

Empirical Software Engineering Research Roadmap

Introduction

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1 Roadmap Motivation

The gathering of leading Empirical Software Engineering researchers at Dagstuhl provides a unique opportunity to capture the current challenges facing the field. Our gathering enables deep discussions that identify critical issues, discuss promising opportunities, and outline future directions. A typical framework for organizing ideas and plans from thought leaders is the definition of a roadmap for a field, and the researchers gathered at Dagstuhl have agreed to define a roadmap for Empirical Software Engineering research.

The following sections describe what we mean by a roadmap and elaborate on the roadmap process, uses, benefits, types, and structure. We then introduce an example skeletal roadmap for Empirical Software Engineering that serves as a starting point for Dagstuhl working group discussions. In the subsequent sections, we document the working group's outcomes and describe the resulting overall roadmap in a final summary.

2 Roadmaps Overview

Robert Galvin, who is the former Chairman of the Board of Directors for Motorola, states “a ‘roadmap’ is an extended look at the future of a chosen field of inquiry composed from the collective knowledge and imagination of the brightest drivers of change in that field” [Gal98]. The optimal process for gathering and selecting the content of roadmaps is to include as many professionals as possible in workshop discussions. This process allows all suggestions to be considered and evaluates objectively the consensus that emerge. The process should incorporate treatment for minority views and individual advocacies. The following steps help illustrate the process:

- Step 1: Identify goals
- Step 2: Identify key functions supporting the goals
- Step 3: Identify key technologies supporting the functions
- Step 4: Identify the contribution of Empirical Software Engineering to the technologies, functions, and goals

Roadmaps provide multifaceted uses and benefits. Roadmaps communicate visions, attract resources from business and government, stimulate investigations, and monitor progress [Gal98]. They become the inventory of future possibilities for a particular field. They facilitate interdisciplinary networking and teamed pursuit. Roadmap rationale and visual “white spaces” can conjure promising investigations.

Roadmaps typically establish directions and facilitate coordination and assessment of progress. For example, science and technology roadmaps identify or set future directions and facilitate technology assessments. Industry and government roadmaps set industry directions and coordinate execution. Corporate roadmaps set and monitor directions, coordinate execution, and help manage products, platforms, and portfolios.

According to Galvin [Gal98], roadmaps can comprise:

- statements of theories and trends,
- formulation of models,
- highlighting of linkages among and within sciences,
- identification of discontinuities and knowledge voids, and
- interpretation of investigations and experiments.

Roadmaps can also include the identification of instruments, charts, and graphs needed to solve problems as well as potential showstopper challenges. A roadmap's structure commonly adopts an application domain centric viewpoint in order to:

- describe the state of the art,
- describe the state of the practice,
- identify overall key issues and social benefits and impacts,
- agree on a vision for the future,
- determine criteria for achieving progress,
- identify enabling research,
- determine enabling technologies, and
- build chaired working groups.

3 Roadmaps for Empirical Software Engineering

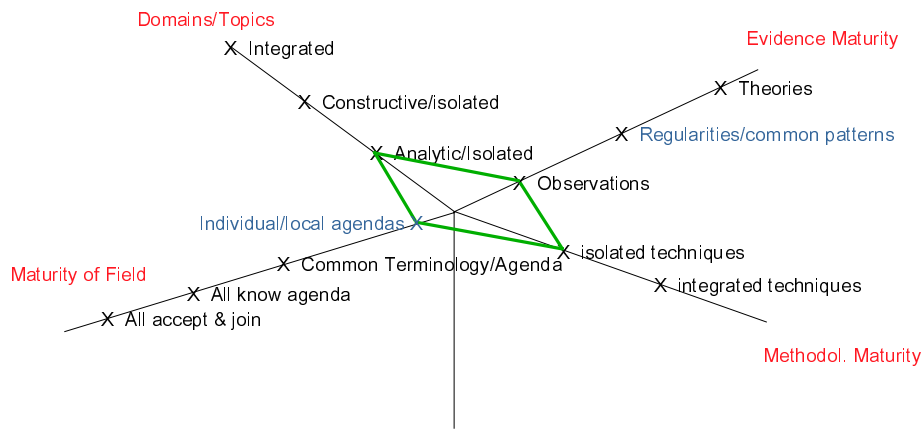
For an Empirical Software Engineering (ESE) roadmap, some important questions to ask for different application domains are as follows:

- Economical and societal driving forces
 - Why is there a need for ESE research?
- Objectives
 - What goals should be attained?
 - What solutions can ESE offer to the stated needs?
- Scientific challenges
 - What are the challenges we – as scientists – are facing?
- Technological driving forces
 - Which key technologies are expected to push development in this area?
- Bottlenecks that hinder progress
 - What hinders the development of ESE in a specific area?
 - What are the societal, economical, and technological obstacles?
- Future research activities
 - Which activities should be (financially) supported?
 - What are the coarse timeframes of development in the areas?

At Dagstuhl, our specific roadmapping approach defines the following objectives:

- Identify important organizational “dimensions” for the ESE field
- Define goals for each dimension
- Identify current status for each dimension
- Establish progress scales along each dimension from current status to goals including short-term, mid-term, and long-term

To initiate discussion, we present an example roadmap for Empirical Software Engineering:



	Key Method.	Int. Approach	Theories	Mature Comm.	Goals
- 2012/14					Enabling Research
- 2009/11					Goals Enabling Research
- 2006/08					Goals Enabling Research
	Analytic/ Isolated	Isolated tech.	Observations	Incons. Terminology	Curr. Status
	Domains/Topics	Methodol. Maturity	Evidence Maturity	Field Maturity	

In support of the roadmap, the above example table provides potentially additional detail.

The following sections document the working group's outcomes and describe the resulting overall roadmap in a final summary.

Reference

[Ga198] Robert Galvin, "Science Roadmaps," Science, Vol. 280, May 8, 1998, p. 803.