CPM
College of Performance Management

EVM World 2013 Conference

ES-05: Time Forecasting using Earned Schedule

The European Experience

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EVM Europe Association

Date: May 29-31, 2013

Agenda

START

2001: Start Collaboration

2003 – 2004: ES Published

2005 – 2010: ES Research

2011 – 2012: Research Extensions

2013 – 2018: CRA Program

.....

2001: Scheduling Congress Antwerp

2001: Start of a collaboration

- A Practitioner:
  - lots of questions on how to better manage schedules
  - Using EVM & SRA

- An Academicus:
  - defended successfully a dissertation on "network generators"

- A collaboration was born

RESEARCH meets **PRACTICE**

2003 - 2004: Earned Schedule

- Publications Measurable News

    - March 2003, "Schedule is Different", Walt Lipke
        - Quirky behaviourof SPI
        - Introduction of ES, SV(t), SPI(t)

    - Summer 2003, "Schedule is Different", Walt Lipke
        - Re-published (this time figures included)

    - Spring 2004, "Further Developments in Earned Schedule", Kym Henderson
        - Prediction capability introduced

2005: EVM Forecasting Methods

Baseline	Anbari [1]		Jacob [6]		Lipke[a]	
Baseline	SAC	Schedule at Completion	PD	Planned Duration	PD	Planned Duration
Status of the project	PVRate	Planned Value Rate	ED	Earned duration	ES	Earned Schedule
	AT	Actual Time	AD	Actual Duration	AT	Actual Time
	SPI	Schedule Performance Index	SPI	Schedule Performance Index	SPI(t)	Schedule Performance Index Time
	SV	Schedule Variance	SV	Schedule Variance	SV(t)	Schedule Variance Time
	TV	Time Variance	---	---	---	---
	CR	Critical Ratio	---	---	SCI(t)	Critical Ratio Time
At Completion indicators	**TEAC = AT + TETC**		**EDAC = AD + UDR**		**EAC(t) = AT + PDWR**	
	TETC	Time Estimate to Complete	UDR	Unearned Duration Remaining	PDWR	Planned Duration for Work Remaining
	TEAC	Time Estimate at Completion	EDAC	Estimate of Duration at Completion	EAC(t)	Estimate at Completion Time
	---	---	---	---	**IEAC(t) = AT + PDWR / P.F.**	
	---	---	---	---	IEAC(t)	Independent Estimate at Completion Time
Assessment Indicator	---	---	TCSPI	To Complete Schedule Performance Index	SPI(t) to go[b]	To Complete Schedule Performance Index for PD
	---	---	---	---	To complete SPI(t)[c]	To Complete Schedule Performance Index for Latest Revised Schedule (LRS)

(a) The terminology used is based on the presentation by Lipke and Henderson "Earned schedule - an emerging practice" presented at the 16th Annual International Integrated Program Management Conference, November 15-17, Virginia.
(b) The SPI(t) to go is equal to the TCSPI (Eq. (15)) or the TCSPI(t) (Eq. (22)) of the current paper
(c) The to complete SPI(t) equals the TCSPI – LRS (Eq. (16)) or the TCSPI(t) – LRS (Eq. (23)) of the current paper

2006: The IJPM Paper

International Journal of Project Management 24 (2006), 289 - 302, "A Comparison of different project duration forecasting methods using earned value metrics", S. Vandevoorde, M. Vanhoucke

- Based on real life project data

- Conclusion:

  "Earned Schedule was the only method which showed satisfying and reliable results during the whole project duration"

- Recommendation:

  "In order to generalise the results found in this study, we will test the three concepts on projects based on a full factorial simulation experiment, rather than relying on a (small) set of real life projects."

Network Database

- Create a database of networks with a controlled topological structure by the use of a network generator

- So we guarantee we have a very large set of networks that can and might occurr in practice

- To control the design of the networks 4 indicators are used:
  - Network indicator: Serial or parallel network (SP)
  - Activity indicator: Activity distribution (AD)
  - Precedence relations indicator: Length of arcs (LA)
  - Float indicator: Topological float (TF)
  - Based on: Vanhoucke, M., Coelho, J.S., Tavares, L.V. and Debels, D., 2004, "On the topological structure of a network"

SP - Indicator

- SP = (m - 1)) / (n - 1)

  - n = total number of non-dummy activities
  - m = number of levels

SP = (3-1)/(9-1)

= 0,25

SP = (5-1)/(9-1)

= 0,50

SP = (1-1)/(9-1)

= 0
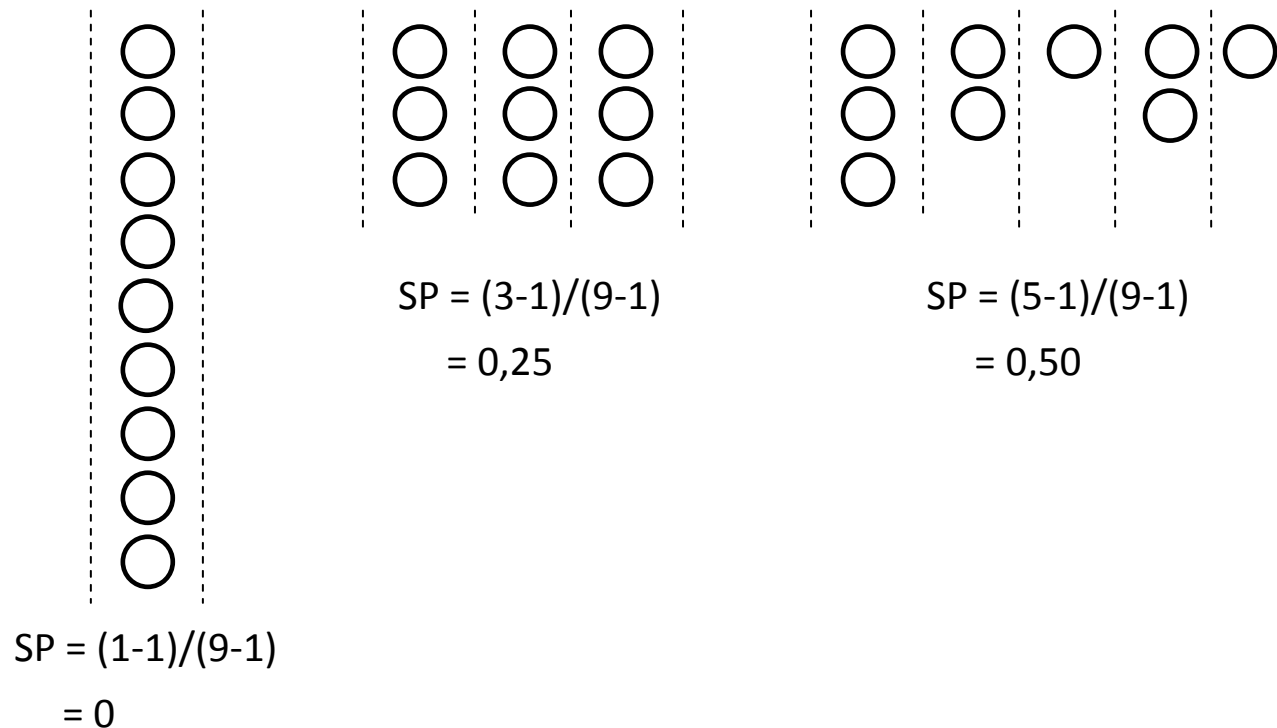
AD - Indicator

- AD = 0: activities are equally distributed over the levels
- AD = 1: activities are concentrated in one level
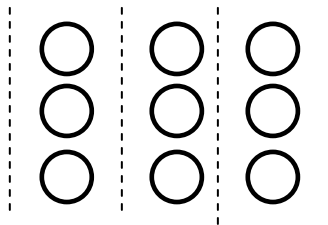
SP = 0,25

AD = 0
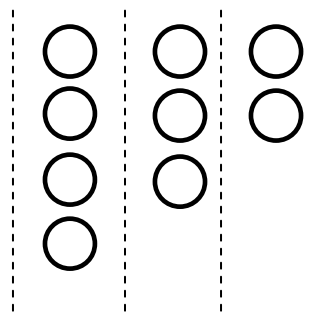
SP = 0,25

AD = 0,25

SP = 0,25

AD = 1

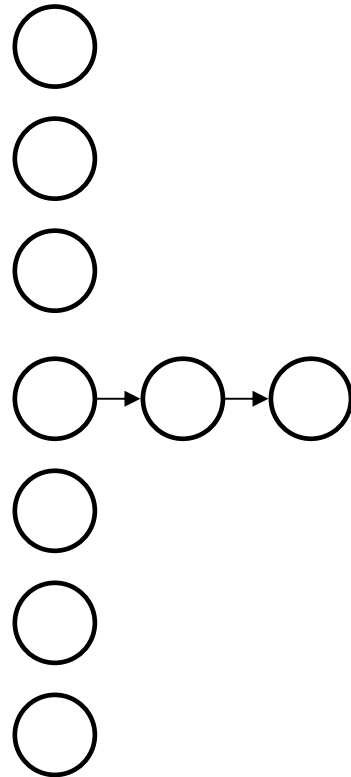SP = 0,25　　　　SP = 0,25　　　　SP = 0,25
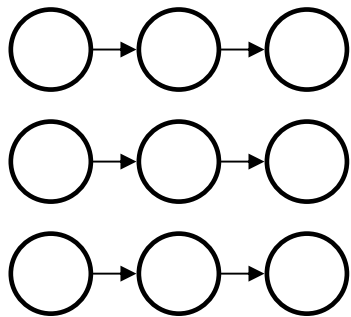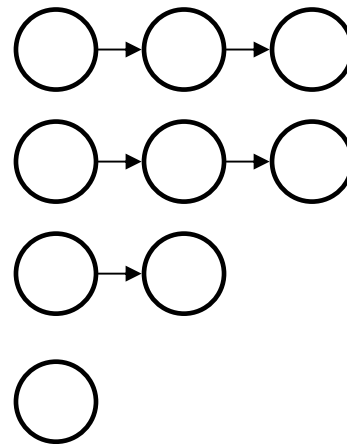
AD = 0　　　　　AD = 0,25　　　　AD = 1
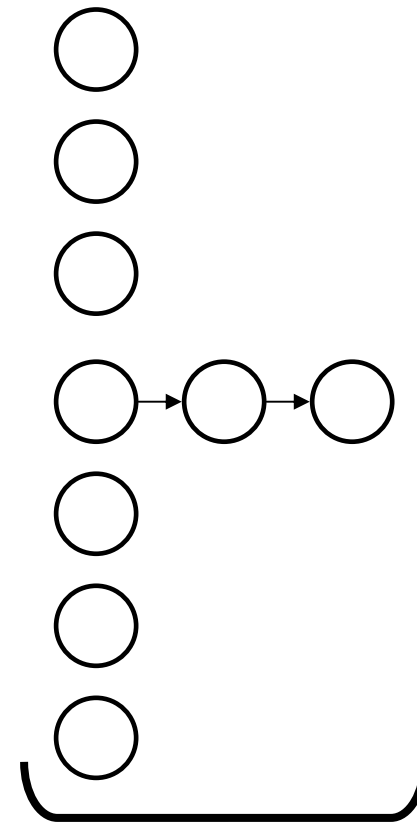
LA = Length of Arc

SP = 0,25

AD = 1

LA = 0

SP = 0,25

AD = 1

LA = 0,50
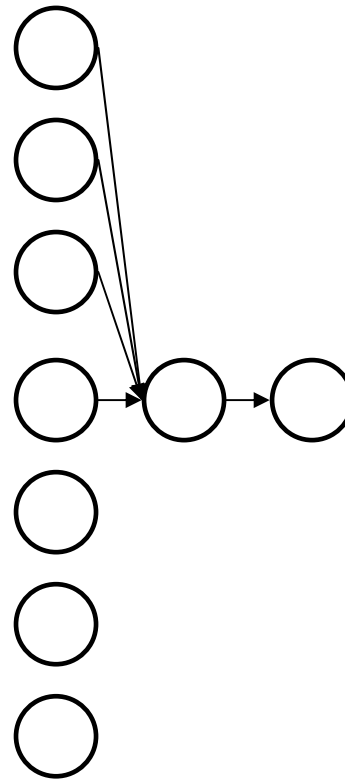
SP = 0,25

AD = 1

LA = 1
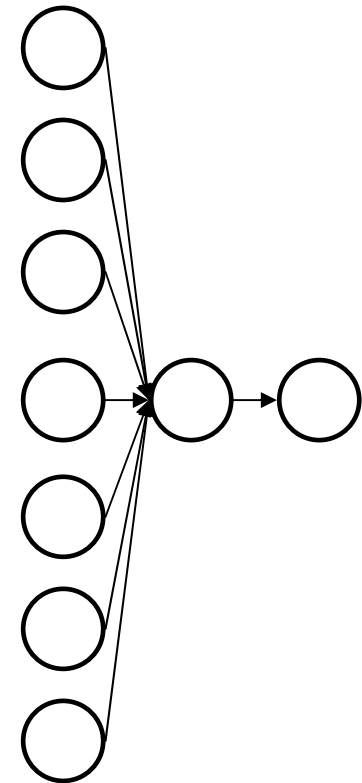
NETWORK TOPOLOGY
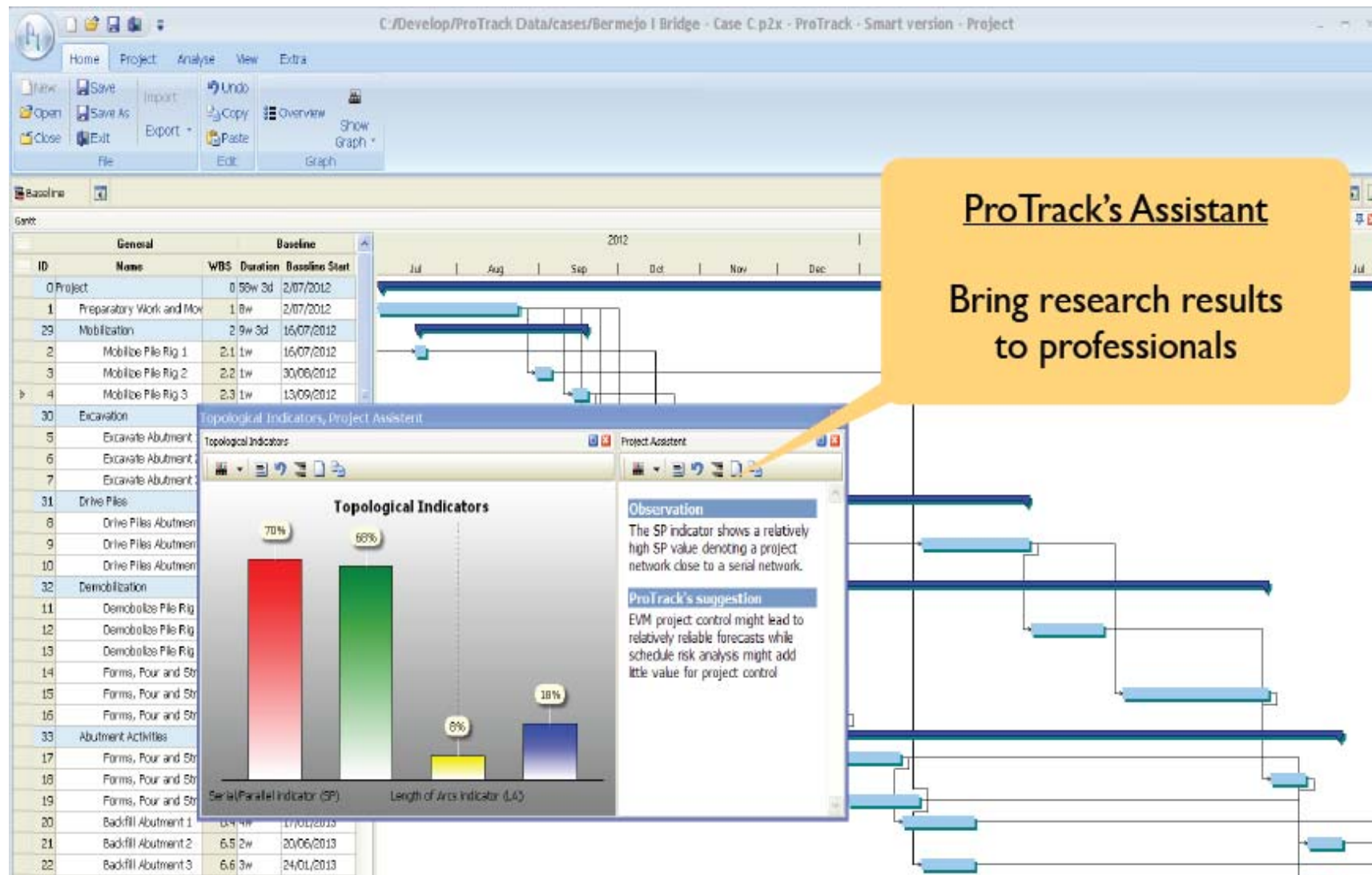
2007: The JORS paper

Journal of the Operational Research Society, 2007, 58 : 1361-1374 ,
"A simulation and evaluation of earned value metrics to forecast the project
duration.", M. Vanhoucke, S. Vandevoorde

- An extensive study by using similated projects with a controlled design (4.100 projects, each 30 tasks)

- Conclusion:

  "The results reveal that the ES method outperforms, on the average, all other forecasting methods"

  "The closeness of a network to a serial or parallel network has an impact on the accuracy of the forecasts."

Research Recognition

- 2007 July, PMI Belgium Chapter Event
  - Research Collaboration Award 5.000 €

- 2008 22nd IPMA World Congress Rome, Italy
  - M. Vanhoucke receives Research Award IPMA 2008

2009 ES Intrest Increasing in EU

- Evidence of ES usage in Europe:
  - Spain: publishing of ES add-in software
  - Papers from Greece, Spain, Polen, UK, …
  - Belgium: ProTrack software, ES research, …

- Need for a "European networking group"
  - Thanks to Kym Henderson who brought "the Europeans" together
  - EVM Europe created in 2009

2010 EVM Europe Ghent

- Working session on the PMI PS EVM 2nd Ed.
    - Chaired by P.M. Greg Schmidt
    - Based on all research available, "Europeans" advocated strongly on inclusion of ES Method as an extension to EV

ES Research Findings

1. SPI(t) behaves correctly during the whole life cycle
   – Real life + simulated data

2. ES forecasting outperforms all other SPI based methods
   – Real life + simulated data
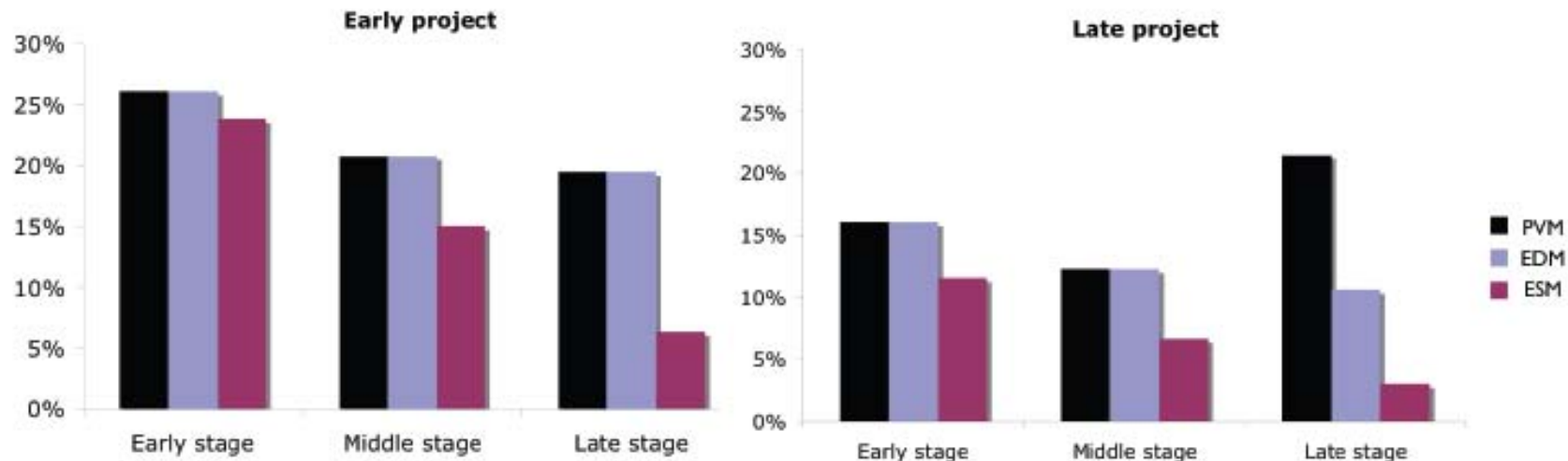
ES Research Findings

3. The P-factor is negatively related to the forecast accuracy, and thus acts as a good early warning signal.

    - The lower the P-Factor, the lower the forecast accuracy
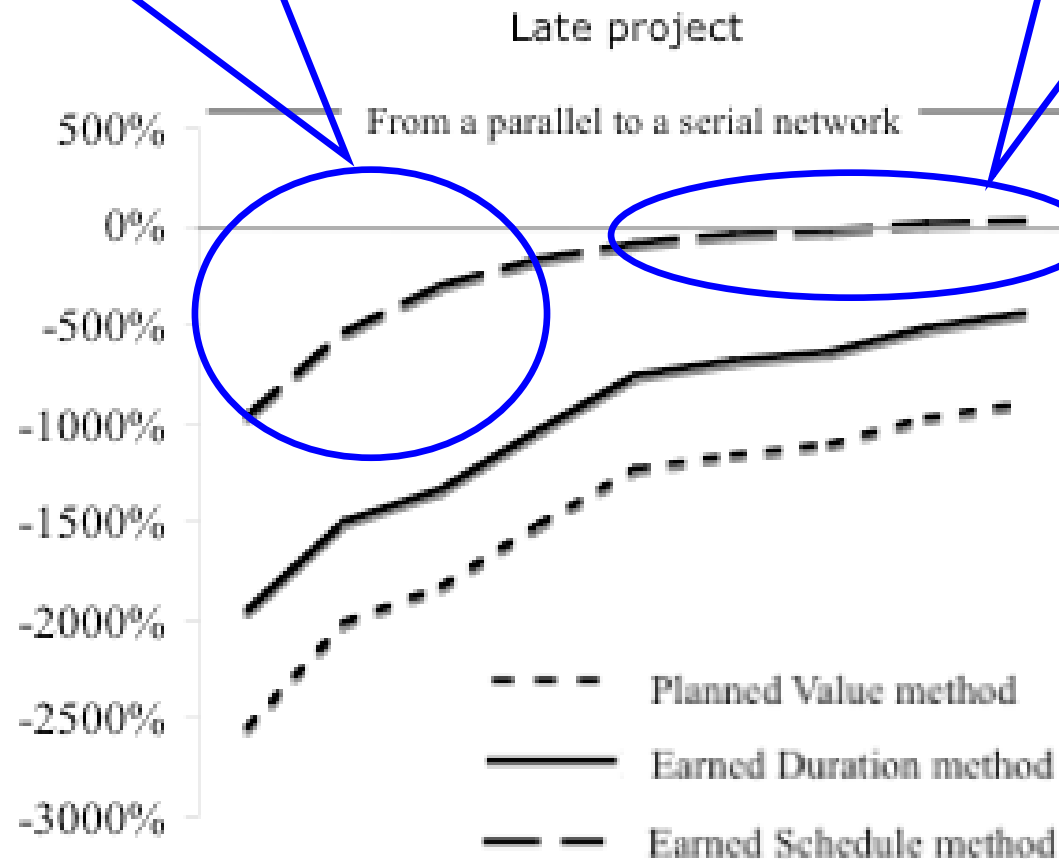   - High P-Factors lead to better forecasts
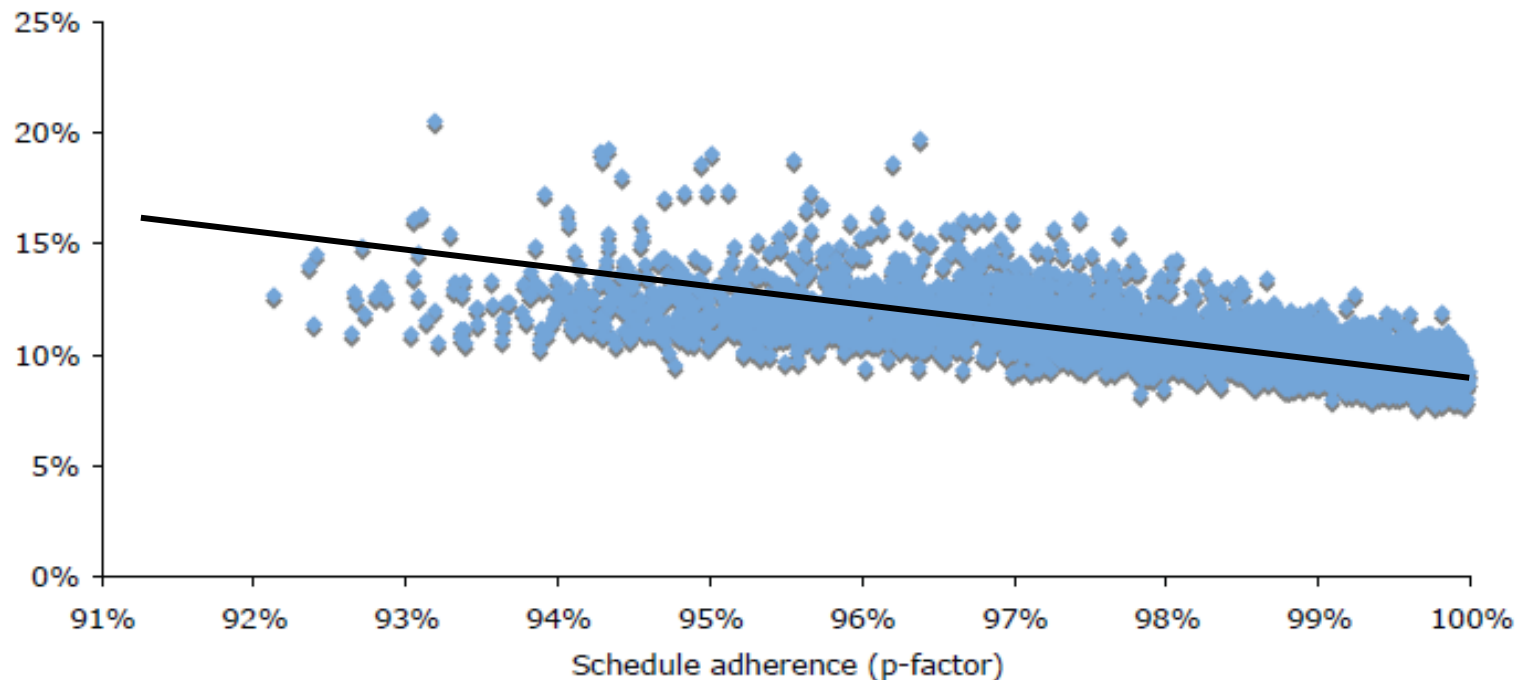
ES Research Findings

4. The schedule topology as measured by the SP-indicator has an impact on the forecast accuracy
   - Serial networks: high forecast accuracy
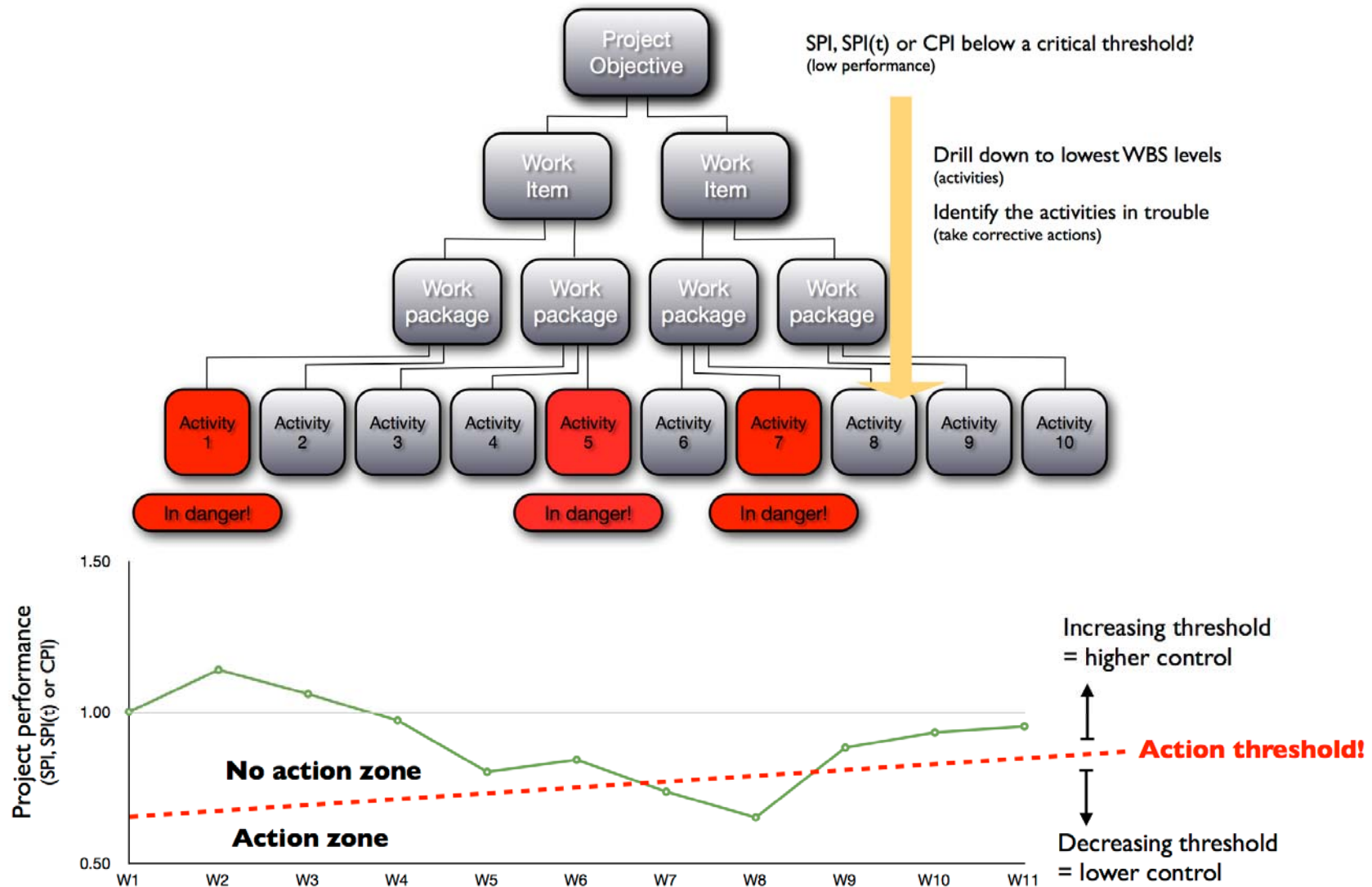   - Parallel networks: low forecast accuracy
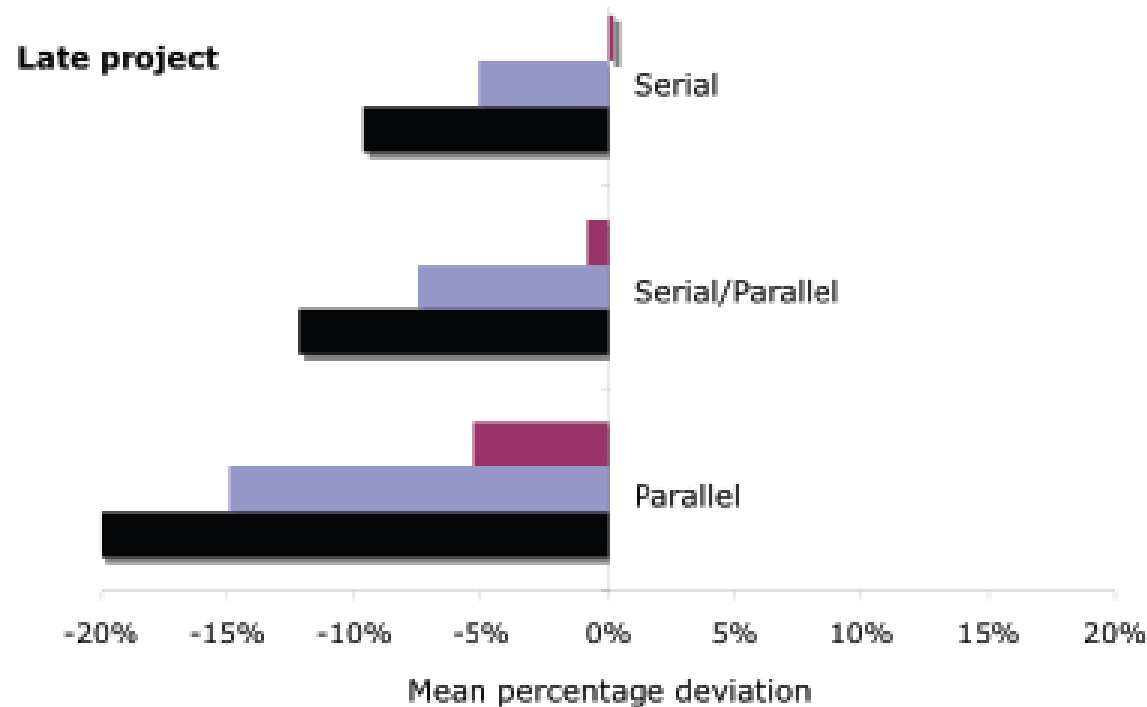
ES vs SRA

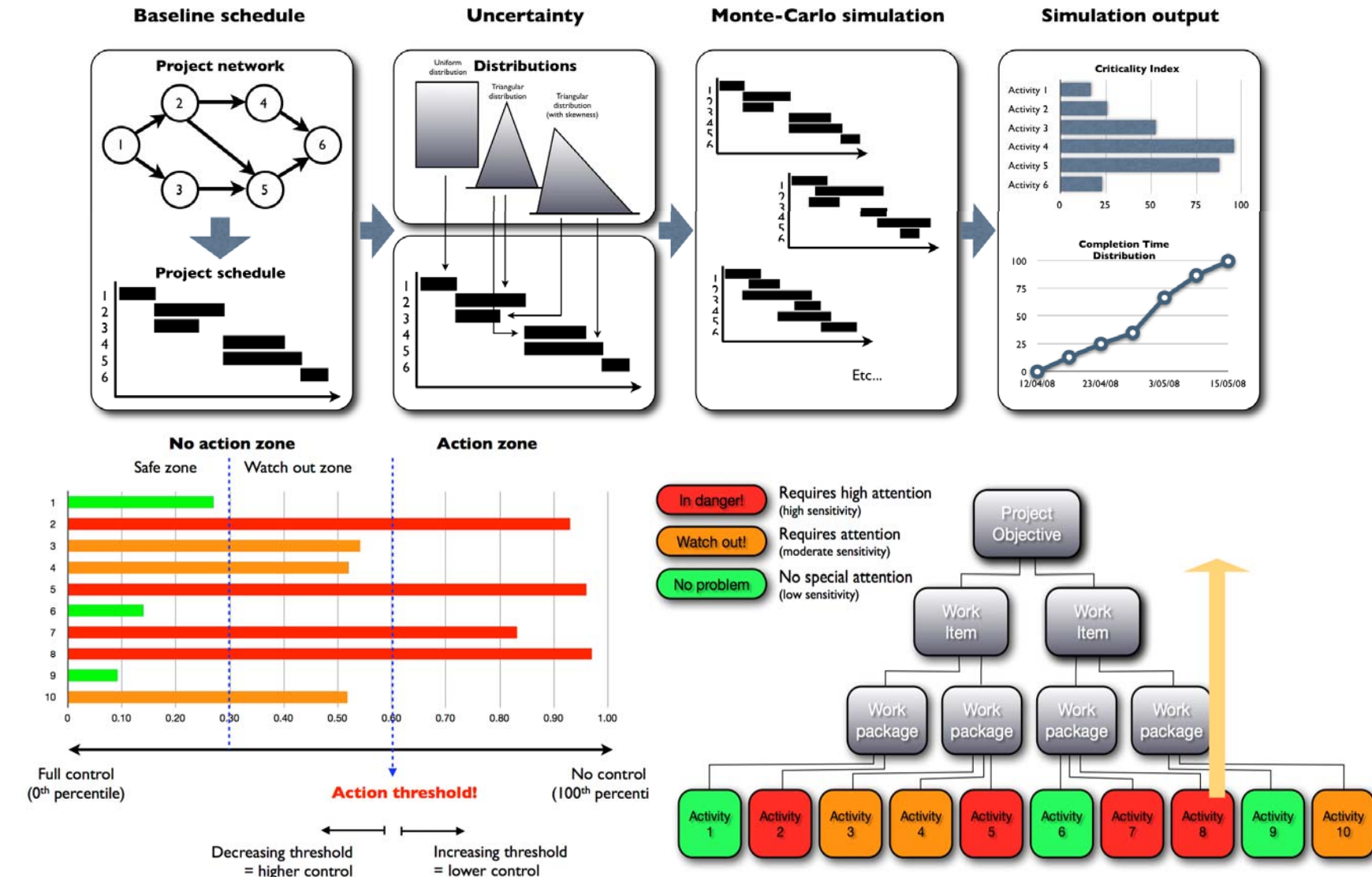ES predictions are unreliable Schedule Risk Analysis
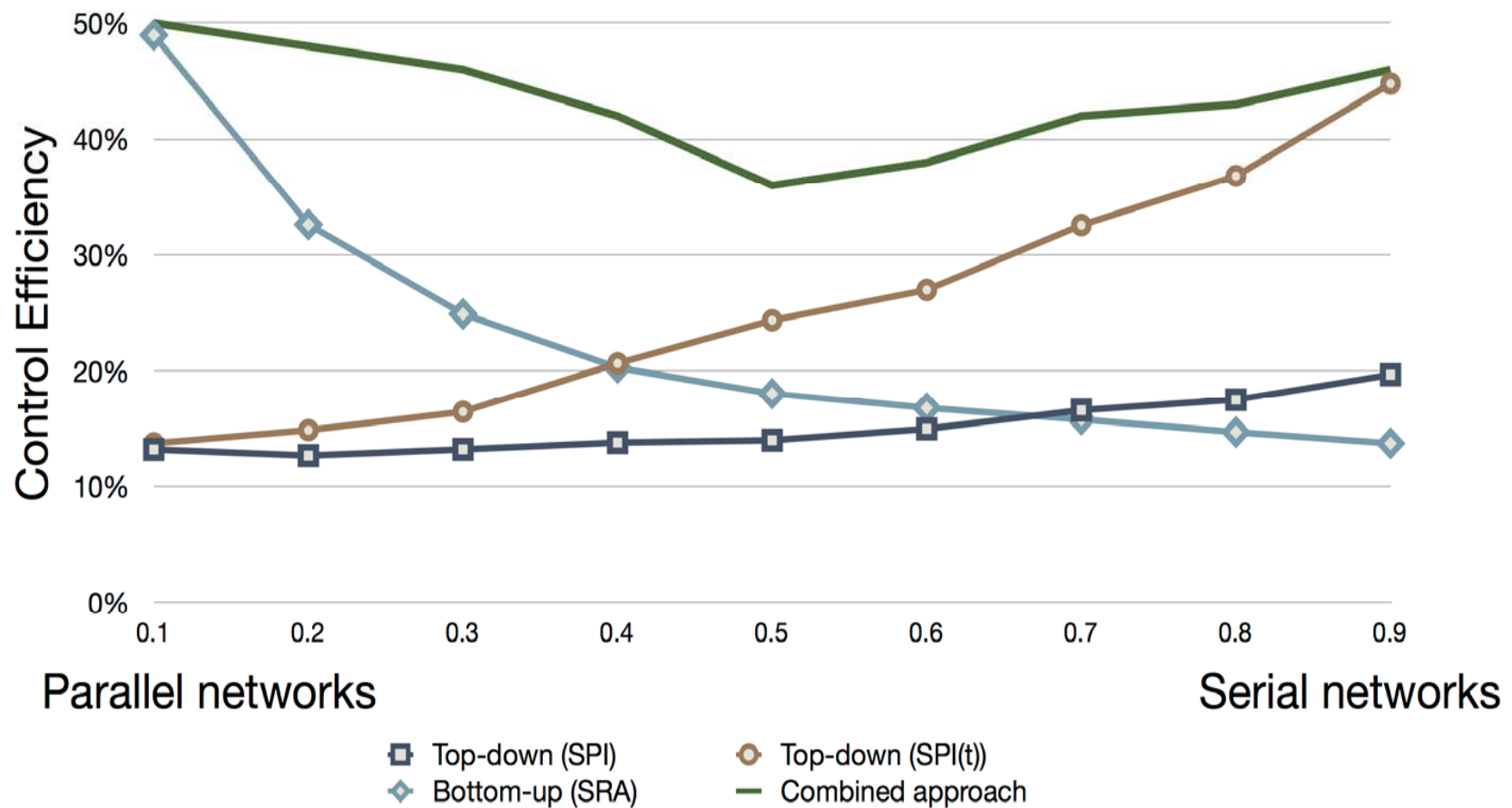
ES predictions are accurate

Late project

From a parallel to a serial network

500%

0%

-500%

-1000%

-1500%

-2000%

-2500%

-3000%

- - - - Planned Value method

——— Earned Duration method

— — Earned Schedule method

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TOP DOWN CONTROL: ES

BOTTOM UP CONTROL: SRA

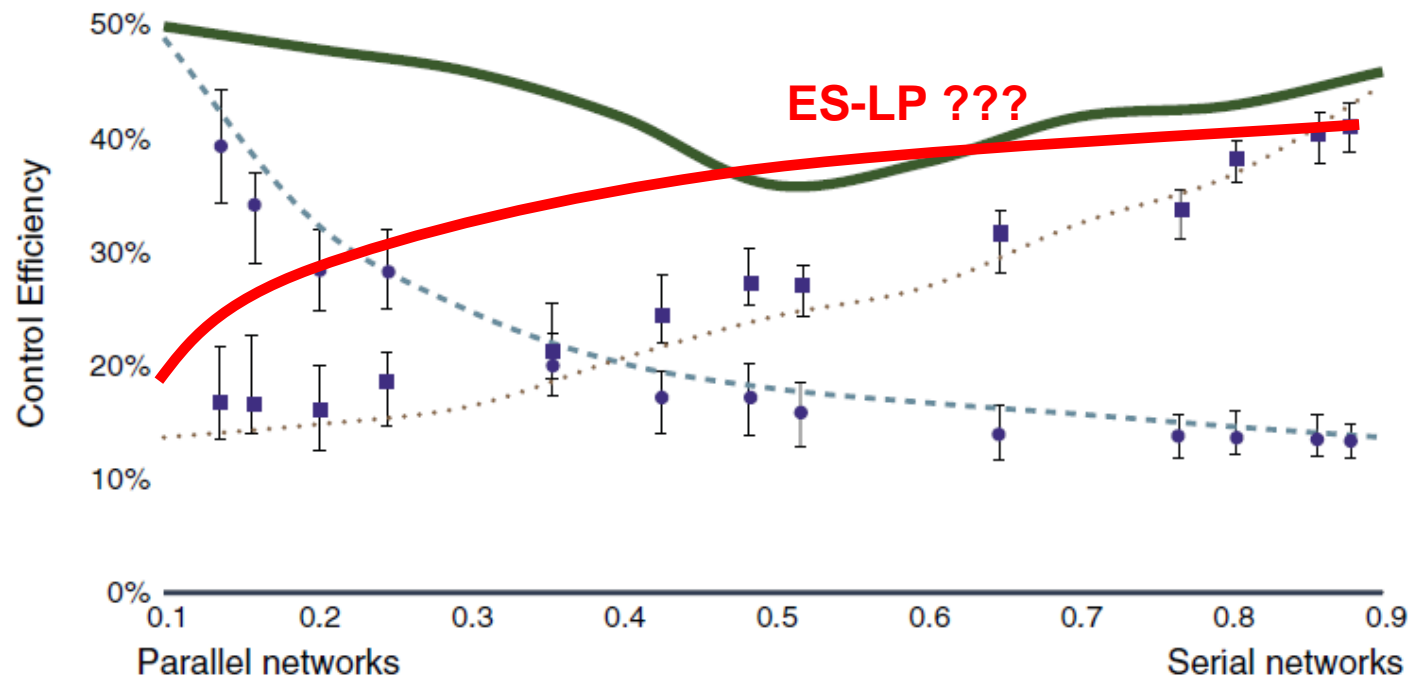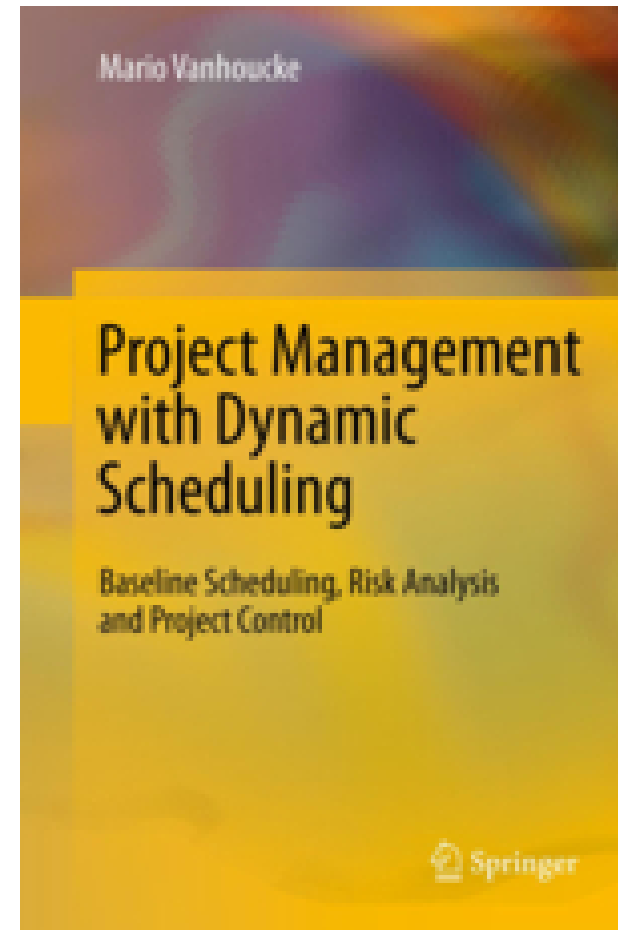# CONTROL EFFICIENCY

CONTROL EFFICIENCY
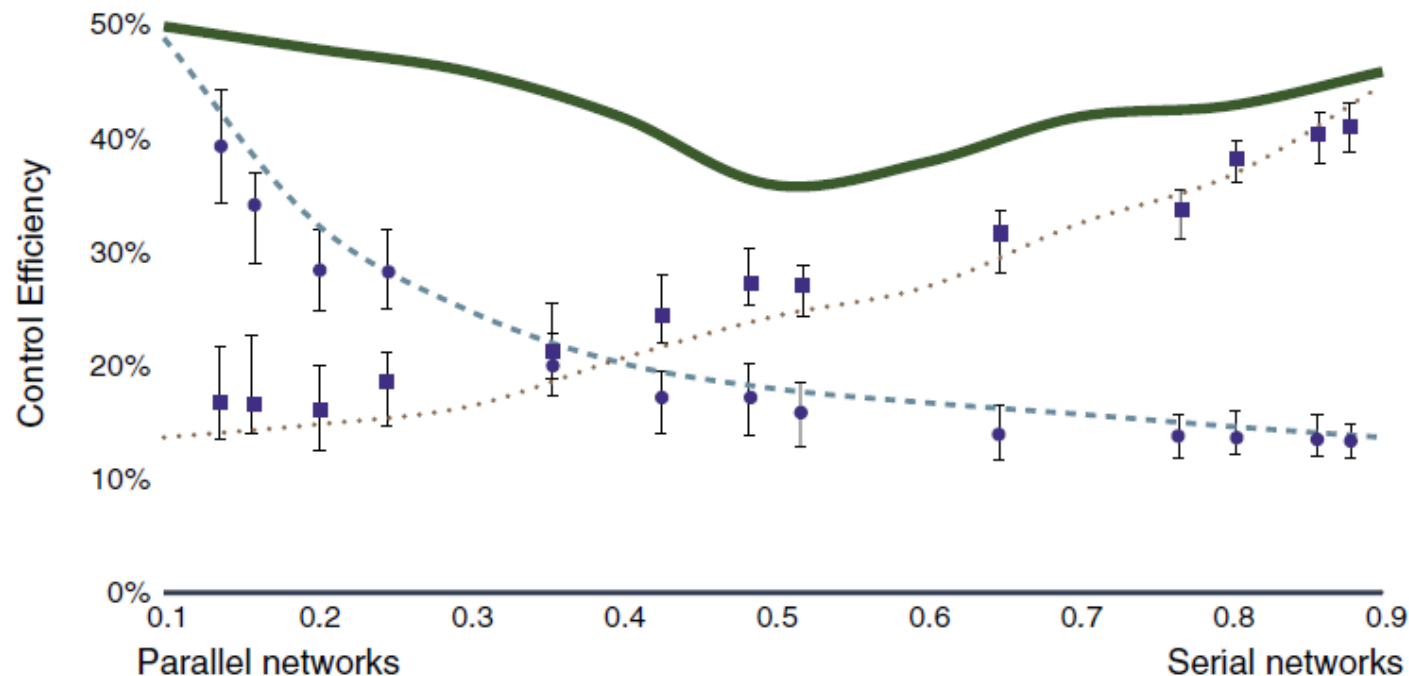
Legend

- - - - EVM with SPI(t) (fictitious data)

········ SRA with SSI (fictitious data)

■ EVM with SPI(t) (empirical data, with an indication of minimum and maximum value)

● SRA with SSI (empirical data, with an indication of minimum and maximum value)

—— Combination of EVM and SRA (fictitious and empirical data)

FURTHER RESEARCH TOPICS

RESEARCH PUBLISHED

2009 (ISBN 978-1-4419-1013-4)   2012 (ISBN 978-3-642-25174-0)

2013 – 2018: CRA Program

- Concerted Research Action awarded by Flemish Government:
  - Time Span: 4 to 6 years
  - Value: > 1.000.000 €
  - 6 researchers

- Searching for static and dynamic project drivers to predict and control the impact of management / contingency reserve on a project's success

- Follow-up study on "Measuring Time"
  - Extend EVM / ES to statistical extensions (SPC)
  - Development of novel scheduling algorithms
  - …

EVM Europe 2013 - Ghent University - Ghent (Belgium)

03/04 December 2013
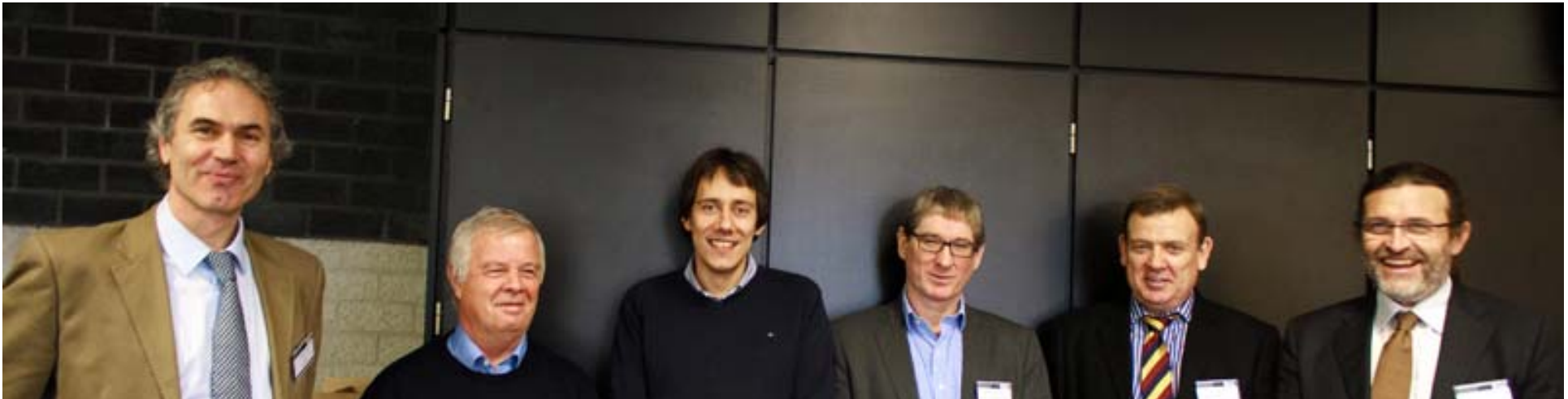
EVM Europe invites you all to celebrate:

- 1 year of the "> 1 million euro" research project
- 5 years of EVM Europe
- 10 years of Earned Schedule

A special message from the board of EVM Europe to Walt

Thank You!

for sharing your ideas and experience

for the collaboration which resulted in many research projects

for all your efforts given to the PM Community

for your friendship