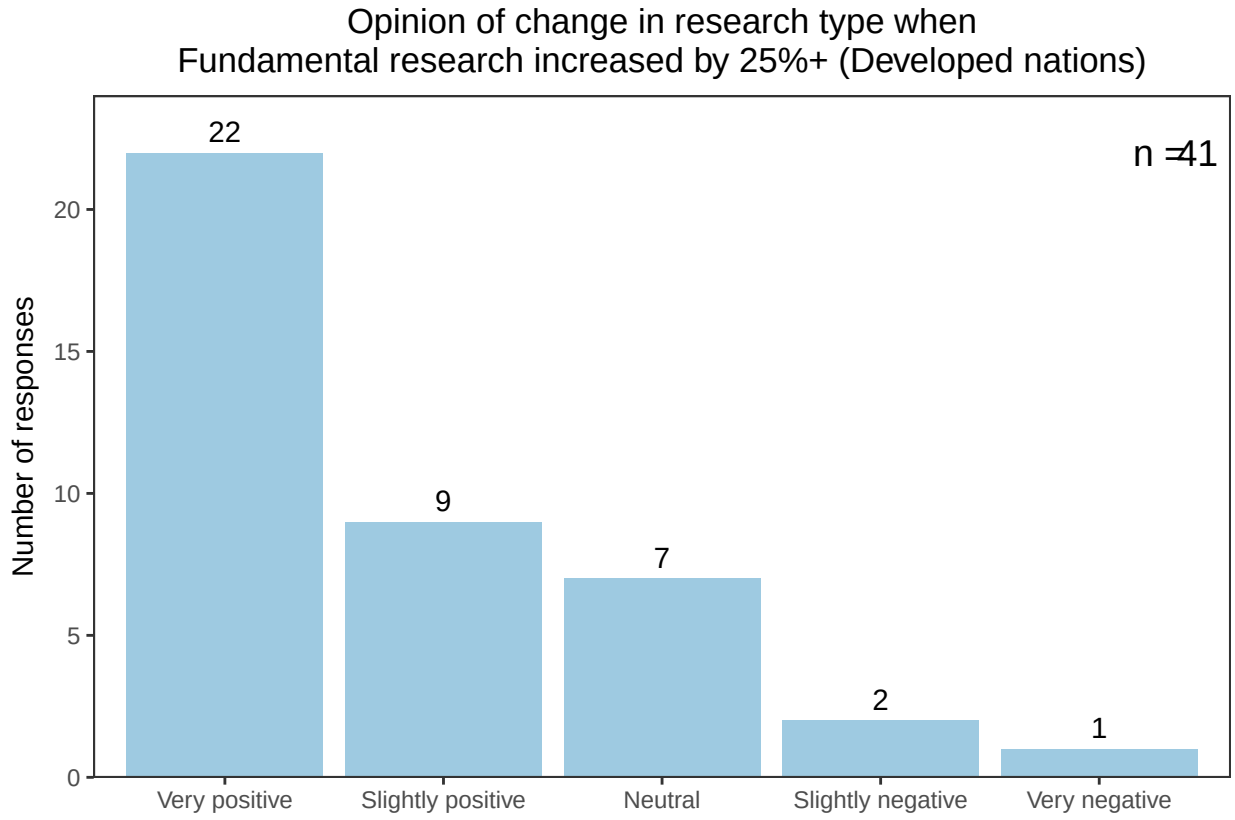
```
myColors4<-(brewer.pal(9, "Blues"))
myColors4<-myColors4[c(9, 8,7,6,5,3)]

#pdf(file="figures/developed/4.4.2_ReasonForFieldChange_FundDecrease.pdf", width = 11, height= 7)

ggplot(sum.fund.dec, aes(x=Var1, y=Freq, fill=Var1)) + geom_bar(stat='identity')+
  theme( axis.text.x = element_text(angle=0, vjust=0.5, size=9), axis.text.y=element_text(size = 9), ax
         panel.grid.minor = element_blank(),legend.text=element_text(size = 9),axis.title.x=element_bla
  scale_fill_manual(name = "Var1",values = myColors4)+
  labs(y="Number of responses", title="Reason for change in research type\nwhen Fundamental research de
  scale_y_continuous(expand = c(0, 0), limits = c(0, 300))+geom_text(aes(label=Freq), vjust=-0.5, size=
```




```
#dev.off()
```

```
### now do it for the increase in Fundamental

#now select for the ones that had 25% + increase in Fundamental
#head(res.port.devp)
fund.inc <- res.port.devp[(res.port.devp$curr_past.fund >= 25),]

#head(fund.inc)
#dim(fund.inc)

#now read in data that has the view on change and why
#head(n.gbl.devp)
#colnames(n.gbl.devp)
```

```r
fund.inc.view.change <- n.gbl.devp[,c(4,12:18, 74, 77:79)]
fund.inc.view.change<-fund.inc.view.change[!fund.inc.view.change$view_change_of_type=="",]
fund.inc.view.change<-droplevels(fund.inc.view.change)
#head(fund.inc.view.change)

#now select for just the ones that had a decrease in fund as above

fund.inc.view.change <- fund.inc.view.change[fund.inc.view.change$id %in% fund.inc$id,]

#head(fund.inc.view.change)
#dim(fund.inc)
#dim(fund.inc.view.change)
# One has 42 and the other 41 so one of the surveys must not of answered the why and view questions

#now follow the same code to make the figure as in the next code chunk (figure 4.5)
fund.inc.view<-aggregate(gender~ view_change_of_type, fund.inc.view.change, length)
#fund.inc.view
fund.inc.view <- droplevels(fund.inc.view)
# change order of the levels
fund.inc.view$view_change_of_type<-factor(fund.inc.view$view_change_of_type,
                                          levels(fund.inc.view$view_change_of_type)[c(5,3,1,2,4)])

myColors.view<-(brewer.pal(9, "Blues"))
myColors.view<-myColors.view[c(4,4,4,4,4)]

#pdf(file="figures/developed/4.5.3_ViewFieldChange_increaseFund.pdf", width = 11, height= 7)

ggplot(fund.inc.view, aes(x=view_change_of_type, y=gender, fill=view_change_of_type)) + geom_bar(stat='
  theme(axis.text.x = element_text(angle=0, vjust=0.5, size=9), axis.text.y = element_text(size = 9), a
  theme(panel.grid.major = element_blank(),legend.text=element_text(size = 9), panel.grid.minor = eleme
```



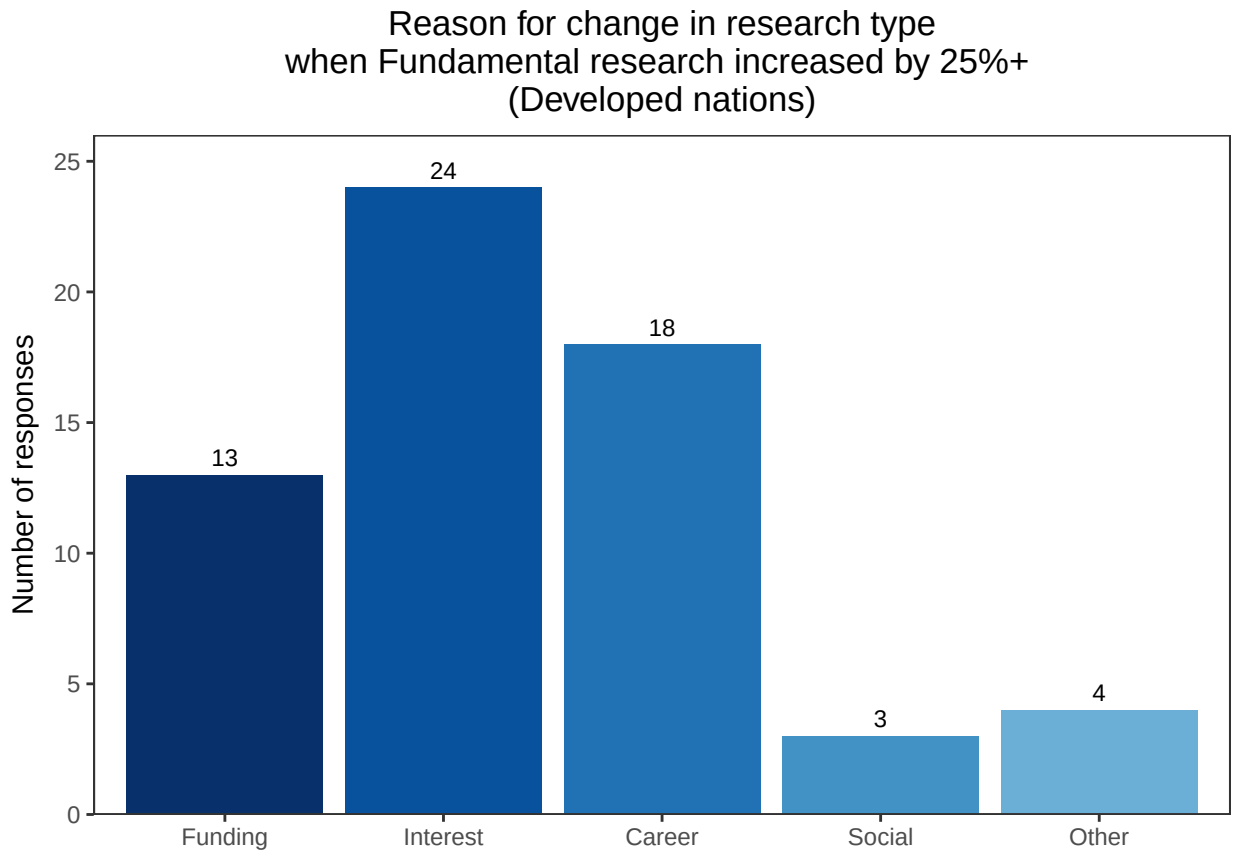

```
#dev.off()


#### now look at why they changed
####reason for change
fund.inc.change<-subset(fund.inc.view.change, select=c("nation", "gender", "Main_reason_change_interest_
                                    "Main_reason_change_Career_related","Main_reason_change_Funding_

# switch to long format
require(tidyr)
fund.inc.change.long<-gather(fund.inc.change, reason.change.fund.inc, yes, -nation, -gender)
# using table to count cases of each category
sum.fund.inc<-data.frame(table(fund.inc.change.long$reason.change.fund.inc, fund.inc.change.long$yes))
#remove non-response
sum.fund.inc<-sum.fund.inc[!sum.fund.inc$Var1=="",]
sum.fund.inc
```

```
##                                 Var1 Var2 Freq
## 1   Main_reason_change_Career_related    1   18
## 2  Main_reason_change_Funding_related    1   13
## 3 Main_reason_change_interest_related    1   24
## 4            Main_reason_change_Other    1    4
## 5 Main_reason_change_Socially_related    1    3
```

```
sum.fund.inc$Var1<-revalue(sum.fund.inc$Var1, c("Main_reason_change_Career_related" = "Career", "Main_r
# change order of the levels
sum.fund.inc$Var1<-factor(sum.fund.inc$Var1,levels(sum.fund.inc$Var1)[c(2,3,1,5,4)])
```

```
myColors.why<-(brewer.pal(9, "Blues"))
myColors.why<-myColors.why[c(9, 8,7,6,5,3)]

#pdf(file="figures/developed/4.4.3_ReasonForFieldChange_FundIncrease.pdf", width = 11, height= 7)

ggplot(sum.fund.inc, aes(x=Var1, y=Freq, fill=Var1)) + geom_bar(stat='identity')+
  theme( axis.text.x = element_text(angle=0, vjust=0.5, size=9), axis.text.y=element_text(size = 9), ax
         panel.grid.minor = element_blank(),legend.text=element_text(size = 9),axis.title.x=element_bla
  scale_fill_manual(name = "Var1",values = myColors.why)+
  labs(y="Number of responses", title="Reason for change in research type\nwhen Fundamental research in
  scale_y_continuous(expand = c(0, 0), limits = c(0, 26))+annotate('text', 5.35,84, label="(b)", size=5
```

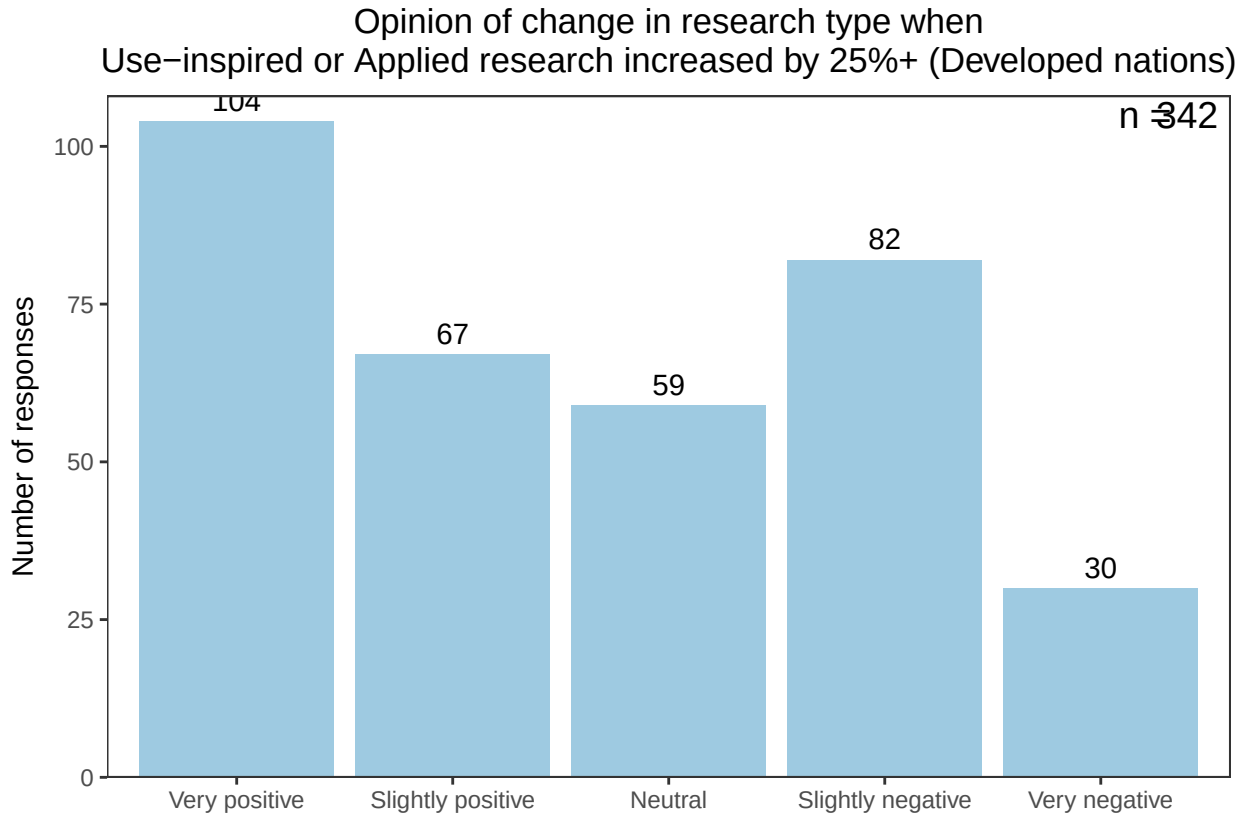
```
## Warning: Removed 1 rows containing missing values (geom_text).
```




```
#+
#  annotate('text', 5.45,21, label= sum(sum.fund.dec$Freq), size=5) +annotate('text', 5.25,21, label= "

#dev.off()
```

```
### now do it for the increase in applied and use

#now select for the ones that had 25% + increase in use or applied
#head(res.port.devp)
app.inc<- res.port.devp[((res.port.devp$curr_past.app >= 25)|(res.port.devp$curr_past.use >= 25)),]

#head(app.inc)
```

```r
#dim(app.inc)

#now read in data that has the view on change and why
#head(n.gbl.devp)
#colnames(n.gbl.devp)
app.inc.view.change <- n.gbl.devp[,c(4,12:18, 74, 77:79)]
app.inc.view.change<-app.inc.view.change[!app.inc.view.change$view_change_of_type=="",]
app.inc.view.change<-droplevels(app.inc.view.change)
#head(app.inc.view.change)

#now select for just the ones that had a decrease in fund as above

app.inc.view.change <- app.inc.view.change[app.inc.view.change$id %in% app.inc$id,]

#head(app.inc.view.change)
#dim(app.inc.view.change)
#dim(app.inc)
# one has 342 and one has 344 so some one may not have answered the why or view questions

#now follow the same code to make the figure as in the next code chunk (figure 4.5)
app.inc.view<-aggregate(gender~ view_change_of_type, app.inc.view.change, length)
#app.inc.view
# change order of the levels
app.inc.view$view_change_of_type<-factor(app.inc.view$view_change_of_type,
                                         levels(app.inc.view$view_change_of_type)[c(5,3,1,2,4)])

myColors.view<-(brewer.pal(9, "Blues"))
myColors.view<-myColors.view[c(4,4,4,4,4,4)]

#pdf(file="figures/developed/4.5.4_ViewFieldChange_increasedApp.pdf", width = 11, height= 7)

ggplot(app.inc.view, aes(x=view_change_of_type, y=gender, fill=view_change_of_type)) + geom_bar(stat='i
  theme( axis.text.x = element_text(angle=0, vjust=0.5, size=9), axis.text.y = element_text(size = 9), a
  guides(fill=FALSE)+
  theme(panel.grid.major = element_blank(),legend.text=element_text(size = 9), panel.grid.minor = eleme
  labs(x="", y="Number of responses", title="Opinion of change in research type when\nUse-inspired or Ap
  geom_text(aes(label=gender), vjust=-0.5, size=4)+
  scale_y_continuous(expand = c(0, 0), limits = c(0,108))+
  scale_fill_manual(name='view_change_of_type', values=myColors.view)+
  annotate('text', 5.4,105, label= sum(app.inc.view$gender), size=5) +
  annotate('text', 5.23, 105, label= "n = ", size=5)
```

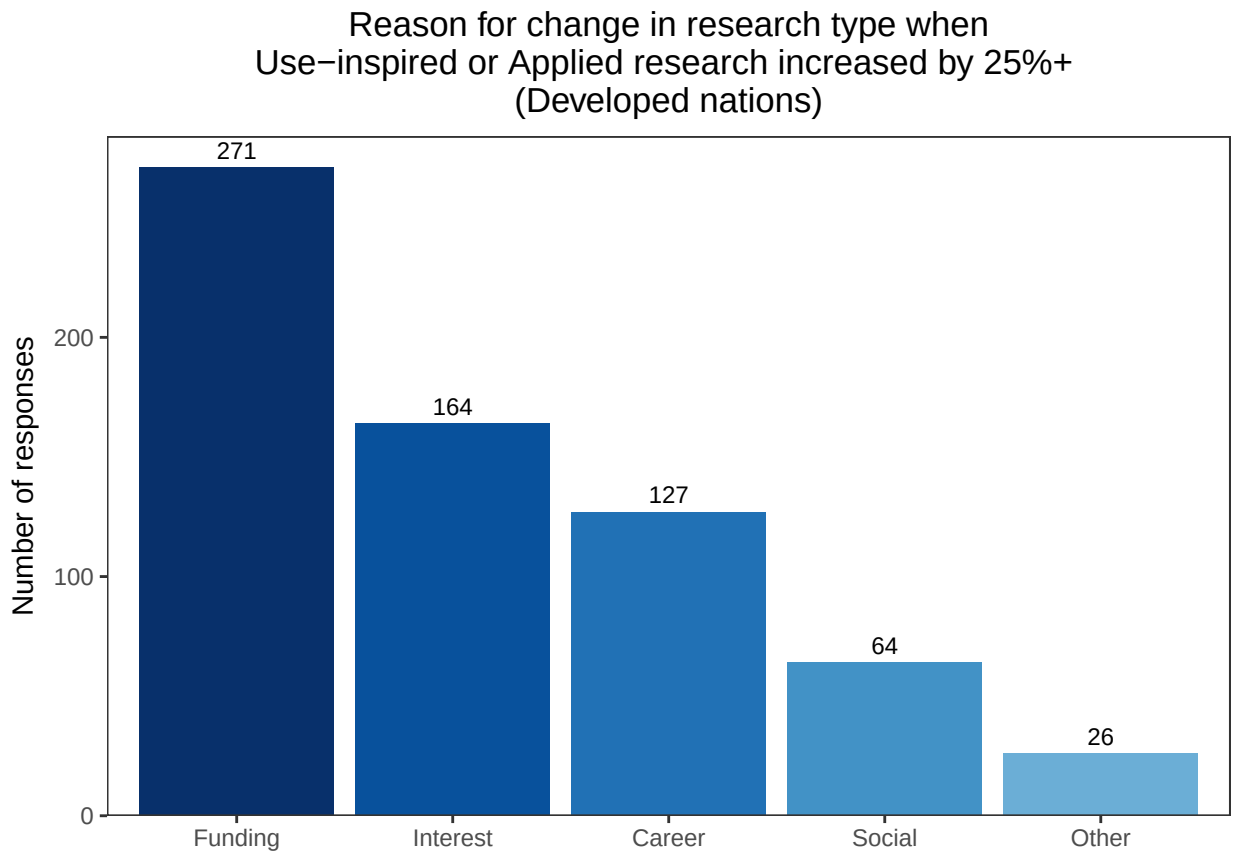



```
#dev.off()


#### now look at why they changed
####reason for change
app.inc.change<-subset(app.inc.view.change, select=c("nation", "gender", "Main_reason_change_interest_re
                                      "Main_reason_change_Career_related","Main_reason_change_Funding_

# switch to long format
require(tidyr)
app.inc.change.long<-gather(app.inc.change, reason.change.app.inc, yes, -nation, -gender)
# using table to count cases of each category
sum.app.inc<-data.frame(table(app.inc.change.long$reason.change.app.inc, app.inc.change.long$yes))
#remove non-response
sum.app.inc<-sum.app.inc[!sum.app.inc$Var1=="",]
sum.app.inc
```

```
##                                 Var1 Var2 Freq
## 1   Main_reason_change_Career_related    1  127
## 2  Main_reason_change_Funding_related    1  271
## 3 Main_reason_change_interest_related    1  164
## 4            Main_reason_change_Other    1   26
## 5 Main_reason_change_Socially_related    1   64
```

```
sum.app.inc$Var1<-revalue(sum.app.inc$Var1, c("Main_reason_change_Career_related" = "Career", "Main_reas
# change order of the levels
sum.app.inc$Var1<-factor(sum.app.inc$Var1,levels(sum.app.inc$Var1)[c(2,3,1,5,4)])
```

```
myColors.why<-(brewer.pal(9, "Blues"))
myColors.why<-myColors.why[c(9, 8,7,6,5,3)]

#pdf(file="figures/developed/4.4.4_ReasonForFieldChange_IncreasedApp.pdf", width = 11, height= 7)

ggplot(sum.app.inc, aes(x=Var1, y=Freq, fill=Var1)) + geom_bar(stat='identity')+
  theme( axis.text.x = element_text(angle=0, vjust=0.5, size=9), axis.text.y=element_text(size = 9), ax
         panel.grid.minor = element_blank(),legend.text=element_text(size = 9),axis.title.x=element_bla
  scale_fill_manual(name = "Var1",values = myColors.why)+
  labs(y="Number of responses", title="Reason for change in research type when\nUse-inspired or Applied
  scale_y_continuous(expand = c(0, 0), limits = c(0, 284))+geom_text(aes(label=Freq), vjust=-0.5, size=
```




```
#+
#  annotate('text', 5.45,21, label= sum(sum.fund.dec$Freq), size=5) +annotate('text', 5.25,21, label= "

#dev.off()
```

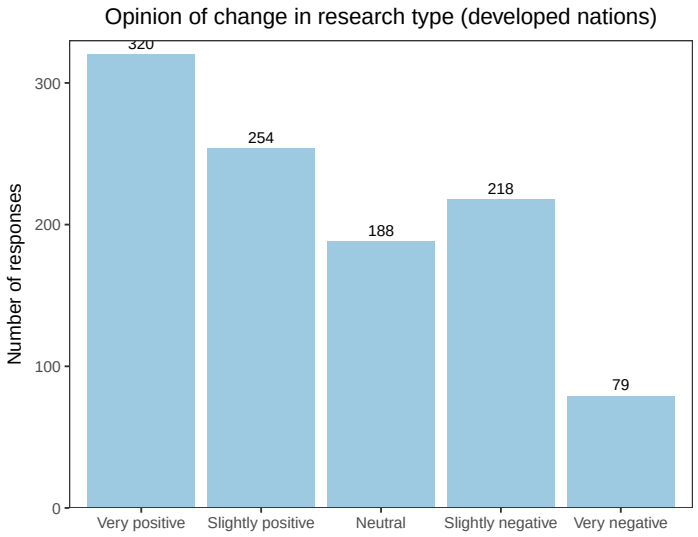



Figure 6: Figure 4.5 View of change in proportion of research. Researchers were asked how they viewed the change in the type of research they conduct/supervise.

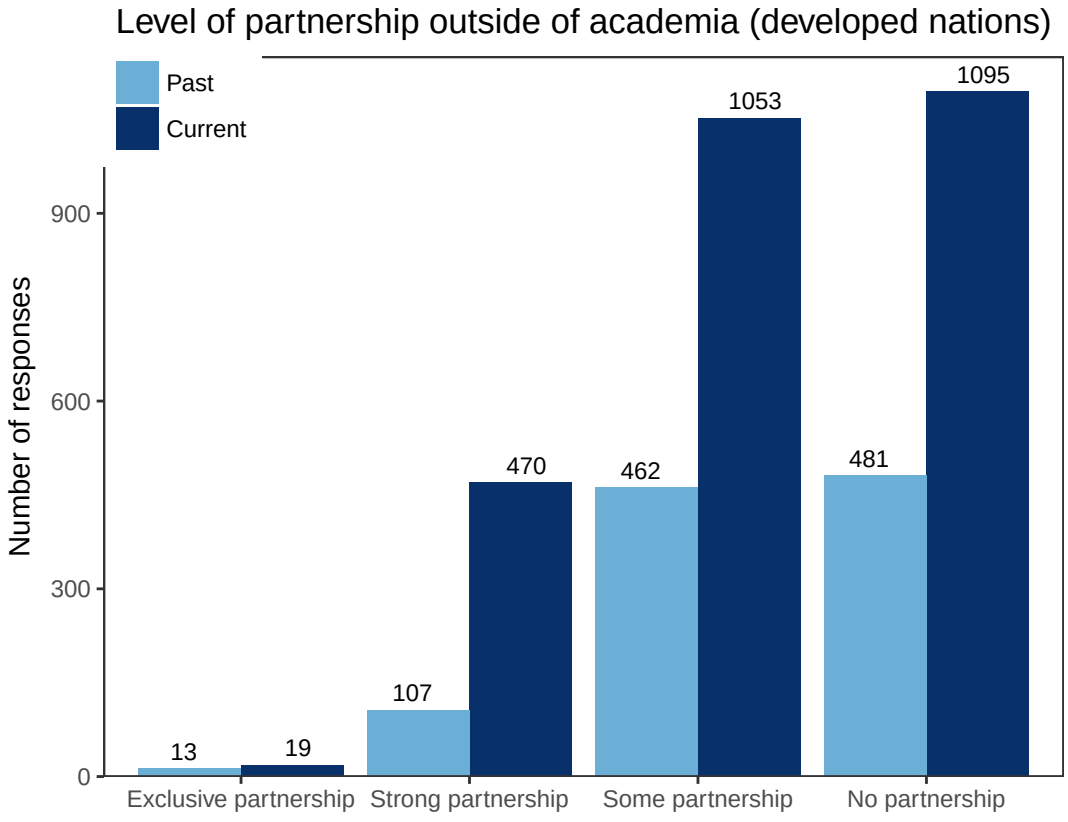



Figure 7: Figure 4.6 Current vs past level of partnership outside of academia. Researchers indicated the level of partnership that their current and past (10 years ago) research program had outside of academia).

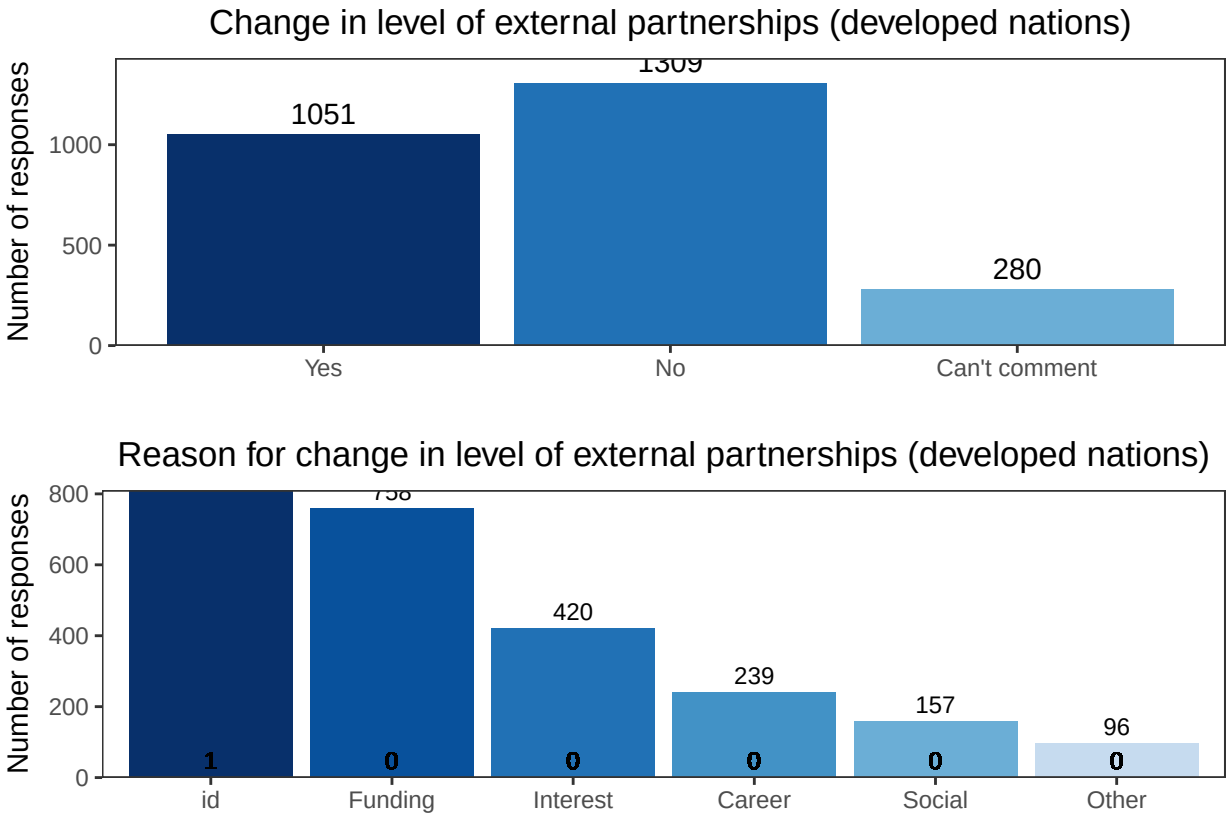



Figure 8: Figure 4.7a&b Did it change and reasons for change in level of external research partnerships over the past decade.

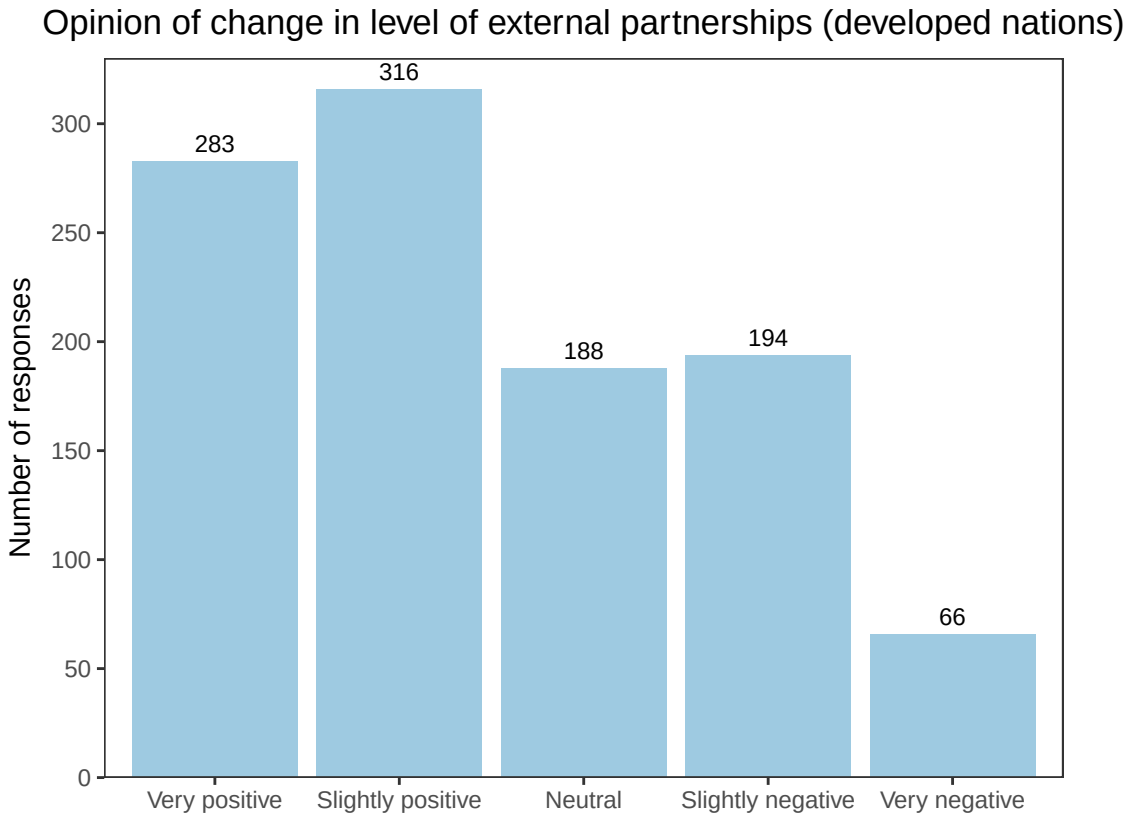



Figure 9: Figure 4.8 View of change in external partnerships. Researchers were asked how they viewed the change in the level of partnership with external groups.

Number of research grant applications (developed nations)

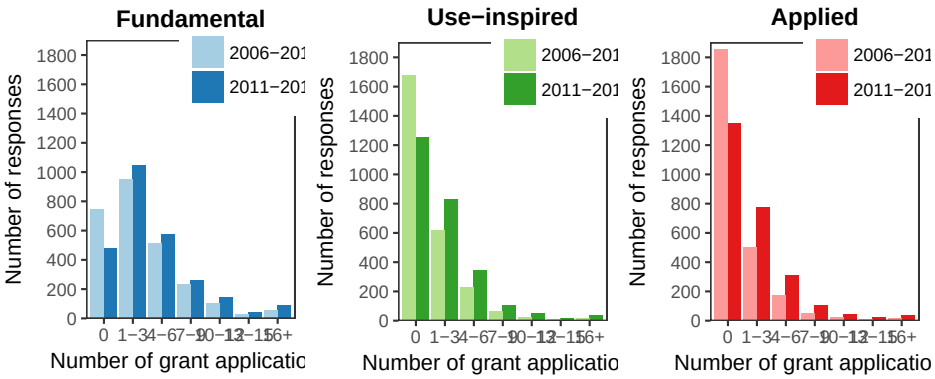



Figure 10: Fig. 4.9 Number of research grant applications by research category in 2006-2010 and 2011-2015.

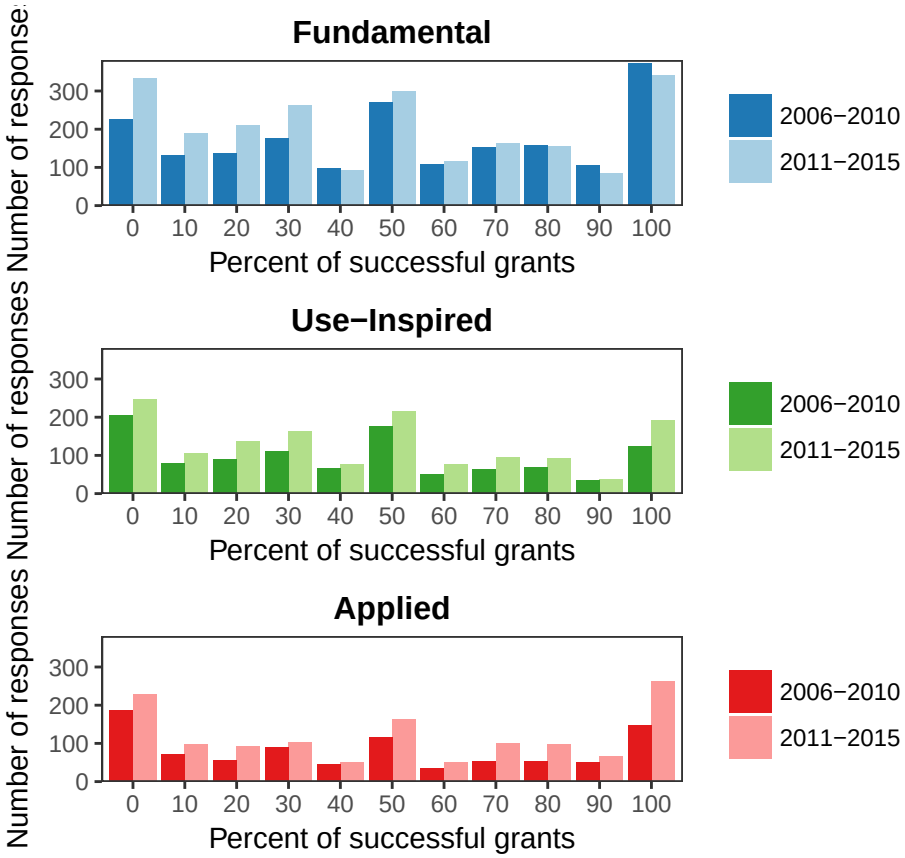



Figure 11: Fig 4.10 Research grant application success over the past 10 years. Researchers were asked to estimate the percentage of their research grant applications that were successful in 2006-2010 and in 2011-2015. Respondents also had the choice to answer No need for applications for this research type.

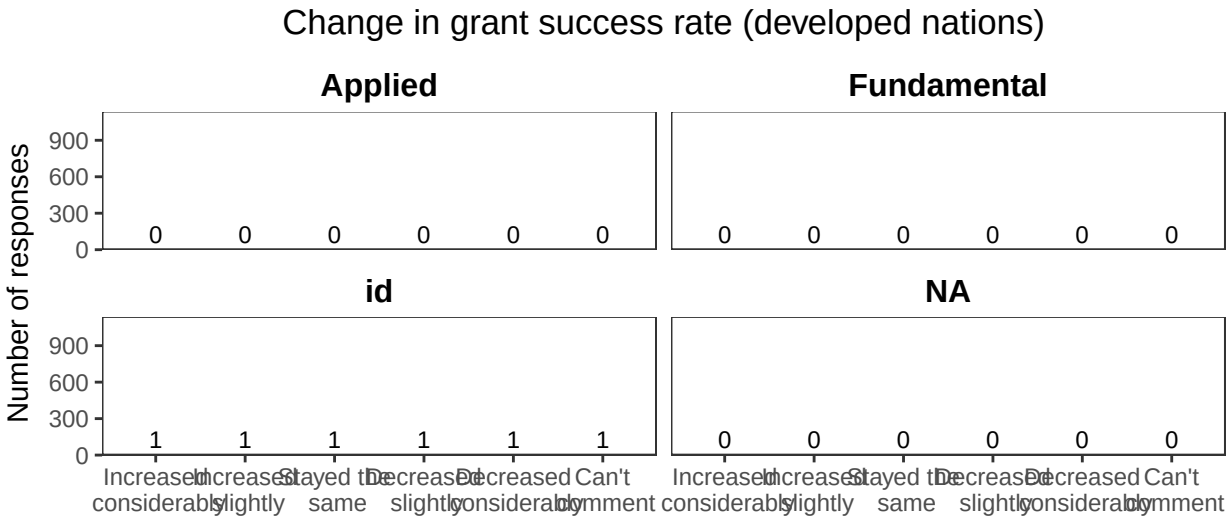



Figure 12: Fig 4.11 Change in grant success rates over the past 10 years. Researchers were asked if they thought that grant sucecss rates have changed in the past 10 years for each research category.

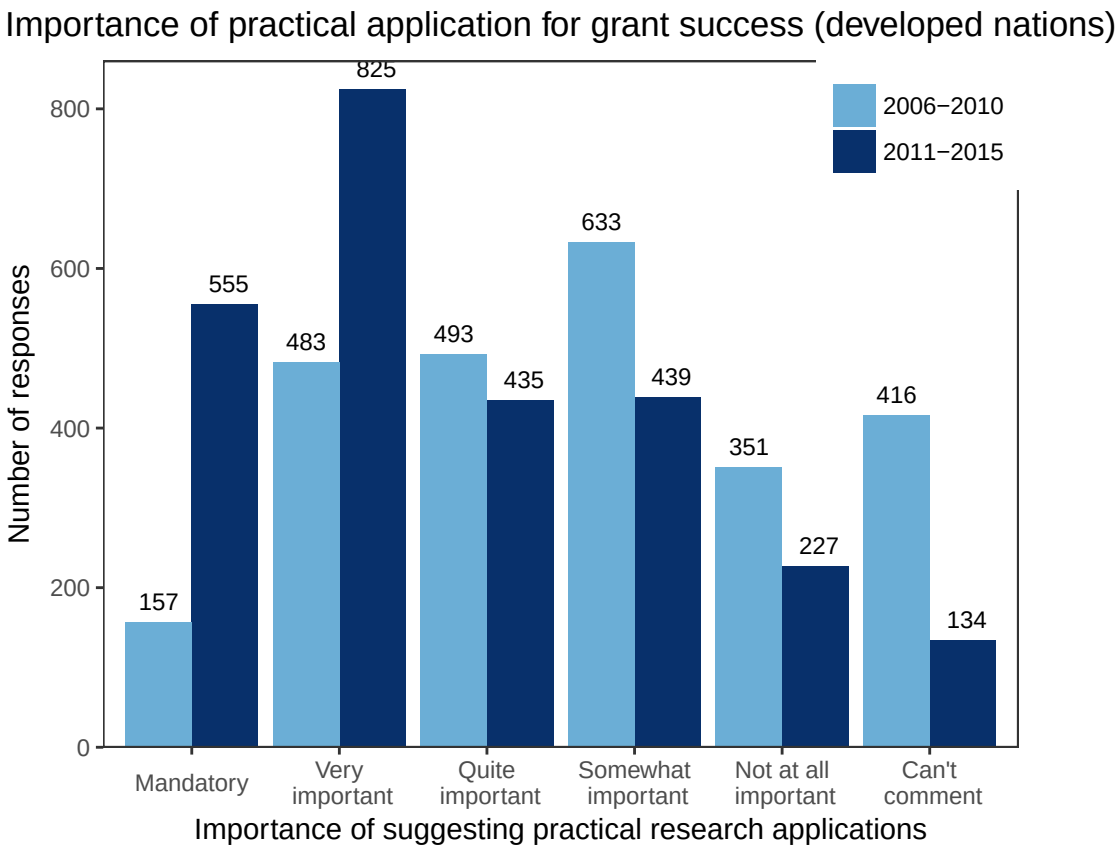



Figure 13: Fig 4.12 Importance of practical application of research over the past 10 years. Researchers were asked how important it was to suggest practical applications of their research to ensure that the grant was successful in 2006-2010 and in 2011-2015.

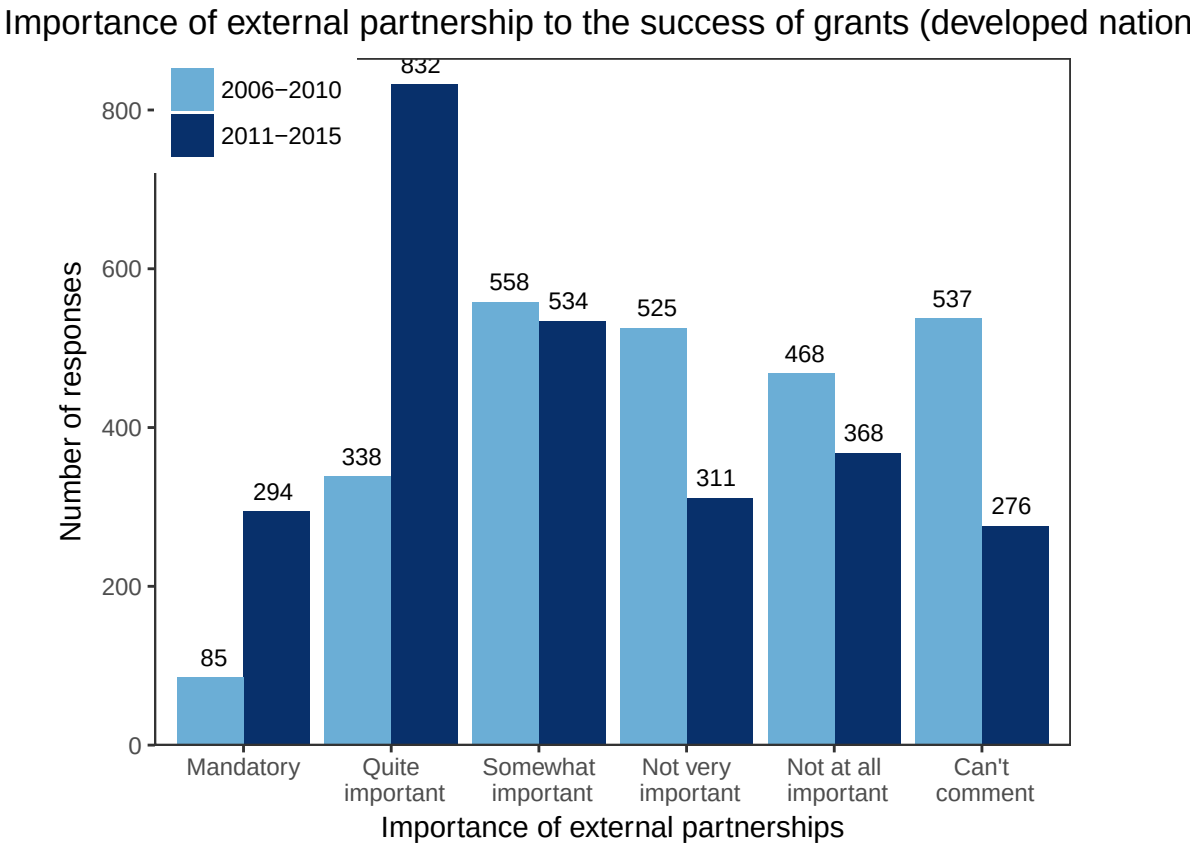
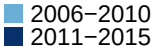
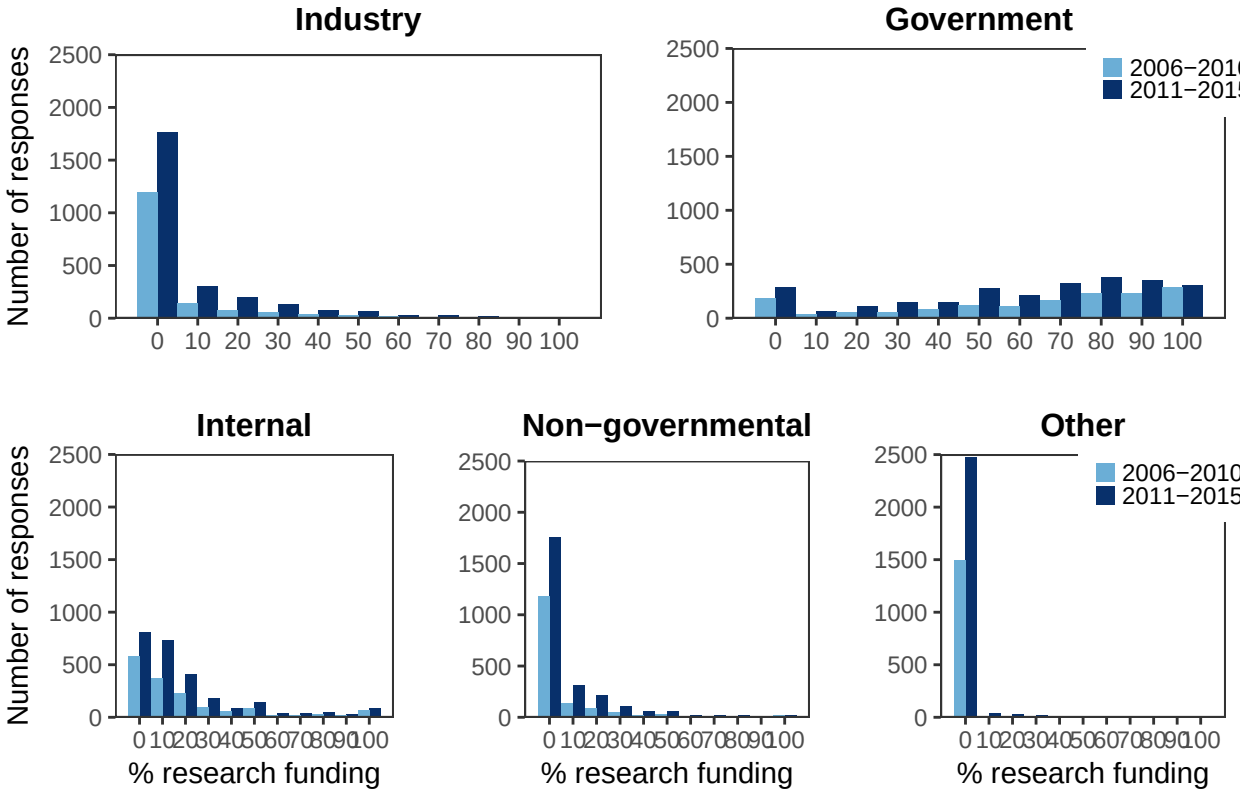



Figure 14: Fig 4.13 Importance of including partners from for-profit or non-governmental sectors in grant success. Researchers were asked how important it was to include external partnerships in their research to ensure that the grant was successful in 2006-2010 and in 2011-2015.


2006–2010
2011–2015


Distribution of research funding (developed nations)
Industry
Government
Internal
Non−governmental
Other
Number of responses
% research funding
2006−2010
2011−2015

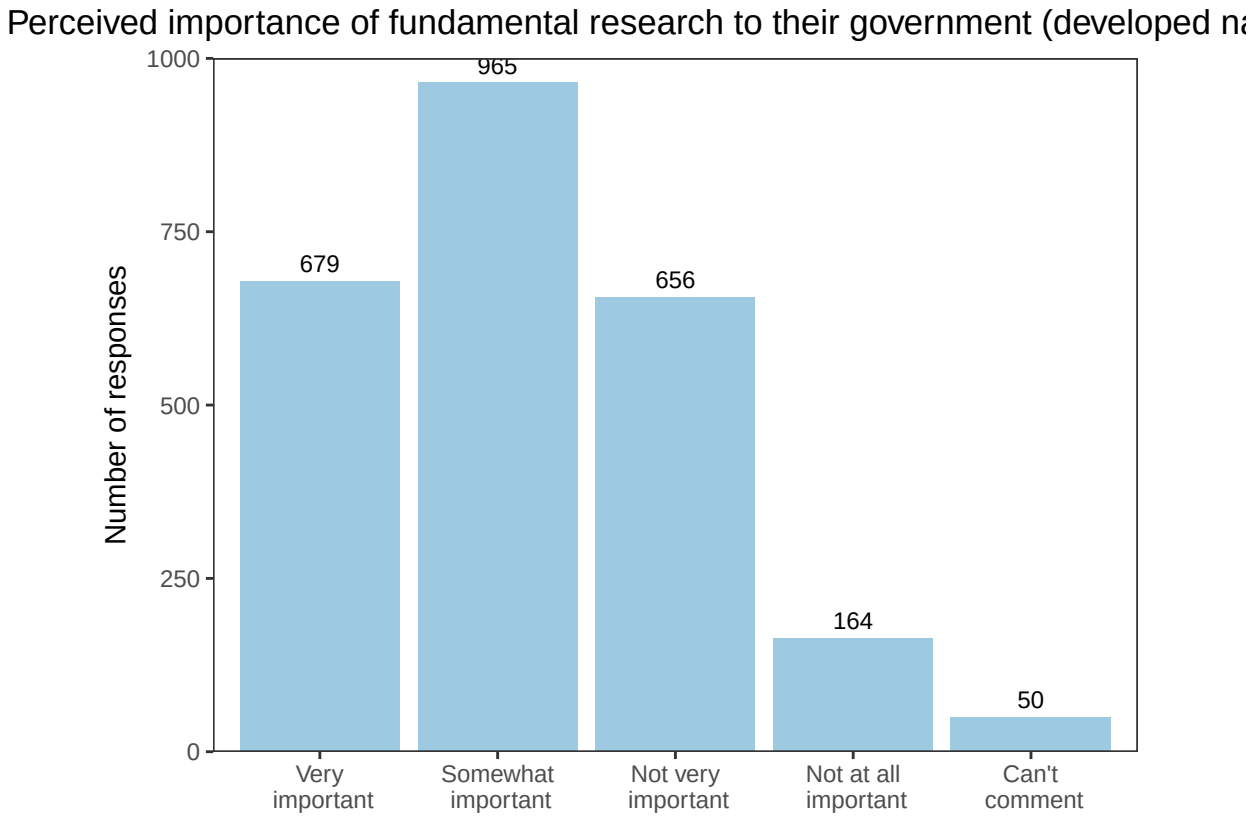



Figure 15: Fig 4.15 Perceived importance of fundamental research to their government. Researchers were asked how important they thought fundamental research was to the their government. Responses were/were not significantly different between genders.

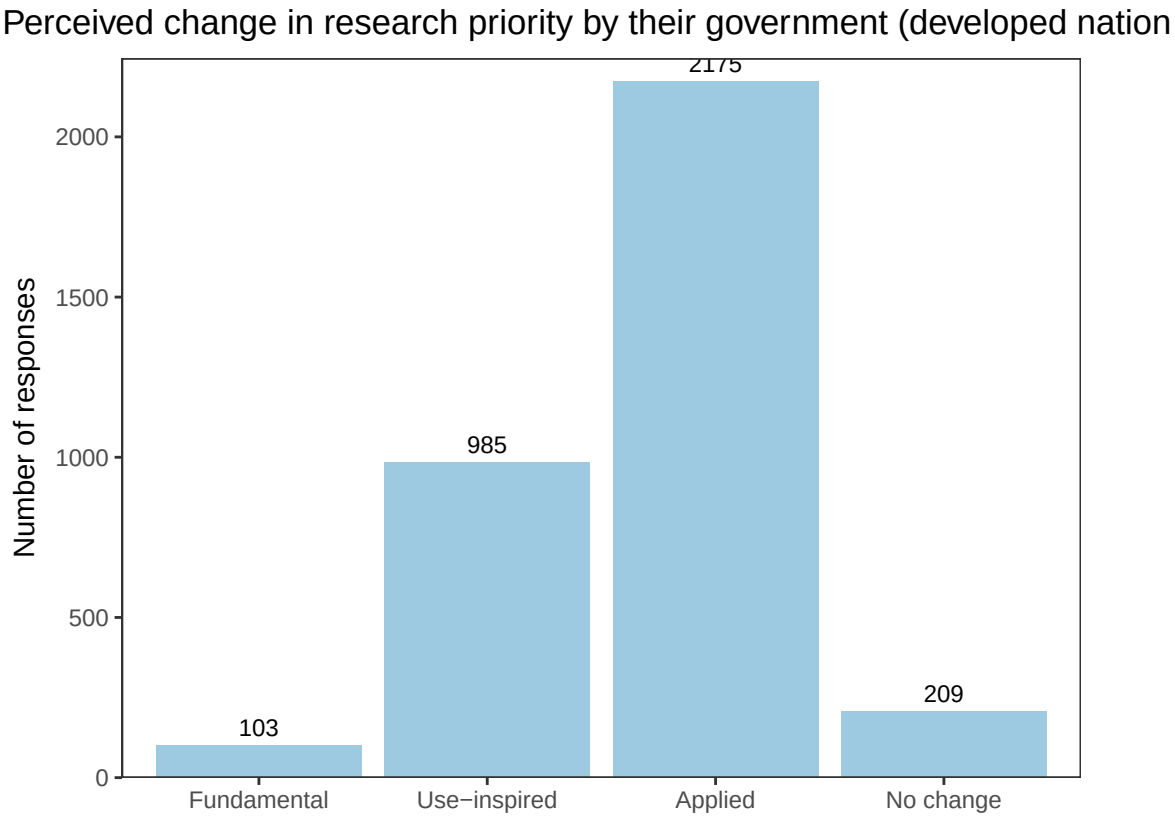



Figure 16: Fig 4.16 Perceived change in research priority by their government. Researchers were asked whether any types of research had become higher priority for the their government. Responses were/were not significantly different between genders.

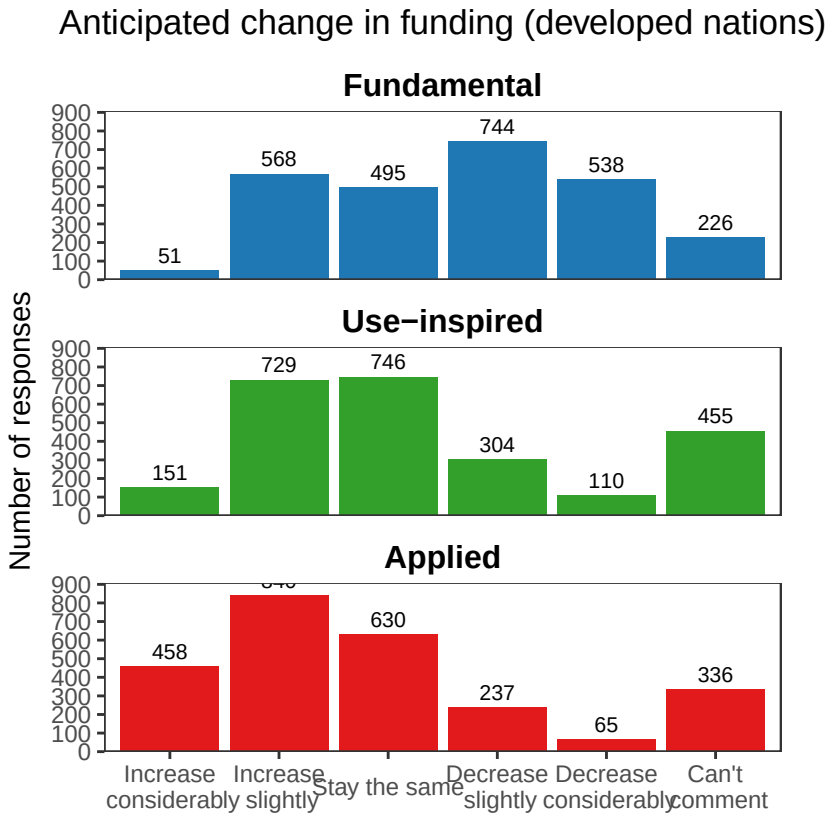



Figure 17: Fig 4.17 Anticipated change in research funding in next five years. Researchers were asked whether the availability of research funding would change in the next five years.

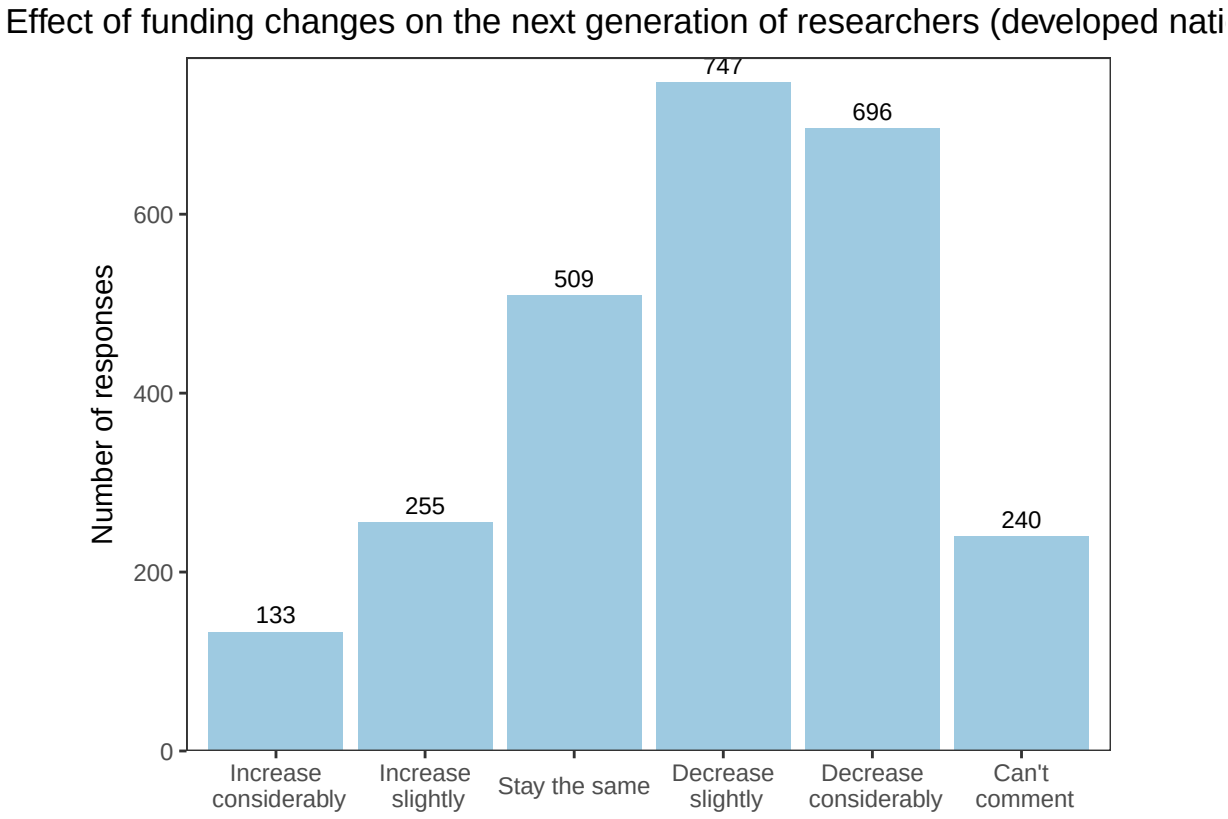



Figure 18: Fig 4.18 Effect of change in research funding on research careers of next generation. Researchers were asked if they though that changes in funding availability would influence the likelihood of the next generation pursuing careers in research. Responses were/were not significantly different between genders.