
Economics of Procrastination: The Case of EU Grants

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Abstract:

Purpose: This article concerns the study of economic effects of procrastination. The research sample consists of 6568 grant applications under EU programs in Poland, collated in order to establish whether the delay in submitting the application is a statistically significant factor affecting the quality of the application and the final financing decision.

Design/methodology/approach: The study is based on three logistic regression models in which the dichotomous explained variable was a negative or a positive decision on the application. The most important explanatory variable for the study is the percentile of time in which the application is submitted - it represents the delay of the applicant.

Findings: The result is confirmed by previous studies, which have proven that procrastination negatively affects organizations, and that the significant weight of undertaken projects can cause procrastination among leaders.

Practical implications: As the study concerns European grants, determining the impact of procrastination on financing decisions can serve to better prepare potential beneficiaries for submitting an application, providing them with knowledge on whether an earlier submission translates into the probability of the application being successful or whether the persons managing the application process should better supervise their timely submission.

Originality/value: To date, little research has been devoted to confirming the economic impact of procrastination. Previous studies mainly concern cost estimation caused by delaying employees, however, this study shows that procrastination has a real, significant impact on the economic efficiency of management activities. The methodology is innovative, because procrastination has not been previously analysed in terms of the time orientation of grant applications. Machine learning techniques have never been used in procrastination research. Moreover, the majority of research to date has focused primarily on individuals, on explaining what factors are statistically significantly related to procrastination or can lead to it through modelling, however, no research has been conducted to date in which statistical models would directly examine the economic impact of procrastination.

Keywords: Procrastination, EU grants, Poland, innovation policy.

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1. Introduction

Procrastination is a phenomenon widely studied in the field of psychology and multiple definitions have been created to explain its nature, however the definitions vary only in respect to highlighting various elements of human behaviour within the same phenomenon. Sabini and Silver (1982) proposed one of the first definitions in 1982, which focused on the irrationality of the phenomenon, where procrastination is the illogical delay of a given behaviour. Solomon and Rothblum (1984) define procrastination at work as a delay in actions combined with subjectively felt discomfort, focusing on the aspect of the feeling of nuisance related to the delayed action. Beswick and Mann (1994) offer a more general definition according to which procrastination occurs when we delay the start or end of planned activities. Steel (2007) proposed a combination of all the above-mentioned elements - postponing, discomfort, and irrationality. In his view, procrastination is a voluntary postponement of intended actions despite the expected negative consequences of delaying.

However, little research has been devoted to confirming the economic impact of procrastination. Previous studies mainly concern cost estimation caused by delaying employees, however, this study shows that procrastination has a real, significant impact on the economic efficiency of management activities. In the context of previously conducted research on procrastination, this study is somewhat innovative in at least three respects. First, the methodology is innovative, because procrastination has not been previously analysed in terms of the time orientation of grant applications. Secondly, machine learning techniques have never been used in procrastination research - this is probably due to the fact that the majority of such research is conducted within the field of psychology, where machine learning models are rarely built. Thirdly, the majority of research to date has focused primarily on individuals, on explaining what factors are statistically significantly related to procrastination or can lead to it through modelling, however, no research has been conducted to date in which statistical models would directly examine the economic impact of procrastination on organizations.

This work concerns the economic impact of procrastination. To this end, over six thousand applications for grants from two European Funds programs: Intelligent Development Operational Program (POIR – from Polish: Program Operacyjny Inteligentny Rozwój) and Regional Operational Programs (RPO – from Polish: Regionalne Programy Operacyjne) were examined in terms of submission delay of the application and how it translates into the final decision on granting the funds. The answer to this question is important for at least several reasons. The most crucial is the insight into the actual economic impact of procrastination on organizations.

As the study concerns European grants, determining the impact of procrastination on financing decisions provides extremely valuable information. It can serve to better

prepare potential beneficiaries for applying, providing them with knowledge on whether an earlier submission translates into the probability of the application being successful or whether the persons managing the application process should better supervise their timely submission.

The study can also be useful to the EU program managers. According to the regulations of grant competitions, the order of submission of grant applications should not be a decisive factor in granting the funds if the application was indeed submitted within a predetermined deadline. The study makes it possible to better determine whether this is an important factor for organizers of grant competitions, despite it not being a part of the regulations.

2. Literature Review

A key element of procrastination is that it relates to actions that have been decided and are necessary. The central research problem in procrastination studies is the explanation of the dissonance between human intention and ambition and sabotaging one's own actions. The lack of connection between good intentions and their implementation results in a gap of intentions and actions (Rozenal and Carlbring, 2014). The difference between procrastination and laziness is also important - in the latter case, a person who does not undertake a given action does not have any ambitions connected to the action and neglecting it does not necessarily cause discomfort (Modzelewski, 2018).

The extensive psychology literature presents various causes of procrastination. Halvorson (2012) sees them in the search for immediate gratification in external stimuli such as the use of modern information technologies (tablets, telephones) or spending time with friends for recreational purposes. According to Vitelli (2015) the causes lie more in personality, especially in the case of neuroticism, which is also confirmed by Wypych (2018), indicating impulsiveness and lack of self-control. Pychyl (2010), on the other hand, sees the cause of procrastination, above all, in the effect of low internal motivation.

Wright *et al.* (2004) analysing the case-study of procrastination in organizations, indicate the following as its causes:

- Postponing changes - In particular in the context of industry leaders who ignore the changing market reality;
- Over-reliance on proven solutions - The more successful a company is in a given industry, the more it relies on solutions that have generated its profit over the past years;
- High personal responsibility for a given task - If the decision to be made is either very difficult or has significant consequences, the management board of the organization can wait with it for a long time, fearing to take responsibility for it.

Bazerman *et al.* (1984) suggest that stress associated with prior failure may cause procrastination. In turn, Ferrari (2009) analysed the most common excuses and reasons for academic procrastination in the context of gender and student grades. Over 52% of respondents declared regular and frequent academic procrastination, and it prevailed among men. The most frequently reported reason for academic procrastination was fear of failure and lack of risk management techniques. No relationship was found between grade point average and procrastination. Such large estimates in the context of the number of procrastinating individuals are confirmed by research from the private sector.

According to a survey by Financial Engines (2018), a financial company, more than 68 percent of adults over the age of 55, in the US are delaying the development of a retirement plan. The cost of procrastination reaches almost half a million US dollars per person. According to a report of RateSetter, an investment company (Alois, 2015), British economy bears a loss of 76 billion pounds a year (almost one tenth of the country's public debt) due to procrastination of employees in British companies. According to surveys' results, the average person procrastinates on average 43 minutes a day, which translates into three hours and 35 minutes a week (Alois, 2015). However, this is only an estimated loss resulting from employee procrastination at work. There are no studies that would estimate the real loss suffered by the society and the economy due to, for example, delaying medical visits - if we considered this factor, we can suspect that the losses would be much greater.

Singh and Dhaliwal (2015) analysed the relationship between procrastination and management style. In their opinion, leaders feeling great responsibility for their decisions, delay decisions for fear of failure and loss of authority. In turn, Dewitte and Schouwenburg (2002) studied the impact of impulsiveness on problems with procrastination. Procrastinators are highly motivated people who lack the skills to avoid temptations and distractions during professional activities, and who have particular problems with completing projects which have already been started. Khoshouei (2017) studied procrastination among nurses. The research shows that there is a strong, positive relationship between procrastination and a sense of lack of control over one's fate - it is most visible among employees who have little autonomy at work and occupy low-level positions. They avoid important decisions and prefer to rely on their colleagues. In turn, the study of Pakistani teachers by Mohsin and Ayub (2014) concerned the relationship between procrastination, delayed gratification, job satisfaction and stress. The analysis showed that there is a significant negative relationship between procrastination and job satisfaction. Delayed gratification and procrastination have also proven to be important predictors of stress levels at work. Teachers who procrastinated less, were more satisfied with their work and less stressed.

Gupta *et al.* (2012) examined managers from large technology and financial companies in India. The study aimed to determine how time perspective perception is correlated with procrastination. Time orientation was based on the time

dimensions proposed by Zimbardo and Boyd (1999). The group most susceptible to procrastination turned out to be the people who have a present-fatalistic orientation, which confirms the aforementioned research in which the sense of lack of control was the cause of procrastination.

3. Research Methodology and Data

Procrastination is a problem that negatively affects not only individuals, but also organizations, which after all consist of individuals, and delaying action translates into actual financial losses or loss of the possibility of obtaining additional income. At the same time, the phenomenon of procrastination is not widely described in the fields of management and economics but mainly in the field of psychology. There is a visible lack of research assessing whether there is a statistically significant relationship between the financial condition of an organization and the procrastination of its employees in any given fields of functioning. Therefore, the subject of this study is the economic impact of the phenomenon of procrastination on organizations involved in applying for grants from European funds in Poland in 2015-2019. The lists of competition applications are publicly available, which facilitated the survey. Many organizations applied in the competitions - from 14 in the smallest competition to 639 in the largest. As a result, the final research sample has over 6,000 entries - this is much more than the previously cited studies, where the largest sample was the 2,000 of the UK citizens (Alois, 2015). The aim of the study is to verify whether a later submission of the application, within the agreed time frames of the competition, translates into a change in the likelihood of a positive consideration of the application.

The applications for funding competitions were collected from competition lists in three groups - containing applications from regional, national and mixed programs. The logistic regression model was used, in which a positive or negative decision regarding the financing of the proposed project was the explained variable. Procrastination is represented by the percentile of time in which a given grant application was submitted as part of the competition, resulting from the application registration number. It should be noted, however, that in many competitions up to 90% of applications are submitted on the last day of the intake.

Due to the dichotomous nature of the explained variable, a decision was reached to build logistic regression models. There are no universal measures that would compare the effectiveness of classification of different logistic regression models based on different research samples. Therefore, for this purpose, a decision was reached to use the machine learning technique of the Confusion Matrix. The Confusion Matrix will be used to assess the quality of classification of models with the explained dichotomous variable.

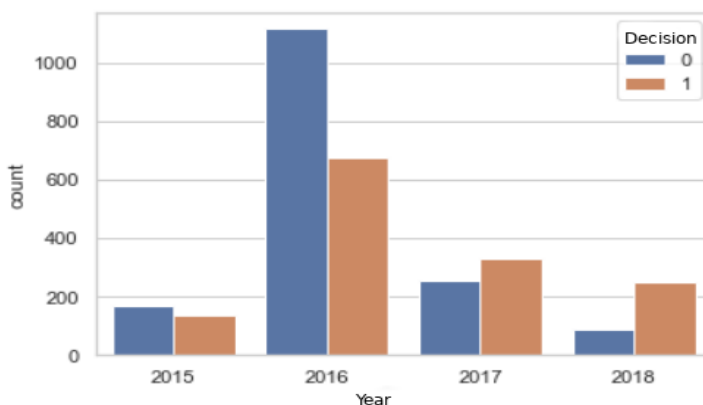
Accuracy is calculated based on the information collected in the Confusion Matrix, with the following formula:

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

The first research subpopulation were the applications submitted under the regional programs. The sample consisted of 3017 grant applications from eleven voivodships. Due to the lack of participation of all voivodships in the survey, the unequal division of applications into voivodships and concerns about too many parameters of the nominal (categorical) variable for the model, the voivodships were not taken into account as variables. Almost 60% of the applications came from competitions aimed at increasing the competitiveness of entrepreneurs from a given region. These focused mainly on supporting the small and medium-sized enterprise sector, supporting innovation, investment in R&D and the development of ICT. The rest of the applications came from many various competitions, including re-activation of the unemployed, infrastructure for social services, thermo-modernization of buildings, development of the quality of social services and environmental protection.

Figure 1 shows that the applicants in 2016 had the lowest chances for a positive decision on the application, after which the trend changed. Information on how the acceptance of applications trends change, depending on the year, was considered valuable in the context of the study. Therefore, the year in which the competition took place was selected for the study as a nominal (categorical) explanatory variable.

Figure 1. *Distribution of decisions regarding financing of applications in particular years, for the RPO program*



Source: *Own elaboration.*

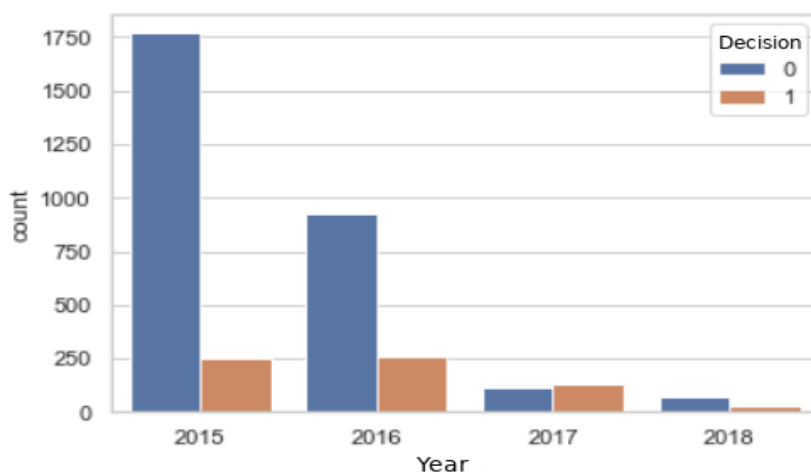
Another program used in the research is the nationwide POIR. While regional programs are in fact a dozen or so independent programs and each relates to a particular voivodship, the POIR is a nationwide and centralized initiative, although at the project implementation level there are some differences between the

individual regions, e.g. in the level of financial aid, i.e. the percentage of subsidies within the expenses being subsidized.

The research sample from the POIR program consisted of 3,555 applications for subsidies from four categories: enterprise R&D projects (Measure 1.1), sector R&D programs (Measure 1.2), R&D projects financed with the participation of capital funds (Measure 1.3), and scientific research and development projects (Measure 4.1).

Due to lack of participation of the majority of categories of activity in the study and the overwhelming number of applications belonging to one category only, it was decided not to include individual categories as nominal variables. The applications came from competitions organized in 2015 - 2018, of which more than half came from 2015, this is due to the availability of data. The chart below shows how the tendency to positively review the application changed from year to year - with the exception of 2017, there were significantly higher numbers of rejected applications in comparison with the successful ones. As in the case of RPO, in the POIR model, the year was included in the study as a categorical explanatory variable.

Figure 2. Distribution of decisions regarding financing applications in individual years for the POIR program



Source: Own elaboration.

In addition to the RPO and POIR databases, a final combined database was created that covered all competition applications from both databases. An additional explanatory variable - 'Program' - was introduced in this model, which described whether a given application came from the RPO or the POIR program.

4. Research Results

Using the R program, three logistic regression models were built, one for each of the previously built databases - 'POIR', 'RPO', and a combined database - 'POIR + RPO'. The explained variable in each of the models was the 'Decision', a dichotomous feature indicating whether a given application was successful in the course of the competition (value '1') or not (value '0').

The following Table summarizes the explanatory variables selected for each model.

Table 1. *Explanatory variables selected for each model*

	POIR Model		RPO Model	POIR+RPO Model
Explanatory variables	Percentile, Grant amount requested, Year		Percentile, Year	Percentile, Year, Program

Source: Own elaboration.

Using the `glm()` function of the R program, a logistic regression model was built for the database containing the applications from the POIR program.

Table 2. *Results for the POIR model and Coefficient Confidence Intervals*

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Deviance Residuals:
  Min       1Q   Median       3Q      Max
-1.3034  -0.6840  -0.5208  -0.4899   2.0998

Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.817e+00  1.067e-01 -17.033 < 2e-16 ***
Percentile  -2.621e-01  1.545e-01  -1.696  0.0899 .
Grant amount requested -1.595e-09  5.741e-09  -0.278  0.7811
Year2016      6.936e-01  9.747e-02   7.117  1.10e-12 ***
Year2017      2.117e+00  1.537e-01  13.776 < 2e-16 ***
Year2018      1.032e+00  2.301e-01   4.486  7.27e-06 ***
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Null deviance: 3443.7 on 3553 degrees of freedom
Residual deviance: 3221.9 on 3548 degrees of freedom
AIC: 3233.9

              2.5 %       97.5 %
(Intercept) -2.028135e+00 -1.609882e+00
Percentile  -5.653527e-01  4.054041e-02
Grant amount requested -1.310315e-08  9.417731e-09
Year2016      5.027035e-01  8.849301e-01
Year2017      1.816945e+00  2.419857e+00
Year2018      5.674250e-01  1.472492e+00
    
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Source: own elaboration.

When examining the impact of procrastination (represented by the submitted application percentile) on the positive consideration of an application, one should

assume the null hypothesis about the lack of significance of this factor's impact on the final decision, because the p-value of the 'Percentile' variable coefficient is $0.08\% > 0.05\%$. The negative value of this coefficient, however, shows that with each subsequent percentile in which the application is submitted, the logarithm of the chances for its positive consideration is reduced. Contrary to the researcher's intuition, the size of the p-value for the coefficient of the 'Applied amount' achieved the worst result in the model - over 78% - which proves that the amount of the requested grant in the POIR program does not have a statistically significant impact on the approval or rejection of the application.

In the model examining the POIR database, the 'Year' variable turned out to be the most important explanatory variable, with each category reaching a p-value well below 0.001%. This means that submitting the application in a given year translates into a positive or negative consideration of the application much more than the amount of funds requested or the deadline for submitting the application. The positive value of the coefficient indicates that with each year after 2015, the overall chance of positive consideration of the application has been increasing.

After the interpretation of the coefficient parameters, the predict() function was launched, which provided a base for the creation of the Confusion Matrix for predictions and the calculation of accuracy.

Table 3. Confusion Matrix for predictions and the accuracy of the POIR regression model

	Predicted negative	Predicted positive
Observation negative	2775	108
Observation positive	546	125
Accuracy: 0.815982		

Source: Own elaboration.

The model proved to be coping very well with the original data. The Accuracy value of > 0.8 indicates that the model classified only one in five cases incorrectly without any additional adjustment.

An analogous procedure was applied to the regional applications database. The 'Percentile' variable in the RPO logistic regression model turned out to be the most important, with Wald's p-value close to zero. The negative sign at the parameter value indicates that with each percentile in which the application is submitted, the logarithm of the chances of positive consideration of the application decreases, indicating in the case of the RPO program, a negative impact of procrastination. As in the case of POIR, the 'Year' variable also obtained a very low p-value for each category. Compared to 2015, in 2016 the logarithm of chances for positive consideration of the application decreases to increase again in the following years. Again, the predict() function was used to create the confusion matrix and to calculate the accuracy. The accuracy of the model is considered satisfactory.

Accuracy of > 0.6 means that the model is wrong in qualifying 2 out of 5 times. After the models were prepared and analysed for national and regional programs, a combined database was created, on the basis of which another model was built, containing all previously examined competition applications from 2015-2018.

For the model based on the combined database, we rejected the lack of significance hypothesis for each variable as the sizes of their p-values for the Wald test are close to zero. The negative value of the coefficient for the 'Percentile' variable indicates that with each percentile of time in which the application was submitted, the logarithm of the chances for positive consideration of the application decreases, which indicates the negative impact of procrastination. The additional 'program' variable, absent from previous models, proved to be statistically significant. The confusion matrix was also created for the combined model and the accuracy was calculated. Accuracy > 0.7 means that the model classifies incorrectly three out of ten cases. This is an acceptable value.

Table 4. *Comparison of model accuracy*

	POIR Model	RPO Model	POIR+RPO Model
Accuracy (rounded %)	82%	62%	72%

Source: Own elaboration.

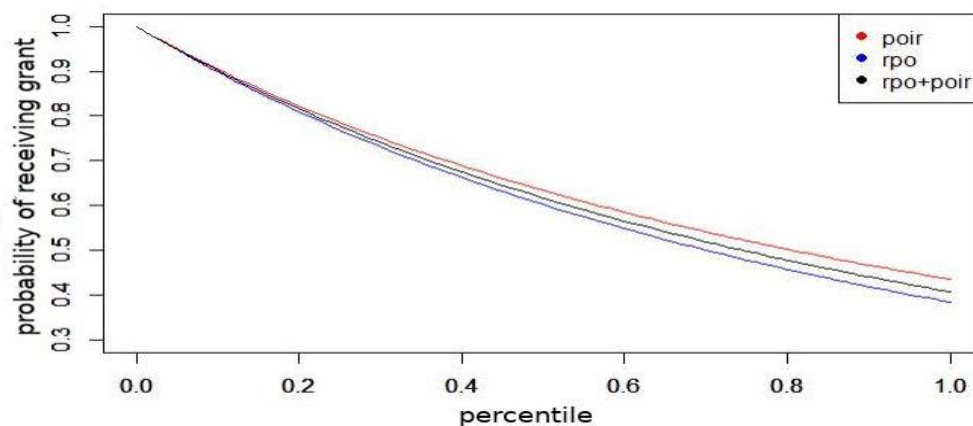
The POIR model had the highest accuracy out of the three developed models, at 82%. It is worth noting that the POIR model was based on the best-quality source data. Unlike the RPO, POIR competition lists contained all the competition applications - including those that did not receive funding. Considering this factor and high accuracy of prediction, the results obtained under this model can be considered reliable. The accuracy of the RPO model is much lower, the result is as much as 20% lower. However, it was the model with the least number of variables - only the 'Percentile' and 'Year' variables were considered. Therefore, fitting the model to data at this level should not raise too much concern about its reliability.

In the RPO and POIR models, the procrastination factor turned out to be very important and in addition - negative. For each of the models, a logit transformation was performed on the parameters of the 'Percentile' coefficient, and charts were created for the probability of receiving a grant versus the percentile of the time of the competition in which the application was submitted. These were superimposed to facilitate interpretation and compare models.

Despite the different models, with different data and variables, the charts are very similar. The more the applicant delayed submitting the application, the lower the probability of its positive consideration. The differences between the models in this respect are small - the probability of success is lower for the last submitted application in RPO and POIR by about 10%, while the mixed model is more or less in the mid-point of these values. For each model, the 'Year' variable proved to be

very important. Compared to 2015, there is a very large increase in the likelihood of positive consideration of applications in subsequent years. This is particularly important when interpreting the results of the POIR model, where the 'Grant amount requested' and the 'Percentile' variables turned out to be insignificant. It follows that the year in which the application is submitted is the factor with the greatest impact on decisions for this program.

Figure 3. Comparison of the probability of receiving a decision function to the percentile of the submitted application for the models covered by the study



Source: Own elaboration.

It has been observed that indeed, for the RPO program, there is a very strong relationship between procrastination and success of the application, i.e. receiving of funding. The assumption that if procrastination has effects then they are negative, has also been confirmed. In the case of regional programs, a very strong relationship was found between procrastination and granting of funds, despite the flaws in the source data adversely affecting this result. What's more, it was proven that procrastination has a negative impact on decisions for each of the models. The models also proved to be fairly well-suited for classification, given the very low number of variables.

5. Discussion

Ultimately, for all three models, the same procrastination tendency exists - the more the application is delayed, the less likely it will be to succeed. This is by far the most important conclusion from this study. Applicants should be careful and prepare for competitions in advance to submit their application as soon as possible after the start of the competition.

The study also confirms the previously discussed prevalence of procrastination (Ferrari 2009, Financial Engines 2018). For the second half of the percentiles in the combined RPO and POIR models, 2343 out of 3295, so over 70% of applications

were rejected, and procrastination was a statistically significant factor. In the case of RPO and POIR competitions, organizations submitting applications compete for relatively high amounts of funding. In the case of POIR competitions, where the amounts of co-financing for all competition applications are disclosed, the amounts expected by the applicants ranged from 700 thousand up to 80 million zlotys. The average amount requested in applications submitted in the second half of the percentiles is PLN 6.7 million and the sum of all the amounts requested for these applications was over PLN 9 billion. This confirms earlier reports that the price of procrastination should be measured in millions of dollars.

These are, in particular for micro and small enterprises, which were able to take part in the competitions, very large sums that could potentially change the future of the organization. Faced with the magnitude of such endeavour, organizations delayed the decision to complete and finally submit the application, satisfied with the status quo (Burt *et al.*, 2004) or, for various reasons, treated the submission of the application as a success. However, it is the decision-makers, not organizations per se, that delay the submission of applications and in the context of such magnitude of that action, the responsibility of employees and managers should be considered. The primary data used for the study did not contain information about the persons responsible for completing and submitting the application, but referring to the previously cited research, we can propose some patterns.

Taking on projects of very high importance, like the ones analysed, involves significant responsibility. Leaders who run such a project can often be transformational leaders who, as Singh and Dhaliwal (2015) have shown, have the greatest tendency to procrastinate. In this case, despite the fact that the deciding person initiating the project is highly motivated, they will eventually delay the final decision, which will translate into a lower probability of success. Earlier studies by Dewitte and Schouwenburg (2002) confirm that procrastinators are actually people with strong personal motivation, and that there is a statistically significant relationship between procrastination and the lack of ability to complete started projects, which is consistent with the image of the transformational leader.

Therefore, in order to increase the likelihood of successful completion of a high-weight project, organizations should avoid leaders and decision makers who procrastinate. A seemingly highly motivated, idealistic manager can eventually turn out to be paralyzed by the responsibility connected with the decision, especially since success in obtaining funding is only the beginning of a long process of project implementation. In turn, if the organization tried unsuccessfully for subsidies in earlier years, or in other subsidy programs, the leaders responsible for the unsuccessful projects could increase their involvement in subsequent rounds, which would explain why in later years there is a higher probability of receiving a subsidy (Bazerman *at al.*, 1984). Undoubtedly however, such situation could have been affected by both the increasing experience of applicants, who each year had more

experience in EU procedures, but also a kind of "drift" of requirements in relation to applications, caused by the fear of lack of timely use of allocated funds.

In the case of a funding project, the function of the project leader and its deliverer could be different - competition applications are a large and complicated undertaking which, especially in the first years of competitions, when the percentage of rejected applications was very high, could cause a sense of lack of control hopelessness among the project deliverers (Khoshouei, 2000). At the same time, such a task involves a lot of responsibility, so employees could procrastinate because from the outset they condemned the project to failure, in particular if they perceived the present in a fatalistic way (Gupta *et al.*, 2012). Previous research in the field of procrastination (Mohsin and Ayub, 2014) also suggests that procrastination is significantly correlated with the lack of job satisfaction - one should be warned against delegating such responsible tasks to employees who may seem unsatisfied with their position at the time, who have a fatalistic approach and are convinced of failure in the long run.

One should also beware of leaders who are too motivated and have too great ambitions - ultimately, they may not be able to bear the weight of serious decisions and the resulting changes themselves. On the other hand, from the point of view of the organizations operating grant competitions, knowledge of a decrease in quality as applications are submitted may lead to the division of grant amounts into smaller sums and the organization of competitions in subsequent rounds, while creating incentives for timely submission of applications (e.g. a larger amount allocated for the earlier competitions). However, this does not change the existing state of affairs consisting in the inevitability of procrastination mechanisms not only at the level of individuals, but also organizations.

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