How to Succeed in Getting an MSCA Individual Fellowship?

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Background

- BS in Physics, TR, 2002
- MS in Computational Science and Eng., TR, 2005
- PhD in Optics and Photonics, USA, 2010
- R&D Scientist in Industry, USA, 2011-2015

MSCA Experience:

- 2015-IF-ENG: Fail *pre-TR application (shoot and see)*
- 2016-IF-ENG: Reserve list -> Main list
- 2017-IF-RI: Main list

My Project

- NOVEL: Nanoscale Vertical Cavity Surface Emitting Laser and its arrays
- Panel: ENG -Information Science and Engineering
- Duration: 24 Months
- Type of Action: MSCA-IF-EF-ST

NOVEL

- A: Nanoscale lasers are new
- B: Vertical Cavity Surface Emitting Laser (VCSEL) is old
  - Established technology to make the smallest size lasers
  - But only micron sizes are possible
  - Smaller is better
- A+B: novel and it promises unique and important features
- I proposed a method to make A+B possible
- It is based on my previous experience
  - My CV/background indicates that I can do this research (show it)
- The host is a right place to do this work
  - i.e. infrastructure, two-way transfer of knowledge, supervisor..

Pre-application

- What is expected from a proposal? :
- New, overlooked or interdisciplinary problem/method that is important
- Can use but not an extension of your PhD work
- Ambitious goals (but not too many)
- Impact on:
  - Your career
  - EU
  - Science, technology and public

Support

- Bilkent TTO office
  - Non-technical revision
  - Feedback on consulting companies
  - Attended two panels on MSCA
- TÜBİTAK
  - Project pre-evaluation support (company or individual)
  - H2020 Focused Group Training – MSCA, İzmir
- Consulting
  - Many iterations for revising/polishing (~1 month)
  - Be persistent. Ask anything.

Individual Fellowships (IF)
Call: H2020-MSCA-IF-EF-RI-2017

PART B

"NOVEL"

"NanOscale Vertical cavity surface Emitting Laser and its arrays"

- Excellence: 7 pages
- Impact: 1 page
- Implementation: 2 pages

1. Excellence - Research

- Detailed project description
- Review the state-of-the-art
  - Up to date
  - Appropriate references (make sure to include some EU researchers)
  - Compare: Status in the world vs. EU, industry and university
  - What are the inabilities of the state-of-the-art
- Convince that the project is original, innovative, and presents a new direction in the field
- Objectives should target significant advancements
  - Clearly defined quantitative targets
  - Quantify the expected advance with respect to current and competing technologies
- Research methodology should be
  - Sound and elaborated in detail
  - Consistent with the project objectives and your experience in the field

1. Excellence – Researcher & Host

- Researcher:
  - Experience in the proposed project
  - Track record of research, achievement and exploitation of research output (highlight in CV)
  - Training objectives and knowledge exchange between the researcher and host
  - Integration and career plan, how to develop your professional maturity and independence

- Host:
  - Supervisor with expertise in the field (not subject) of the project
  - Supervisor’s experience in advising postdocs, PhDs, EU projects
  - Research team
  - Supervisor’s international network as an opportunity for you

  - Collaborative environment of the host (examples). Highlight any interdisciplinary future.
  - Well-equipped research facilities needed for the project

I started with a 1-page summary of the proposal.

Motivation → The miniaturization of lasers promises

This requirement was the motivating force behind the development of small laser and nanolasers

in this IF project, I propose to explore, innovate and build on the most promising combinations of VCSELs and nanolasers.

Idea → **The Idea:** I propose **to develop a novel**

Challenges → **The Challenges:** This proposal is based on
Another challenge is the requirement of
The third challenge is
NOVEL is expected to overcome all these significant technical challenges.

Method → **My Approach:** I propose to use

In this project, I will utilize **concept aiming for three main objectives:**

These will be key steps for producing next-generation devices, which are not feasible by using current technologies.

- Status in the world vs. EU, industry and university

The industry is well-established in the USA supported by strong academic and industrial research efforts but, in Europe, innovative research is limited and few companies exist

the successful completion of this timely and innovative project will increase the competitiveness of Europe through the development of new technologies as it is well aligned with the Horizon 2020 Work Programme[1].

- What are the inabilities of the state-of-the-art

Today's technologies are unable to achieve the following requirements needed for existing, emerging and possible future applications:

-
-
-

NOVEL will address and deliver results in ALL these aspects. To address the challenges, I have planned a

- Quantitative targets and advancement with respect to current/competing technologies

Table 1. State-of-the-art performance of current VCSEL and nanolaser technologies versus the proposed targets of NOVEL.

Laser Type	Oxide-VCSEL (GaAs-based)	Nanolasers (InP-based)	Diffusion-VCSEL (previous work)	NOVEL Targets
Minimum size	> 4μm	**< 1 μm**	> 1 μm	**0.5 μm**
Scalable to smaller than λ^3	No	**Yes**	No	**Yes**
Reliability & Lifetime	good for >4 μm	Unknown	**Very good**	**Excellent**
Thermal conductivity	low	Low to high	**high**	**high**
Nanolaser I_{th} (μA)	-	**5**-600 [Ref. 6]	-	
Nanolaser P_{max} (mW)	-	0.10 [Ref. 6]	-	
Single-mode P_{max} (mW)	6 [Ref. 11]	0.06 [Ref. 6]	3 [Ref. 10]	

- Originality and innovative aspects of the research programme

  - **Sub-micron scalability**
  - **Design flexibility**.
  - **High density arrays.**
  - **High thermal conductivity**.
  - **High carrier and photon confinement**

- Training objectives and knowledge exchange between the researcher and host
  - Technical and non-technical skill you are planning to acquire
  - Itemize so that you can include them later in the Gantt chart.

Knowledge Transfer from the Host Institution to the Researcher:

TO1: To extend my professional academic skills through

TO2: To extend my teaching skills

TO3: To acquire experience in

TO4: To create new projects through collaborations.

Knowledge transfer from the Researcher to the Host Institution:

KTO1: To transfer the academic and industry experience

KTO2: To organize

KTO3: To transfer pioneering results of NOVEL

KTO4: To use my industrial experience to set up new university-industry collaborations

2. Impact

- Potential impact on your career
- Proposed dissemination activities
  - Publications, conferences..
- Detailed exploitation plan
  - Appropriate and credible plan
  - Address any patent generation, potential for commercialization
  - Impact in EU industry, possible collaborations and development of applications
- Communication plans
  - With different channels
  - High school students, general public through scientific magazines, industry

2. Impact - Examples

On your career:

The acquired experience will enable me to secure a faculty position and to establish my own independent research group with the aim of embracing both industry-aligned research and fundamental science.

Dissemination:

The major outcomes of this project will be published in high impact, open access journals such as

I will present the results at three international conferences

Exploitation:

This project is well aligned with the Horizon 2020 Work Programme for Information and Communication Technology (ICT) research and innovation action priorities for

Bilkent *Technology Transfer Office* (TTO) will assist me in the development of university-industry collaborations and manage the intellectual property rights (IPR)

The European semiconductor laser industry could gain a significant lead over their USA competitors through the early adoption of the results generated in this project.

The potential major European companies that would be interested in the outcome of the research include

We will open discussions with these companies about possible collaborations in the exploitation of the NOVEL results.

3. Implementation

- Work plan
  - In line with the detailed project description, research and training objectives
  - Include: Detailed goals, deliverables (publication, patent etc.), quantitative and realistic milestones
  - Details of experimentation, equipment and methods
  - Allocated amount of person months to different work packages
  - Well-designed Gantt Chart
- Appropriateness of
  - Management (supervisor, technical personnel, project finances)
  - Tasks and resources
  - Infrastructure. Address if there is any outside equipment involved.
- Risk management
  - Both technical and non-technical risks need to be addressed with mitigation plans
  - Discuss unavoidable tradeoffs
  - Any financial risks to be addressed
  - Risk of equipment failures

3. Implementation - Examples

There is a work package (WP) for each research objective (RO)

WP1: ***RO1 (medium risk, 8 months):***

WP2: ***RO2 (high risk, 12 months):***

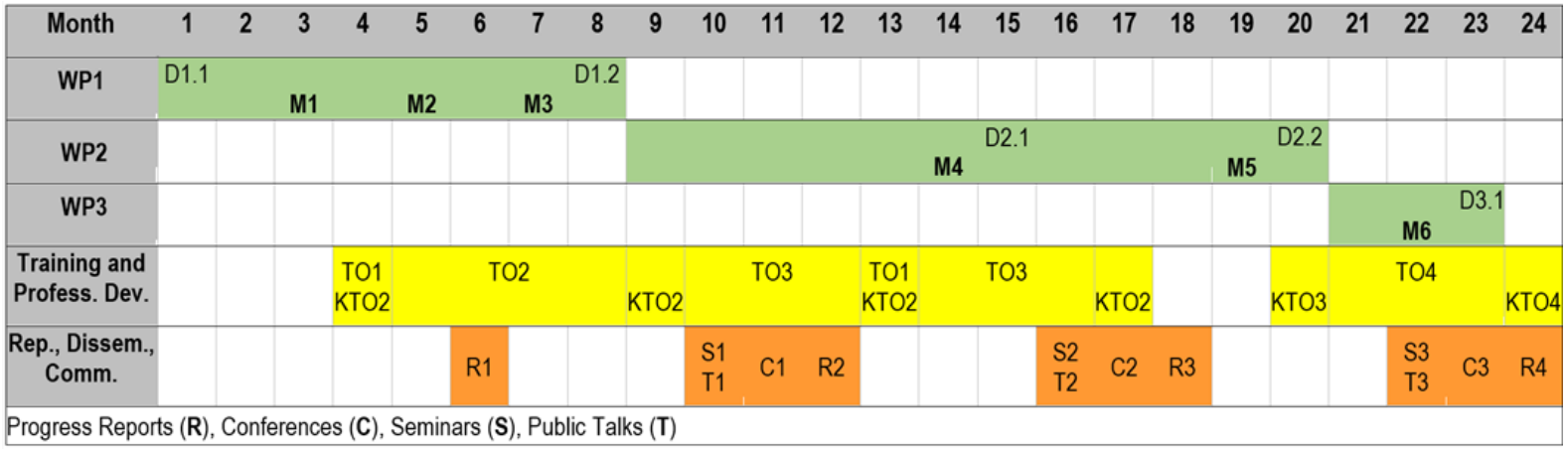
WP3: ***RO3 (low risk, 3 months):***

List of major milestones;

M1 Optimized design (Month 3)
M2 Growth and fabrication (Month 5)
M3 Demonstration of (Month 7)
M4 Demonstration of (Month 14)
M5 Demonstration of (Month 19)
M6 Fabrication of (Month 22)

List of major deliverables; (The numbering refers to the WP in which these deliverables will arise)

D1.1 *Patent application*: (Month 1)
D1.2 *Publication*: characterization results (Month 8)
D2.1 *Publication*: major test results (Month 15)
D2.2 *Publication*: Detailed study of nanocavity (Month 20)
D3.1 *Publication*: array characterization results (Month 23)



- Risk management

The low and medium risks in WP1 and 3 are discussed above.
The main technical risks in this project are related to the challenges in WP2 and the following contingency plans have been designed to cope with this.

1) Sci. risk 1
2) Sci. risk 2
3) Sci. risk 3
4) Equipment failures
5) Financial risks

B2. CV

- Include a career profile

CAREER PROFILE

I have … of academic and industry experience on …. in USA since 2005. Recently, I moved to Turkey to continue my research in the field of ….. with the goal of expanding my expertise and aiming for ….

I did my PhD in …... ….

In …, I joined ….. My research involved …. I demonstrated the record high …. I also realized the highest … demonstrated in industry and academic literature.

I think a unique qualification that I have comes from …. My career goal is to ….

- Highlight your contributions in 3-5 main publications

2. **A. Demir**, …… (2015).

I came up with the idea, carried out the simulations and led the experimental work on this project. The key outcome was the demonstration of … This has opened the possibility of ... and improved the output power by more than … with record high power demonstrated for … laser diodes.

Evaluation Summary Report

Evaluation Result

Total score: 94.20% (Threshold: 70/100.00)

Criterion 1 - Excellence

Score: **4.80** (Threshold: 0/5.00 , Weight: 50.00%)

STRENGTHS

- The objectives are clearly defined with quantitative performance targets.
- The state of the art is well-reviewed, with a range of appropriate references, most of which are reasonably up to date.
- The proposal makes a convincing case that the presented research program is both innovative and original and represents a new direction in the field of study.
- The research methodology, leading to improved theoretical models for this type of VCSEL (vertical-cavity surface-emitting laser) device and to the demonstration of practical devices, is sound and consistent with the project objectives.

- Knowledge transfer from the researcher to the host in the area of industrial semiconductor laser fabrication is convincingly described.
- There is good potential for knowledge transfer from the host to the researcher in the field of nanocavity modeling, characterization and nanofabrication.
- The proposed supervisor is a highly experienced academic of international standing with a substantial publication record. He has a strong and current experience in the supervision of research students and post-doctoral staff.
- The research team at the host institution is of high quality.
- The incorporation of the researcher in the host team is clearly described.
- The supervisor's integration in the international network in the domain of opto-electronics and photonics will give ample networking opportunities to the researcher.
- The researcher has a very strong track record of research, achievement and exploitation of his research output. He is well-placed to benefit from the fellowship and demonstrates a good capacity for developing his professional maturity and independence.
- The formation of the researcher's career development strategy is appropriately discussed.

WEAKNESSES
No major weaknesses are identified.

Criterion 2 - Impact

Score: **4.90** (Threshold: 0/5.00 , Weight: 30.00%)

- **Enhancing the potential and future career prospects of the researcher**
- **Quality of the proposed measures to exploit and disseminate the action results**
- **Quality of the proposed measures to communicate the action activities to different target audiences**

STRENGTHS

- The fellowship has a potential to enhance the future career prospects of the researcher in academia.
- The fellow will be exposed to a good set of training activities, gaining technical and nanotechnology related skills, skills in academic project management, scientific networking and communication of research to non-specialist and a wider public.
- The proposed dissemination activities, which include publication in high impact journals are very good.
- The exploitation plans are well detailed, with good potential for commercial exploitation.
- The communication plans are of high quality, with different channels, such as visits to schools or science magazines.
- Concrete plans for dissemination and communication activities are included in the Gantt chart.

WEAKNESSES

No weaknesses identified.

Criterion 3 - implementation

Score: **4.20** (Threshold: 0/5.00 , Weight: 20.00%)

- **Coherence and effectiveness of the work plan**
- **Appropriateness of the allocation of tasks and resources**
- **Appropriateness of the management structure and procedures, including risk management**
- **Appropriateness of the institutional environment (infrastructure)**

STRENGTHS

- The work plan is well organized with research objectives, training objectives and knowledge transfer objectives clearly identified.
- The work packages are dedicated to well defined tasks associated with the major axes in conception, modelling, growth, fabrication, characterization and experimentation with the final device.
- The Gantt chart is well designed, showing the duration of the three work packages tasks and the scheduling of deliverables and milestones.
- An adequate number of appropriately scheduled and realistic milestones is described.
- The management structure and progress monitoring mechanisms are appropriate.
- The technical risk management is of very high quality, with well identified risks and credible mitigation strategies.
- The host institution provides a broad range of technical and non-technical infrastructure to support the fellowship, demonstrating strong commitment.
- The number, quality and scheduling of the proposed deliverables is good.

WEAKNESSES

Something not possible to address

- The allocation of personnel resource (person months) to the different tasks is not adequately discussed.
- The growth of the VCSEL structures requires an MOCVD (metalorganic chemical vapour deposition) facility, which is planned to be provided by an external company. Given the key importance of the availability of this system to the successful and timely outcomes of the project, the arrangements for the use of this system are not adequately described.

Final tips

- It is not you/idea, it is the proposal that is being evaluated
- 10 pages max. Be ready to throw away many sentences.
- No typos. No glitches in the figures.
- Okay to have unofficial co-supervisors