Management and resources in the research project: Carbon dioxide (CO_2) laser with applications in industrial engineering

Girdu Constantin

Abstarct: The paper presents the key elements of a scientific research project: goal, strategic targets, project implementation methodology, Gantt chart, results, statistics on the use of CO_2 laser in technological processing and manufacture of metal products (tables, bars) from OT, Al , With. The research includes the design and development of a plan of activities, the calculation of the involvement by activities for the scientific coordinator and the doctoral student (normative), the calculation of the involvement of each human resource with total / man / month. The budget of the research project is completed with the budget title for human resource expenses, logistics, mobility expenses, overhead costs is filled in. The project model stimulates scientific research and innovation, provides skills and competencies for obtaining research grants in industrial engineering.

Keywords: strategic targets, project implementation, CO_2 laser.

I. INTRODUCTION

The project has a set of sequential, logical activities that perform 3-4 strategic targets in a given timeframe, with a predefined / defined budget.

Richard Newton defined the important elements of the project: scale, quality, time-duration, cost, acceptable risk level, which are interdependent with each other. These five sequences represent the life cycle of the project [4], [6].

The task of a management is to have very good results through the actions of others. Peter Drucker, genius in management, believes that the role of a manager is to organize resources, set goals, motivate the team, develop people, monitor results, and take corrective action.

Douglas Mc Gregor has contributed to the management thinking with two ideas that the leaders have on subordinates: Theory X: People are commanded and controlled, Theory Y: does not control employees, gives autonomy to employees [4].

The Pareto principle shows that there are few important things, and insignificant things are numerous. Geoff Round's analysis shows that in order to get the entire mission, the leadership about our action has to be informed.

Girdu Constantin is a professor of physics at the high school in Tg. Jiu and PhD student at Transylvania University of Brasov, Romania. E-mail: girdu2003@yahoo.com

Nicolo Machiavelli advises "not to waste the chances of a crisis" [5]. Wendy Kopp of the USA, one of America's best leaders, has reformed education through the Teach for America organization, using the crisis as a moment for success [3]. Lonnie Pacelli shows that there are many major project pitfalls, but also how to avoid them, as well as making progress in reporting progress on the proposed activity plan [2]. All these results support successful project management.

The latest research programs promoted by NASA are: contacting aliens, discovering extraterrestrial intelligence, finding new planets with the Kepler telescope. Information packets for reception and detection are transmitted. The laser beam is used in alien communications. Recently a signal was transmitted at a distance of 6 light-years for research.

It would be interesting to read stellar jellyfish, alien bacteria discovered by astrophysicist Carl Sagan, SEAL troops, pulsars, Lorimen impulse, Dolphin Order, Franck Drake theory, Duncan's research, Tabby's Star, alien megastrusts with the Manchester telescope, and the energy to find the source, the alien quest ?, etc. (DIGI WORLD). For our model used in the technique we will use CO_2 laser, fiber laser, cutting, drilling, laser welding.

II. MODELING OF A SCIENTIFIC RESEARCH PROJECT

To solve this problem the next steps must be made:

a) Title of the project: Management and resources in the research project: Carbon dioxide (CO_2) laser with applications in industrial engineering.

b) Project goal: To increase the performance of the carbon dioxide (CO_2) laser device by developing technologies for the processing of metallic materials due to the properties and applications of laser radiation in the field of industrial engineering.

c) Strategic objectives / objectives of the project:

O1: Development of laser technology for the processing of metallic materials by means of the carbon dioxide (CO_2) laser device;

O2: Improving the reliability of the parts due to the remarkable properties of the CO_2 laser;

O3: Promoting the results of the CO_2 laser in the field of industrial engineering;

O4: Ensuring quality management within the project.

d) Implementation methodology:

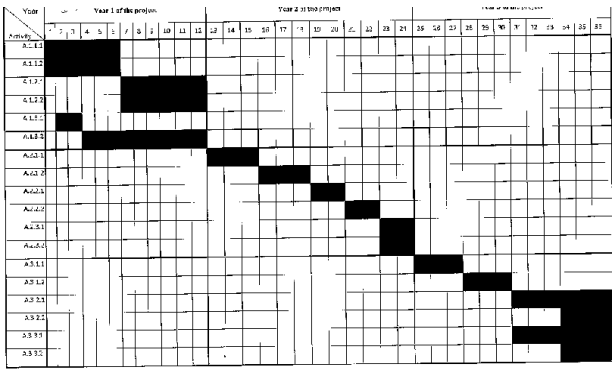
Duration	Objective	Activities	Results
Year 1 of the project	O.1.1 Theoretical basis of CO_2 laser	A 1.1.1 CO_2 laser: description and operation..	R 1.1.1 Literature, Bibliographic List, Fundamental Theory of Lasers
		A 1.1.2 Technology of materials processing using CO_2 laser.	R 1.1.2 CO_2 laser in the processing of metallic materials
			R 1.1.3 Database of research in the field
	O 1.2 The properties of laser radiation;.	A 1.2.1 Radiometry and photometry	R 1.2.1 Sizes and units of measurement in the optical
		A 1.2.2 Laser beam engineering	R 1.2.2 Laser section control
	O 1.3 Plan to promote the project in the first year;.	A.1.3.1 Project Web Page	R.1.3.1 Website of the project
		A.1.3.2 Publication of scientific papers at different conferences.	R.1.3.2 Obtain feedback.
Year 2 of the projet	O.2.1 Processing and finishing of materials due to the remarkable properties of the CO_2 laser;	A.2.1.1 Methods and techniques of machining parts.	R.2.1.1 Welding Laser, Laser Drilling, Laser Cutting
		A.2.1.2 Study of finished materials using laser technology..	R.2.1.2 Defectoscopy of surfaces studied with holograms or X-ray radiation, al.
	O.2.1 Project Promotion Plan in Year II;.	A.2.3.1 WEB Update.	R.2.3.1 Page www. updated
		A.2.3.2 Publication of scientific articles	R.2.3.2 Obtaining feedback, Comments. Ensuring the transfer.
Year 3 of the project	O.3.1.Results obtained from experiments with CO_2 laser in the field of industrial engineering;.	A.3.3.1 Checking the parts obtained	R3.1.1Măsuratori. Research Statistics with CO_2 Laser.
		A3.1.2 Their use in different industrial processes	R3.1.2 Impact study due to CO_2 laser technology.
	O.3.2 Project Promotion Plan in Year III;	A.3.2.1 Updating the site.	R.3.2.1 Updated site
		A.3.2.2 Publication of scientific papers.	R.3.2.2 Obtain feedback- Comments. Ensuring transfer.
	O.3.3 Project Management; .	A.3.3.1 Analyzing and comparing the results obtained	R.3.3.1 Achieving the purpose and objectives of the project
		A.3.3.2 Completion of the project	R.3.3.2 Completed project - documentation and archiving.

e) Activity Plan

Duration	Objective	Activities	Results	Time
Year 1 of the project	O.1.1 Theoretical basis of CO_2 laser	A 1.1.1 CO_2 laser: description and operation..	R 1.1.1 Literature, Bibliographic List, Fundamental Theory of Lasers	L1-L6
	O.1.1	A 1.1.2 Technology of materials processing using CO_2 laser.	R 1.1.2 CO_2 laser in the processing of metallic materials	L1-L6
	O.1.2		R 1.1.3 Database of research in the field	
	O 1.2 The properties of laser radiation;	A 1.2.1 Radiometry and photometry	R 1.2.1 Sizes and units of measurement in the optical	L7-L12
		A 1.2.2 Laser beam engineering	R 1.2.2 Laser section control	L7-L12
	O 1.3 Plan to promote the project in the first year;.	A.1.3.1 Project Web Page	R.1.3.1 Web site of the project	L2-L3
		A.1.3.2 Publication of scientific papers at different conferences.	R.1.3.2 Obtain feedback.	L4-L12
Year 2 of the project	O.2.1 Processing and finishing of materials due to the remarkable properties of the CO_2 laser;	A.2.1.1 Methods and techniques of machining parts.	R.2.1.1 Welding Laser, Laser Drilling, Laser Cutting	L13-L15
		A.2.1.2 Study of finished materials using laser technology..	R.2.1.2 Defectoscopy of surfaces studied with holograms or	L16-L18

			X-ray radiation, al.	
	O.2.1 Project Management;	A.2.2.1 Study of works, specialized articles	R.2.2.1 Information needed to continue the project	L19-L20
		A.2.2.2 Drawing up the project.	R.2.2.2 Project in initial form.	L21-L22
	O.2.1 Project Promotion Plan in Year II;.	A.2.3.1 WEB Update.	R.2.3.1 Page www. updated	L23-L24
		A.2.3.2 Publication of scientific articles	R.2.3.2 Obtaining feedback, Comments. Ensuring the transfer.	L23-L24
Year 3 of the project	O.3.1.Results obtained from experiments with CO_2 laser in the field of industrial engineering;	A.3.3.1 Checking the parts obtained	R3.1.1Măsuratori. Research Statistics with CO_2 Laser.	L25-L27
		A3.1.2 Their use in different industrial processes	R3.1.2 Impact study due to CO_2 laser technology.	L28-L30
	O.3.2 Project Promotion Plan in Year III;	A.3.2.1 Updating the site.	R.3.2.1 Updated site	L31-L36
		A.3.2.2 Publication of scientific papers.	R.3.2.2 Obtain feedback-Comments. Ensuring transfer.	L34-L36
	O.3.3 Project Management; .	A.3.3.1 Analyzing and comparing the results obtained	R.3.3.1 Achieving the purpose and objectives of the project	L31-L36
		A.3.3.2 Completion of the project	R.3.3.2 Completed project - documentation and archiving.	L34-L36

f) Gantt Chart: Project Chart



g) Planning human resources

Involvement of human resources by activity [6]

	Involvement by activities; involvement in the entire duration of the activity		
	Ph. D. candidate	Ph. D. supervisor	Total
Activity 1.1.1 (6 monts)	1.2 (0,2x6)	0.6 (0,1x6)	1.8
Activity 1.1.2 (6 months)	1.2 (0,2x6)	0.6 (0,1x6)	1.8
Activity 1.2.1 (6 months)	1.2 (0,2x6)	0.6 (0,1x6)	1.8
Activity 1.2.2 (6 months)	1.2 (0,2x6)	0.6 (0,1x6)	1.8
Activity 1.3.1 (2 months)	0.4 (0,2x2)	0.2 (0,1x2)	0.6
Activity 1.3.2 (9 months)	1.8 (0,2x9)	0.9 (0,1x9)	2.7
Activity 2.1.1 (3 months)	0,3 (0,1x3)	0,3 (0,1x3)	0,6
Activity 2.1.2 (3 months)	0,3 (0,1x3)	0,3 (0,1x3)	0,6
Activity 2.2.1 (2 months)	0,2 (0,1x2)	0,2 (0,1x2)	0,4
Activity 2.2.2 (2 months)	0,2 (0,1x2)	0,2 (0,1x2)	0,4
Activity 2.3.1 (2 months)	0,2 (0,1x2)	0,2 (0,1x2)	0,4
Activity 2.3.2 (2 months)	0,2 (0,1x2)	0,2 (0,1x2)	0,4
Activity 3.1.1 (3 months)	0,6 (0,2x3)	0,3 (0,1x3)	0,9
Activity 3.1.2 (3 months)	0,6 (0,2x3)	0,3 (0,1x3)	0,9
Activity 3.2.1 (6 months)	0,6 (0,1x6)	0,6 (0,1x6)	1,2
Activity 3.2.2 (3 months)	0,3 (0,1x3)	0,3 (0,1x3)	0,6
Activity 3.3.1 (6 months)	0,6 (0,1x6)	0,6 (0,1x6)	1,2
Activity 3.3.2 (3 months)	0,3 (0,1x3)	0,3 (0,1x3)	0,6

h) Calculation of individual involvement [6]

	Individual involvement	
	Ph. D. candidate	PhD supervisor
Month 1	0,4	0,2
Month 2	0,6	0,3
Month 3	0,6	0,3
Month 4	0,6	0,3
Month 5	0,6	0,3
Month 6	0,6	0,3
Month 7	0,6	0,3
Month 8	0,6	0,3
Month 9	0,6	0,3
Month 10	0,6	0,3
Month 11	0,6	0,3
Month 12	0,6	0,3
An 1	**7,0**	**3,5**
Month 13	0,1	0,1
Month 14	0,1	0,1
Month 15	0,1	0,1
Month 16	0,1	0,1
Month 17	0,1	0,1

Month 18	0,1	0,1
Month 19	0,1	0,1
Month 20	0,1	0,1
Month 21	0,1	0,1
Month 22	0,1	0,1
Month 23	0,2	0,2
Month 24	0,2	0,2
An 2	**1,4**	**1,4**
Month 25	0,2	0,1
Month 26	0,2	0,1
Month 27	0,2	0,1
Month 28	0,2	0,1
Month 29	0,2	0,1
Month 30	0,2	0,1
Month 31	0,2	0,2
Month 32	0,2	0,2
Month 33	0,2	0,2
Month 34	0,4	0,4
Month 35	0,4	0,4
Month 36	0,4	0,4
An 3	**3,0**	**2,4**
Total months / member	**11,4**	**7,3**
Monthly salary / member	50 Lei/h (8850 Lei/month) According to. Guide	108 lei/h (19116 lei/month) According to Guide
Total expenses / member	**100.890 lei**	**139.546,8lei**

i) The Financial Plan [6]

	Budget chapter (lei)				
	Labor	**Logistics**	**Traveling**	**Costs. Indirect (administration)**	**Total (without administration)**
Activity 1.1.1	22089,6	0	0	24058.11	22089.60
Activity 1.1.2	22089,6	36000	0		58089.60
Activity 1.2.1	22089,6	6000	0		28089.60
Activity 1.2.2	22089,6	22096.85	0		44186.45
Activity 1.3.1	7363,2	0	0		7363.20
Activity 1.3.2	33134,4	0	18260.57		51394.97
Activity 2.1.1	8389.80			24058.11	8389.80
Activity 2.1.2	8389.80				8389.80
Activity 2.2.1	5593,2	6000			11593.20
Activity 2.2.2	5593,2				5593,20
Activity 2.3.1	5593,2				5593,20
Activity 2.3.2	5593,2	22096.85	15000		42690.05
Activity 3.1.1	11044,8			24058.11	11044,8
Activity 3.1.2	11044,8				11044,8
Activity 3.2.1	16779,6				16779,6
Activity 3.2.2	8389.80				8389.80
Activity 3.3.1	16779,6	6000			22779.60
Activity 3.3.2	8389.80	22096.85	15000		45486.65
Total	**234843.60**	**120290.55**	**48260.57**	**72174.34**	**408987.92**

Budget heading	**Year 1**	**Year 2**	**Year 3**	**Total**
1.Staff costs	128.856	39152.40	72428.40	240436.80
2. Logistics (materials, consumables, conference fees, etc)	64096.87	28096.85	28096.85	120290.57
3. Traveling	18260.57	15000	15000	48260.57
4.Indirect costs	~ 24058.11	~24058.11	~24058.11	72174.34
Total budget				481162.28

III. CONCLUSIONS

1. CO_2 laser research ensures improved light energy efficiency with technological changes in the behavior of metallic materials.
2. The results of the research stimulate innovation and technological transfer to the economic circuit to ensure improved products, the project corresponds to the present.
3. The development of research provides for the improvement of technological processes and scientific innovation in the use of CO_2 in the defense, automotive, aeronautical industries.

REFERENCES

[1] Hammer, W., - *Occupational Safety Management and Engineering*, 4thed. Englewwod Clifts, N.J.: Prentice-Hall, 1989.
[2] Woodson, W.E., - *Human Factors Design Handbook*, 2d ed. New York: McGraw-Hill, 1992.
[3] Thorpe, J. F., and W.H. Middendorf, - *What every engineer should know about product liability*. New York: Marcel Dekker, 1979.
[4] Roland, H. E., and B. Moriarty, - *System Safety engineering and management.* 2d ed. New York: Wiley-Interscience, 1990.
[5] Pulat, B. M., - *Fundamentals of Industrial Ergonomics*. Englewood Cliffs, New Jersey: Prentice-Hall, 1992.
[6] Lehto, M. R., and J. M. Miller, - *Warnings: Fundamentals, Design, and Evaluation Methodologies.* Ann Arbor, Mich.: Fuller Publications, 1986.
[7] Lonnie Pacelli - *Project Manager Advisor*, Meteor Press Publishing, 2007.
[8] James Mc Grath, - *The most important 76 questions and answers from management*, Niculescu Publishing House, 2016.
[9] Richard Newton, - *Step by Step Project Management*, Meteor Press Publishing, 2008.
[10] Anca Duță, - *Management of Scientific Research Projects*, Doctoral School, UTBv, 2016.
[11] Clark, T. S., and E. N. Corlett, - *The Ergonomics of Workspaces and Machines: A design Manual.* London: Taylor and Francis, 1984.