

## **Examples of Qualifying R & D**

### Example 1

#### **Nature of business**

The company develops products based on solid state technology for sale, and provides test and calibration services.

#### **Details of Project**

To investigate the application of piezoelectric effect in developing miniaturised motors (“Technology”) and commercialise this “Technology” into mass-consumer products.

#### **Basis why it is a qualifying R&D project**

There is a clear R&D objective which is to gain knowledge of the “Technology”. Based on literature searches, at the date of commencement of the project, this “Technology” was not available in the market and there were no known mass consumer products that used this “Technology”. Hence the R&D objective and novelty requirements have been satisfied.

In addition, conventional motor functions based on electromagnetic principles and the development of a motor driven by piezoelectric effect is a different and novel idea.

The design and manufacture of such miniature motor is an extremely specialised domain, due to the minute dimension and miniscule motion involved. There were technical challenges that cannot be readily resolved by a competent professional in this field. Hence the project also satisfied the technical risk requirement.

The following records/reports were given to substantiate the SIE requirement:-

- 1) Sample design drawings of the miniaturised motor and sample results of simulations (results pertaining to different designs), together with analysis of the simulations
- 2) Experiments on the different prototypes to evaluate/improve its performance, practical deficiencies encountered in the experiments and how the problems were resolved
- 3) An R&D plan with well-defined time line
- 4) Substantive work to integrate the unique engineering design of the “Technology”.

## Example 2

### **Nature of business**

The principal activities of the Company are those relating to designing, manufacturing, assembling, trading and servicing of ventilating products.

### **Details of project**

To develop a fan impeller that will improve the fan ventilation efficiency beyond and above the company's and industry's current product capability, by 10%.

### **Basis why it is a qualifying R&D project**

The project has specified a clear technical objective to study the correlation between fan impeller profile/design and its efficiency.

At the commencement of the project, there was no immediate knowledge on how to directly improve the performance of ventilation fans. The efficiency of ventilation fans is dependent on a complex interaction of various factors such as profile of the impeller (e.g. curvature, length, thickness), impeller housing design, etc.

In addition, there were other non-deterministic and undesirable outcomes such as system resonance, turbulence arising from air flow within the ventilation fan which created unwanted noise and vibration hence decreasing the performance of ventilation fans.

Company carried out experiments to evaluate how the following factors affect the fan performance and its efficiency:-

- 1) different number of fan blades
- 2) different design of the fan blades
- 3) fan blades of different width and height
- 4) varying blade width to wheel diameter ratio

To achieve the targeted fan efficiency, studies on each of the factors were carried out to find out which would give the optimum performance. Various prototypes of the fan blades were constructed with different combinations and configuration (permutations of the above factors) and mounted onto industrial scale motors to evaluate their performance. Results were then tabulated graphically for analysis and used to further fine-tune the profile or configuration of the fan to optimise its performance and to minimise the non-deterministic and undesirable outcomes.

The following records/reports were provided:

- 1) Sample design of the prototype fan impellers
- 2) Experiments performed on the different prototypes together with corresponding results/outcomes
- 3) Analysis and evaluation of the results of the experiments to further improve the outcomes.

The project met the R&D deduction conditions as it had a clearly-stated R&D objective, demonstrated technical risk, together with supporting SIE records.

### Example 3

#### **Nature of business**

Company's principal activities are that of design, manufacture, distribution, research and development of computers, computer peripherals and accessories.

#### **Details of Project**

The objective of the project is to design the thinnest gaming laptop, with a new and unique cooling system, that is able to run the latest range of games at high performance settings.

#### **Basis why it is a qualifying R&D project**

There is a clear R&D objective which is to produce a new product. Based on literature searches at the date of commencement of the project, a thin and light gaming laptop less than a certain weight and able to run the latest range of games at high performance speed is not available in the market. Hence the R&D objective and novelty requirements have been satisfied.

The following studies/records were submitted to substantiate the "SIE" requirement:

- 1) Various experiments were conducted in the placement of the thermal in different layout on the main board. The objective was to test the optimal speed of the fan and its relationship with the heat generated by different components in the laptop. Prototypes were created for the different iterations.
- 2) The prototypes created failed the tests causing the company to relook into the design. Using the results from all the tests conducted, company redesigned the placement of all the components of the laptop. Tests were then done on the new design to anticipate the heat generated and its relationship with heat dissipation so that the fan speed can be increased to the required level. The different resolution per minute of the fan speed was also tested to ensure that there was no trade-off as increasing fan speed will generate more heat. The heat wave spread within the main board and the heat dissipation via airflow due to the interactions among the various components was studied, tested and redesigned to ensure that heat concentration is avoided.

#### Example 4

##### **Nature of business**

The company's business is that of software consultancy as well as development of software.

##### **Details of project**

To create an open globally robust cloud-enabled video analytic platform that provides common exchange repository.

##### **Basis why it is a qualifying R&D project**

There is a clear R&D objective which is to produce an improved product as the existing platform does not allow the usage of video analytic on a large scale basis. Hence the objective requirement has been satisfied.

One of the technical risks stated by the company is how to create a benchmarking tool that will assist the users in determining the accuracy and system performance. Company has provided the overall system architecture diagram and the description and the functions of the various modules. There were evidences to show the complexity, challenges and uncertainty in combing the detection techniques of Histograms of Oriented Gradients (HOG) and Local Binary Pattern (LBP) and the use of Deep Learning for classification. These are technical challenges that cannot be readily resolved by competent professionals in the relevant fields. Hence the technical risk requirement has been met.

Samples of testing reports on the accuracy and speed of the project were submitted. The documents showed a planned and orderly approach of the steps taken, the activities undertaken to explore the problems encountered and the iterative steps taken to test the potential solutions to resolve the problems indicated in the various studies. The SIE requirement was met.