"Soft" factors and software productivity - which ones matter?

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Outline

- Objectives
- Common subjective factors?
- Factors influencing productivity?
- How to use this knowledge?
- Conclusions

Factors influencing effort

- Size
- Productivity:
  - Quantitative: programming language, team size, business sector, user base, ...
  - Qualitative: team skills, user involvement, quality, ...
- Quantitative factors explain half the variation in effort

Data set (465 projects)

- *Up to 17500 FP; median 320 FP*
- *62% new, 33% enhancement*
- *41% MIS, 33% transaction processing*
- *68% are banking, government, insurance, manufacturing, utilities, business services*
- *53% 3GL, 39% 4GL (30+ languages)*
- *60% MF, 20% MR, 20% PC*

Analysing subjective factors

- *Read factors, classify, count*
- *Statistics:*
  - *Code each project for each soft factor:*
    - *Positive comment, negative, neither, both*
  - *Exclude inappropriate projects*
  - *Remove "outliers", combine small groups*
  - *Normalise effort*
  - *Analysis of variance*

Normalising effort (% by phase)

	Plan	Spec	Build	Test	Impl	Total
Dev team	7	13	31	12	5	67
Support	0	0	10	1	3	14
Users	0	8	0	8	3	19
Total	7	21	41	21	11	100

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Team skills/experience 54 %

- Front end (analyst) 25 %
- Back end (programmer/tester) 43 %
- Experience in problem domain 12 %
- Experience with application 14 %
- Experience with env/tools 19 %

Requirements *50 %*

- *Completeness, clarity* *17 %*
- *Stability* *15 %*
- *Difficulty* *11 %*
- *Interfaces to other systems* *8 %*
- *Overhead, omissions* *10 %*

Clients *39 %*

- *Involvement* *34 %*
- *Commitment* *8 %*
- *Experience* *6 %*
- *Communication, proximity* *15 %*

Methods 26 %

- Methodology 11 %
- Particular techniques 12 %
- Reuse 8 %
- Rework 5 %

Environment 25 %

- Development/testing 9 %
- Tools 17 %

Team operation 24 %

- Stability 6 %
- Harmony, “team spirit” 6 %
- Commitment 6 %
- Organization / structure / size 14 %

Importance *20 %*

- *Priority* *5 %*
- *Management commitment* *9 %*
- *Deadline* *11 %*

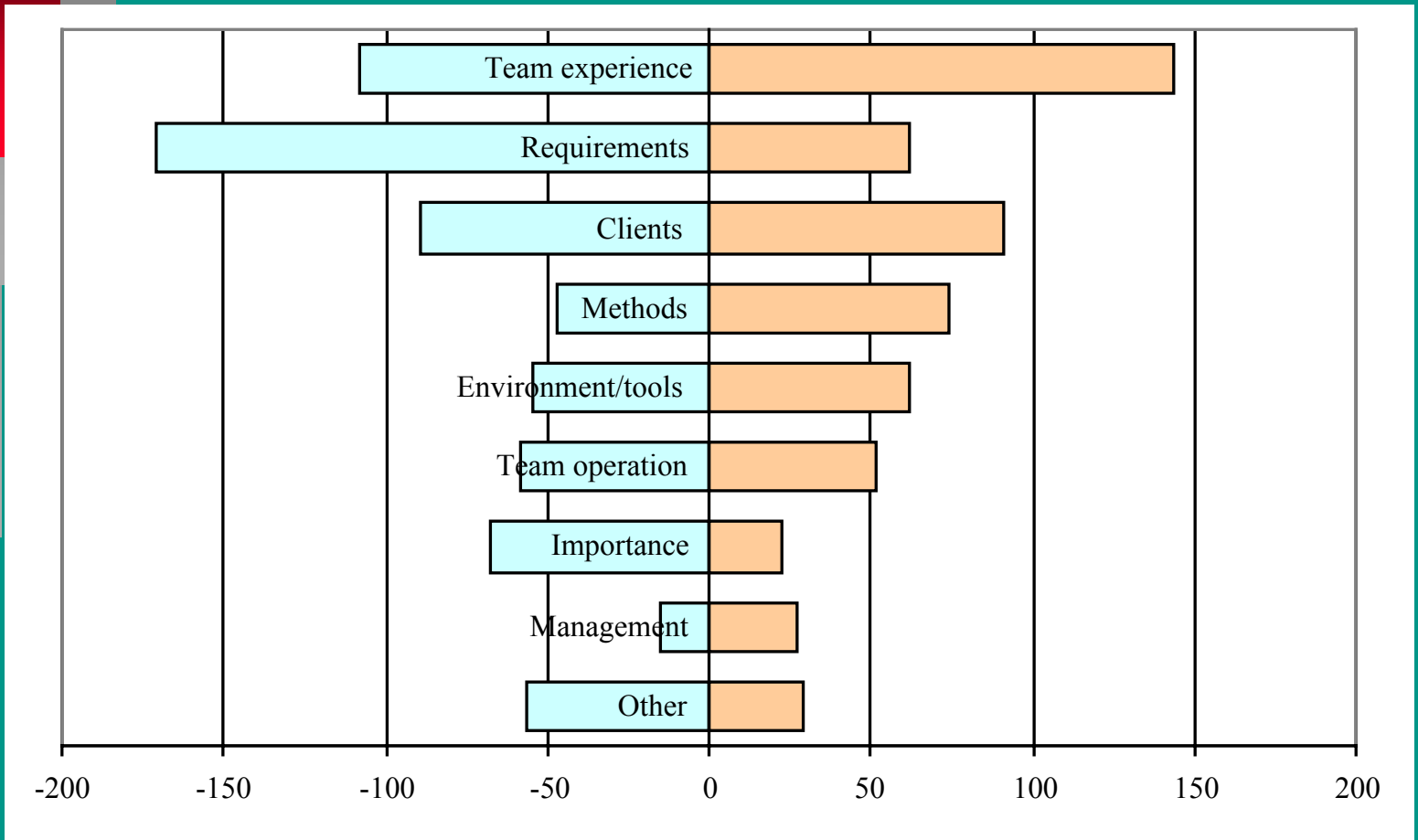
Managers *9 %*

- *Experience* *3 %*
- *Management quality* *6 %*

Other 16 %

- Third party
- Good base to start from
- Noisy workplace
- Building relocation
- Part of umbrella project
- …

Positive and negative comments



What has changed in 6 years?

- Demographics have changed:
  - Broader industry base
  - New languages, applications
  - PC projects replace midrange projects
- Change in soft factors?

  Nothing!

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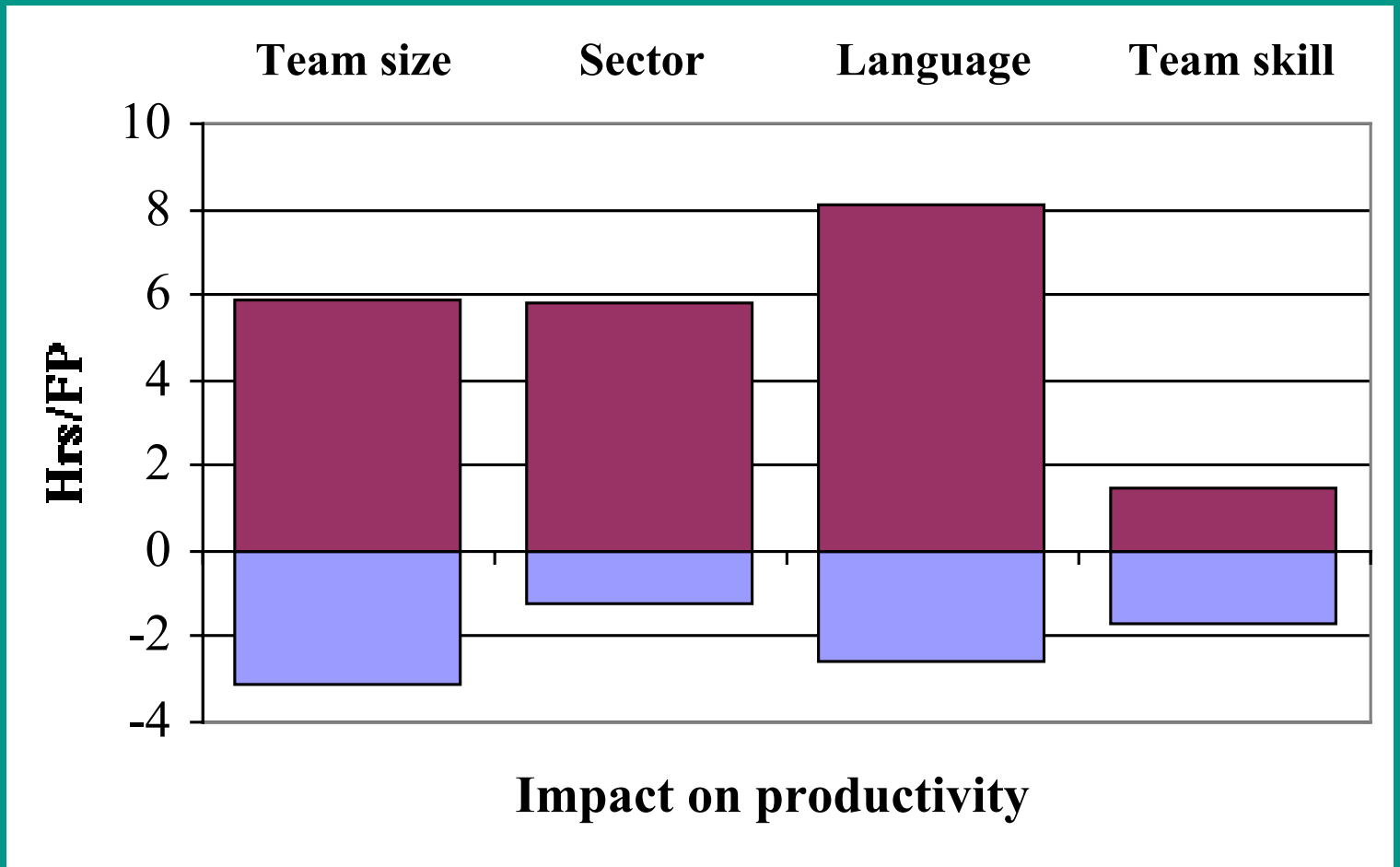
Factors influencing productivity

1. *team size*
2. *context*
   - *organisation type, business area*
3. *development "platform"*
   - *language, DBMS, type of computer*
4. *team skills*

? *techniques; other soft factors ... (?)*

Estimated PDR = 6.3 hrs/FP, plus the effects from the factors below							
Max team size		**Organisation type**		**Language**		**Team skills**	
1 to 4 [93]	-3.1	Retail & wholesale [7]	-1.2	Misc 3GL [6]	-2.6	Pos [88]	-1.1
Unknown [139]	0.3	Manufacturing [44]	-1.2	Visual Basic [15]	-2.1	None [143]	0.0
5 to 10 [87]	0.9	Insurance [43]	-0.9	Misc ApG [9]	-1.6	Both [47]	0.3
11+ [36]	6.9	Financial (exc. Bank) [39]	-0.8	Access [24]	-1.3	Neg [77]	0.8
		Other [74]	-0.6	SQL [18]	-0.9		
		Public administration [50]	-0.4	Oracle [4]	-0.7		
		Electricity, gas, water [27]	-0.1	Powerbuilder [11]	-0.5		
		Communications [10]	1.0	Natural [40]	-0.1		
		Community services [9]	1.8	Misc 4GL [33]	0.0		
		Banking [53]	5.8	Cobol II [37]	0.3		
				Telon [10]	0.3		
				Easytrieve [9]	0.4		
				Unknown [8]	0.9		
				PL/I [28]	1.1		
				Cobol [53]	1.5		
				C [14]	1.7		
				Smalltalk [13]	4.5		
				C++ [12]	8.1		


Team size
Sector
Language
Team skill
10
8
6
4
2
0
-2
-4
Hrs/FP
Impact on productivity

Estimating effort

Model	R^2	*MMRE*	*P(.50)*	*Mean |error| in PDR*
Size	*0.48*	*1.22*	*0.44*	*4.86*
Size, team size, org type, language, team skill	*0.69*	*0.79*	*0.58*	*3.82*

Other factors (?)

- *quality of requirements* *-1.8 to 0.1*
- *use of prototyping* *-0.1 to 0.5*
- *relationship with client* *-1.5 to 2.1*
- *environment/tools* *-0.3 to 1.4*

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Observations

- Limits: 2,000FP 13,000 hours
- Estimates poor
  - Initial ball-park; use other methods also
- Factors identified are all known early
  - Accuracy comparable to other methods
- Most factors affect PDR by ± 20%

Conclusions

- *Industry evolves, but soft factors stay same*
- *Key soft factors:*
  - *developers, requirements, clients*
- *Impact on productivity:*
  - *small (with weak information)*
  - *adding more factors (“cost drivers”) no help for estimation*

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