

## IMPORTANCE OF R&D AND PROJECT MANAGEMENT LESSON IN VOCATIONAL SCHOOLS AND ITS CONTRIBUTION TO INDIVIDUAL INNOVATION: "NATIONAL INNOVATIVE CYCLE MODEL"

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**Cite As** | Yüksel, A. (2021). "Importance Of R&D And Project Management Lesson In Vocational Schools And Its Contribution To Individual Innovation: "National Innovative Cycle Model", International Academic Social Resources Journal, (e-ISSN: 2636-7637), Vol:6, Issue:30, pp:1407-1413

### ABSTRACT

The way to innovate is through research and development studies. The role of innovation in education is related to raising a young workforce with knowledge-based analysis and decision-making skills. Innovation and innovative literacy ability; wondering; questioning his curiosity; it will thrive with the younger generation who are keen to produce and create something new. The purpose of this article is to explain the content of the "R&D and Project Management" lesson and to reveal its contribution to innovative individuals in line with its importance in Vocational Schools. The research method adopted for this study is the descriptive analysis method that analyzes the content of the "R&D and Project Management" lesson included in the school common lesson in Hereke Ö.İ.U Vocational School in 2019-2020. The data consists of activities carried out over 16 weeks and their contribution to innovation and innovative individual. At the end of the research, a model proposal was made based on the data.

**Keywords:** Innovation, R&D and Project Management, Vocational Schools, Education

### 1. INTRODUCTION

It is known that unemployment rates are increasing rapidly around the world. In this context, the value and priority given to the education of vocational colleges is gradually increasing. These schools; due to the fact that they train trained intermediate staff, they carry a large workload in the countries. Therefore, vocational colleges are centers where the human resources needed by the industrial sector are provided.

Innovation, which is the main pillar of R&D, usually occurs as a result of the change in customer needs and the emergence of new needs. While this need for innovation is related to the new product- service and production method on the one hand, it also activates the raw material supply, logistics, marketing and other business functions.

The lack of an innovation culture in businesses is due to the difficulties experienced in finding qualified workforce. In addition, negative features such as insufficiently developed collaborations with universities and other actors, not commercializing the output obtained as a result of innovation activities, and insufficient knowledge on intellectual property rights affect their innovation. On the other hand, it is possible to increase innovation capability with business skills.

The formation of an innovation culture ensures that innovation capability is increased. University-industry cooperation is very important in increasing this ability. The need for university-industry association is inevitable in the impasse where universities cannot convert knowledge into production and industry cannot take production beyond the standard.

Collaboration between academia and industry is promoted by governments as a way to increase national competitiveness and wealth creation (Barnes, et al., 2002).

The concept of handwork in personnel management, brought to the management by Taylor, has turned into knowledge work in human resources management today. "The productivity of the knowledge worker" has just begun (Drucker, 1999).

It is inevitable to train qualified people, to transfer the existing and potential opportunities of universities to the industry, to ensure that the opportunities of the industrial sector are evaluated by universities, to create synergy between the university and the industry, and to ensure the necessary progress in science and technology through these means.

Education is defined by UNESCO as "organized and continuous communication designed to enable learning". Learning successfully completed at a certain level provides a formal qualification (OECD, 1992).

In terms of the professional workforce, the primary focus is on skilled production workers, especially tradesmen and technicians. It has been found that these professions and vocational training system have a

unique role and make an important contribution to innovation both in production and in Research and Development. Especially in project-based teaching concepts, social skills, such as interpersonal skills, development of critical thinking, self-management and communication with others can be learned.

Members with a high level of education and self-esteem increase the effectiveness of R&D project teams (Kessler and Chakrabarti 1996). Creativity is also recognized as a key factor for the production of competitive advantages and a skill that can be developed through education (Tsai, *et al.*, 2018). Damanpour (1991); argues that the diversity of skills and experience allows for different units where collaborative relationships can emerge and add significant value to innovation outcomes.

Vocational schools are an important resource that trains qualified intermediate manpower required by the industry. Vocational schools train intermediate manpower with the title of technician and professional staff. The role of vocational high schools, which train intermediate staff, which undertakes an important mission in development policies, is undisputed in training innovative individuals. Teaching policies that train the necessary human resources; science and technology should be innovative, productive and transform this into social benefit.

This article focuses on the importance of education required for innovation in vocational colleges and explains the necessity of the R&D and project Management lesson aimed at this.

The study methodology focuses on qualitative concepts. The first stage consists of the literature review, the second stage is the definition of the lesson, content analysis, evaluation outcomes and weekly monitoring plan, and the third stage consists of recommendations.

## **2. R&D, PROJECT MANAGEMENT AND EDUCATION**

Engaging in research and development is a long-term work that requires attention and patience. The researcher tries to reach the result with an intuitive approach while acting in a logical sequence from the facts that are self-fixed in nature or determined by people. It is this intuitive feature of the researcher that is not expected from everyone.

The ability to innovate is about the integration or synergy of certain skills to deliver performance. However, talent cannot be evaluated directly. MacPherson (1997) innovation; defines as a result of commercialization after a period of successful design, development and completion or proper improvement of a product

High-tech industries are characterized by rapid change, intense competition, and an extremely uncertain environment (Amabile, 1997). R&D is not easy. Innovation requires skill and knowledge.

R&D and information technologies studies, which are completely an investment for the future, will gain meaning and value with the increase in researcher human resources to support it. The education system in all its ranks from primary education to higher education should be restructured. It is now inevitable for the direction of investments to focus on innovation management.

In general, the factors that create the need for university-industry relations and cooperation can be counted as economic development, technological development, R&D, industrialization, technology transfer, productivity, manpower and manpower planning, orientation to the profession, development plans and higher education (Ensari, 1989). According to Freeman (1995); The R&D system, established by universities conducting basic research and large-scale public research laboratories conducting applied research, was seen as the source of innovation.

The basic basis of the project resource in R&D project management is mainly human. They are the main structures for creating intellectual beings. Human capital, which is one of the inputs of intellectual capital, is not as visible as traditional resources and cannot be accurately valued and measured (Freeman, 1995; Liebowitz and Megbolugbe, 2003).

The top priority of human capital in R&D organizations is the attraction and retention of talent to support product or service growth (Kochanski *et al.*, 2003) because creativity is the source of innovation and is integrated with talent (Huang and Lin, 2006).

In the "Frascati Handbook", the Organization for Economic Co-operation and Development distinguishes the following categories of research activity (R&D, research and experimental development): basic research; applied research; and experimental development. While basic research represents the primary competence of university research, business R&D focuses heavily on experimental development (OECD, 1994)

Pavitt *et al.* (1989); It links the successful implementation of innovation to three factors: effective horizontal links (both internally and externally), the characteristics of the "business innovator" responsible for the outcome of the innovation, and flexibility and speed in decision making. The role of Universities in this complex structure is the external links in these networks. The creation of technology is the result of knowledge. Collaboration with research institutes often gives small and medium-sized businesses innovative ideas and serves as a good resource for new technologies (MacPherson, 1997).

The results obtained by students in R&D projects enable them to reach their goals. R&D projects provide a new and motivating dimension in higher education (Luoju *et al.* 2015).

In this context, linking university basic and applied research with the market through technology transfer and commercialization mechanisms, including state-university-industry partnerships and venture capital investments, constitutes the necessary trigger mechanism and driving tool for sustainable competitive advantage and prosperity.

### 3. METHOD

The research method adopted for this study is the descriptive analysis method that analyzes the content of the "R&D and Project Management" lesson included in the school common lesson in Hereke Ö.İ.U Vocational School in 2020-2021. The data consists of activities carried out over 16 weeks and their contribution to innovation and innovative individual. The analysis consists of two structures. The first structure analyzes the content of the lesson. The second structure consists of suggestions.

The sample of the study consists of 165 students who have chosen the R&D and Project Management lesson within the scope of the school common lesson at Hereke Ö.İ.U Vocational School in 2020-2021. The data were collected by interview technique. The semi-structured interview form developed by the researcher was used as the information gathering tool in the study. The interviews consist of the situation assessment form created by the researcher within the scope of the lesson, and the feedback and lesson details from the interviewers.

### 4. FINDINGS AND DESCRIPTIVE ANALYSIS

Table 1. Semester Lesson Plan

Week	Subjects
1	Introduction and definitions of R&D and Innovation
2	R & D and Innovation in the World and Turkey
3	Creativity and Individual Innovation Concept
4	Creative Thinking Techniques (Swot, Brainstorming, Benchmarking etc.)
5-6	Creating Innovative Ideas (Theory and Practice)
7	Project Concept, Definitions
8	Project Management and Processes
9	R&D, Innovation and Project Management Relationship
10	R&D Supports (Tubitak, KOSGEB, TTTGV, Development Agencies, European Union etc.)
11	Sample Projects and Implementation (writing project ideas)
12-13	Sample Projects and Implementation (transforming ideas into projects)
14-15	Project Termination and Overview
16	Lesson Evaluation

#### 4.1. The Aim of lesson

The aim of the "R&D and Project Management" lesson; Understanding of basic concepts in R&D, innovation, creativity, new product development and innovation process management and gaining the skills to prepare and follow up sufficient application documents. The content of this lesson includes the concept of innovation and R&D, developing project management competence and gaining skills to benefit from financial support.

#### 4.2. Lesson Scope

Following the theoretical information given in the lesson, the known techniques are taught for the competencies such as observation, questioning, analyzing, and comparing necessary for students to reach the researcher self. Brainstorming, Swot Analysis, 5N1K, Benchmarking techniques have been the most beneficial techniques.

Table 2. Lesson Outcomes

Week	Practise	Evaluation
1	Theory	Attendance
2	Theory	Attendance
3	Theory	Attendance
4	Theory	Attendance
5-6	Theory	Attendance
7	Receiving innovative ideas	Exam
8	Theory	Attendance
9	Guest Speaker / Seminar	Attendance
10	Theory	Attendance
11	Theory	Attendance
12-13	Guest Speaker / Seminar	Attendance
14-15	Best project selection and presentation	Attendance
16	Lesson completion and comments	Exam
Total		

Table 3. ECTS Workload

Activities	Number	Duration (hours)	Total Workload / hour
Homework	1	2	2,00
Project	1	6	6,00
Final	1	2	2,00
Class Participation	8	2	16,00
Application / Practical	4	2	8,00
Field Study	2	3	6,00
Integration	1	2	3,00
ECTS value			3

In this context, an attempt is made to create a researcher's eye for students. The difference was found to be positive. In the following weeks, students are asked to gain an innovative idea of their profession. Some tactics are given in writing skill. In the following weeks, Project Management is explained and the writing stages of a project are taught. After the 3-week project writing classes, students are asked to turn their existing ideas into projects. Project management skills are gained with the students who form the idea and the idea is transformed into a project and business plan. Because of the large number of students, they are allowed to write their projects practically by dividing them into groups of four.

Analysis of the relationships between different variables provides evidence of the conditions that affect the transfer of project management training to specific behaviors (Bartezzaghi, et al., 2011)

At the end of the term, at least 20 project outputs are reached in this context. It is seen that students who are timid at the beginning of the lesson and have difficulties even at the point of generating ideas, develop as a result of research and development techniques.

At the end of this lesson, the student;

- ✓ Defines the project idea and analyzes it with a suitable tool (eg SWOT analysis, problem tree, needs analysis etc.).
- ✓ Designs main work packages and provides work / time / man planning (PERT, Gantt etc.) for them,
- ✓ It creates the general budget and distributes the resources according to the targets and outputs,
- ✓ Fills the project application form and predicts the management of the project
- ✓ Defines the sustainability of the project and plans its risk management
- ✓ Defines the project output

The activities mentioned above are also included in practice lessons, depending on the students' preferences and workshop goals. In this case, the time limitation is more because the trainings are intense and short-cycle. Groups are provided with on-site assistance and guidance

The potential project that will emerge from project ideas motivates them to concentrate in the workshop and to be highly interactive (Divjak and Kukec, 2008).

It is seen that the weakness in activities and conversations at the beginning of the semester turn into action and strong words at the end of the lesson.

## 5. CONCLUSION AND RECOMMENDATIONS

This article consists of three stages. In the first stage, literary information on the Innovation-R&D and education spiral was presented and the concepts of the article were understood. In the second stage, the content of the "R&D and Project Management" elective lesson in Kocaeli University, which is the aim of the article, was analyzed and its contributions were tried to be revealed. In the last stage, a national model was proposed by taking the importance of the lesson.

The module of this lesson provides a solution to comprehensively teach theory and practice to a large number of students. Nowadays, R&D and project management can be found in every sector. Therefore, this lesson should be taken by all students. The combination of lecture, seminar and project work is welcomed by the students. Although the project idea and writing work requires a lot of effort for students, it also offers the most learning impact and provides concrete skills.

Countries should implement the factors that will make their dynamic young population productive and productive. The education system should be structured in terms of creativity and research in all its ranks from primary education to higher education. Growing generations begin to realize that new information and perspectives enrich and individualize their lives, and grasp the issue of innovation, only through the philosophy of sustainable lifelong education whose foundations are well established. In this context, suggestions can be listed as follows;

- ✓ R&D and Project Management lesson should be added to university elective lesson programs.
- ✓ Students should be interested in R&D and project management.
- ✓ Encouraging awards and programs should be developed
- ✓ By collaborating with institutions such as TÜBİTAK, KOSGEB and EU, it should be ensured that innovation, R&D and project culture is spread.
- ✓ It should be ensured that ideas are commercialized in cooperation with the industry.
- ✓ The following model, which was previously developed by the author, can be re-proposed for the innovative education model.
- ✓ Ensuring that students taking the R&D and Project Management lesson become honorary members of the "Innovation Thinking Center". This center management should consist of people from the Government, Universities and the sector. Its management should be chosen every 3 years. The member whose project is continuing can remain. This center should organize innovative idea markets, project competitions, trainings and cooperation networks. An "Innovation Week" should be appointed on certain dates, once a year, and the "Innovation Thinking Center" in this model cycle should organize this week.

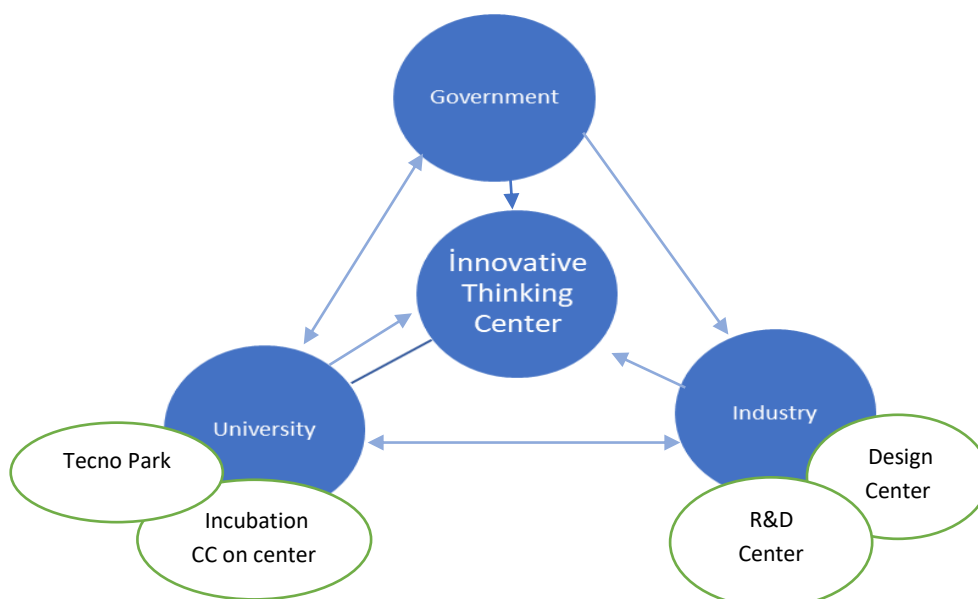


Figure 1. National Innovative Thinking Cycle Model

Networking connects different forms of knowledge production and use of knowledge and also connects different sectors or systems of society (subnational, national, international). Universities and industries offer completely different cultures and mentalities (Barnes et al., 2006). Cooperation is required for them to act together (Carayannis, and Campbell, 2011).

It should take place through the integration of learning and R&D activities and cooperation in an international partner network. For students, these joint networks are a natural channel for networking. On the other hand, R&D projects benefit from using students' multidisciplinary competencies to enrich their R&D activities (Luoju et al. 2015).

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