Steps involved in creating R session when BlueSky Statistics is launched.

1. Get 'rhome' configuration setting value from the configuration file (BlueSky.exe.config) that can be found in (C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Config). By default, 'rhome' points to the R that comes with the BlueSky Statistics, which is in the BlueSky Statistics install directory. (We use the relative path ./R-3.6.1)

2. After getting the 'rhome' value from the configuration we verify if the path is valid or not.
-If 'rhome' is not empty or null and the path is valid, then do the following:
-- if BlueSky Statistics is a 64bit application, then set a C# variable rpath = rhome + \bin\x64. Else if 32 bit application then set C# variable rpath = rhome + \bin\i386
-- now check if R.dll exists in the rpath
-- check if rpath created above exists and R.dll also exists then set C# variables rinstallpath=rhome and rbinpath=rpath. This is now considered as 'verification passed' and set C# variable 'validInstallPath=true'. Else set C# variables rinstallpath=null and rbinpath=null which is considered as 'verification failed' and set C# variable 'validInstallPath=false'.
-- Now we have 3 C# variables validInstallPath, rinstallpath and rbinpath
Note: validInstallPath, rinstallpath and rbinpath are variables in the C# code.

3. If the validInstallPath=true we put a message in the log (in C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Log\ApplicationLog.txt), that we are using the 'rhome' setting from the configuration file. We now set 2 new C# variables rHome = rinstallpath and rPath = rbinpath for using them further in step 5 on wards. Jump to step 5.

4. If validInstallPath=false, we log a failure message in the log (in C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Log\ApplicationLog.txt) and set rinstallpath and rbinpath to null and then follow the steps below:
- We throw an exception, which is then caught to report this issue as well as handle it.
- We Show a message box with following message:
 "Please make sure:
 - rhome configuration variable is pointing to the correct version of R."

-As soon as user clicks OK button in the above message box, we show a dialog where user can enter correct value for rhome configuration variable. We have a message in this dialog about what to set as a default which is (./R-3.6.1)

Note: ./ refers to a path that is a relative path to BlueSky Statistics install directory. This path is a relative path to the R that comes with BlueSky Statistics. User can check the BlueSky Statistics install folder and can find this folder there or point to any other version of R installed on the machine. However when pointing to a ver of R that does not come with BlueSky Statistics, the BlueSky Statistics application will look for several R packages that it require which may not be installed.

-After entering the correct 'rhome' path user can click OK to save the value in the configuration file. The BlueSky Statistics application will close.

5. In step 3 we know that the 'rhome' is a valid path so now we proceed with creation of R session which has few steps as follows:

6. Set 'rHome' in RDot net StartupParameter object. Also set rPath, rHome in RDot net using the function 'SetEnvironmentVariables()'.

7. Call RDotNet's GetInstance() method to create R instance.

8. Call RDotNet's Initialize() method to initialize the R server.

9. The R session is ready. We now set the R User-personal-library. Although this is uncommon, this is the location which will be used by this R session to install all the R packages the user installs from CRAN or any other source. The User-personal-library must be a location where user has write permissions. See steps below:

a) Get all the R library paths executing .libPaths() and put them in a C# string array.

b) Check which of these library paths have write permission and put this information in the log (in C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Log\ApplicationLog.txt)

c) Get user R library configuration setting 'userRlib' from the configuration file (BlueSky.exe.config) that can be found in (C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Config)

d) If 'userRlib' is non-empty, check if this location has write permission. If yes, then hold this path in C# variable 'userRLib' for later use.

e) If 'userRlib' was empty, we need to set R user library by using steps below:

- Get R standard user library path by executing Sys.getenv('R_USER'). This should give us the path to the Windows 'Documents'. Example: C:\User\<YOURUSERNAME>\Documents. We store this in C# variable 'docpath'

- Get a part of the version of R which is running as the current R session. Use following command:

```
paste(as.character(getRversion()$major),as.character(getRversion()
$minor),sep='.')
```

This should return you something like "3.4" for R-3.4.2 OR "3.6" for R-3.6.1. We store this in C# variable 'Rver'

- Now we create another C# variable 'userlib' by joining 'docpath' and 'Rver' and a hardcode string '/R/win-library/' as shown below.

```
userlib = docpath + "/R/win-library/" + Rver
```

This should give us userlib = "C:/User/<YOURUSERNAME>/Documents/R/win-library/3.6"

f) Check if the 'userlib' created above exists. If not, try to create it. If the path is successfully created we log the message in log (in C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Log\ApplicationLog.txt). In case of failure we put a log message and do no do anything and skip following steps.

g) We now check 'userlib' for write permission. If it has write permission we set this path in another C# variable 'userRLib'. If there is no write permission we set C# variable 'userRlib' to empty.

h) If 'userRLib' is empty we put a message in logs(in C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Log\ApplicationLog.txt). We do not set any path for user library. We go to step 9.

i) If 'userRLib' is not empty then try following:
- we execute following R command to set .Library (the library path from where the R was launched) as the first path and the 'userRLib' as a user library path as the second path and if any other paths were set (this is uncommon) these paths will follow. This is done because we want the packages in our install directory to be used first followed by the packages that the user installed followed by the packages in the remaining paths.

```
.libPaths( c(.Library, userRLib, .libPaths() )
```

- Finally we put these new library paths in the log (in C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Log\ApplicationLog.txt).

10. After setting up User-personal-library in step 8 above, we need to make sure that the library path from where the R was launched(.Library) as a first library so that the R packages in this location will get preference for loading.

a) Write current library paths in the log (in C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Log\ApplicationLog.txt).

b) execute the following to set the sequence in which paths will be searched to find R packages.

```
.libPaths( c(.Library, .libPaths() )
```

which means the sequence is : 'rhome' library path (the library from the default location from where R was launched) and then the remaining library paths.

c) Write new library paths in the log (in C:\Users\<YOURUSERNAME>\AppData\Roaming\BlueSky\Log\ApplicationLog.txt).

11. Since R session has been successfully created we put following messages in the log.

```
"R DotNet initialized R server"
"R  DotNet Server (deepest function call) initialization ended."
```

12. Now we proceed with creating BlueSky Statistics Main-Window. As soon as BlueSky Statistics Main Window appears all required R packages are loaded.