

Communication between Engineers: Information flow interactions between engineers

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Introduction

- ▶ Intense competition in Industries calls for new products to be developed in lesser time, Concurrent engineering is regarded as one of the best practices to achieve this [1].
- ▶ As projects become geographically dispersed, communication as well as coordination and awareness can be impeded by the spatial and temporal barriers.

Problem

- ▶ Too often designs are “thrown over the wall” to manufacturing only to discover either that they are not producible or need design modifications [2].
- ▶ It has also been shown that engineering designers spend as much as 30% of their time searching for and accessing engineering design information.
- ▶ Designers spend “reinventing the wheel” due to lack of information.
- ▶ Research has showed that designers spend 16% of time in meetings and 23% of time in paper work [3].

Literature Review

▶ The main themes in the Literature are:

1. Graduate Competencies and professional bodies.

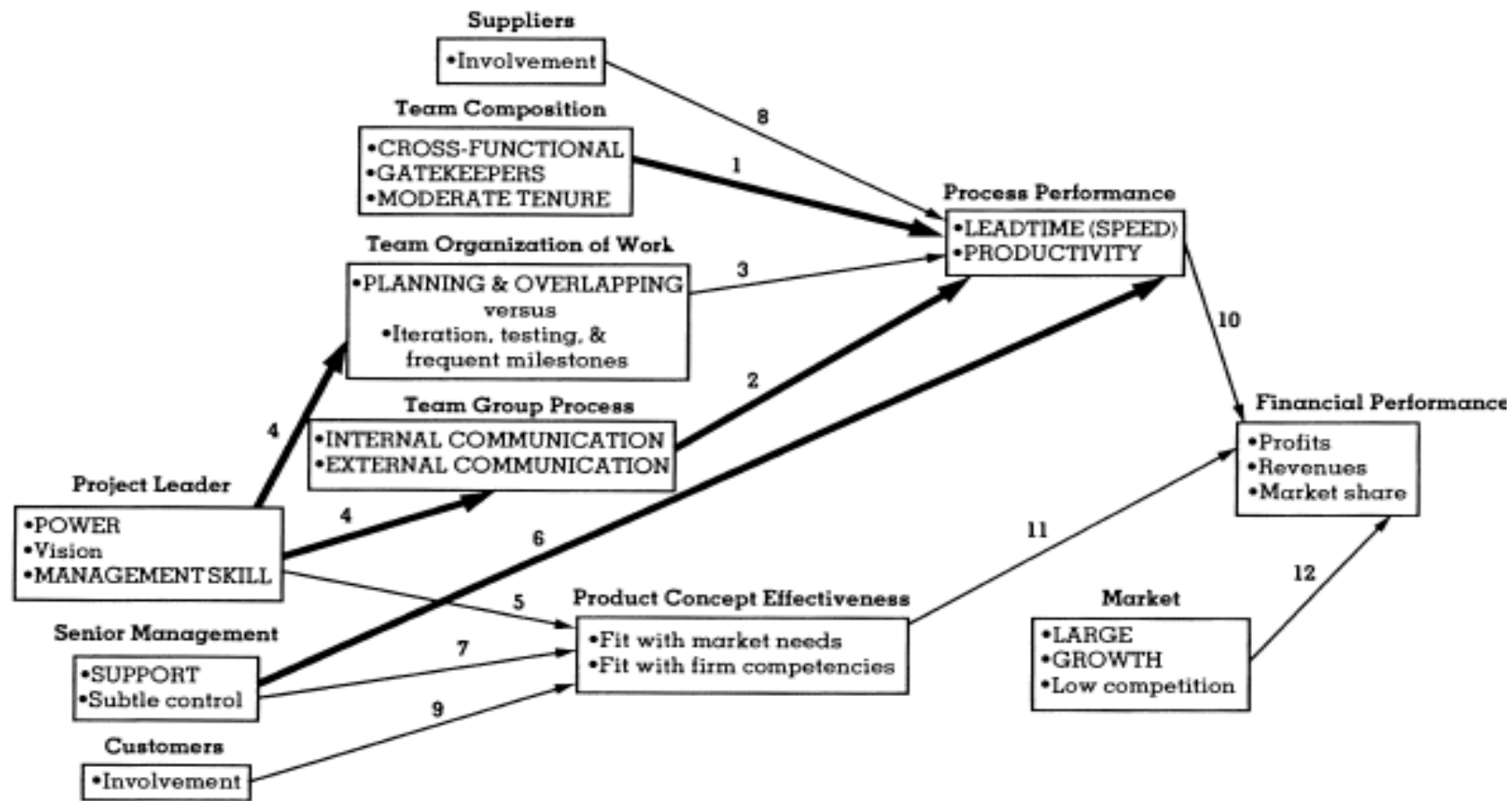
Criterion 10: 'Communicate clearly with other engineers and others that he or she is likely to deal with in the course of his or her professional engineering activities. [This involves] Uses oral and written communication to meet the needs and expectations of his/her audience; Communicates using a range of media suitable to the audience and context; Treats people with respect; Develops empathy and uses active listening skills when communicating with others; Operates effectively as a team member' [5].

2. Mechanics of communication (Documentation and medium).

Research has established that performance of NPD project is affected by communication strategy, medium and the tools used to support the strategy [4].

Informal communication is a critical driver for NPD project success. [6]

FIGURE 1
Factors Affecting the Success of Product-Development Projects^a



^a Capital letters and thickened lines indicate robust findings.

Figure 1 taken from :[4]

Literature Review

3. Management and burden of communication

Misunderstanding provokes conflicts in organizations, which creates a sense of distrust among employees.

Too much detailing and quality improvements to requirement can make it impossible for a product manager to pursue his key responsibility, however too badly specified communications leads to ambiguity and misunderstandings.

4. Communication between engineers (Reviews, feedback and requirements).

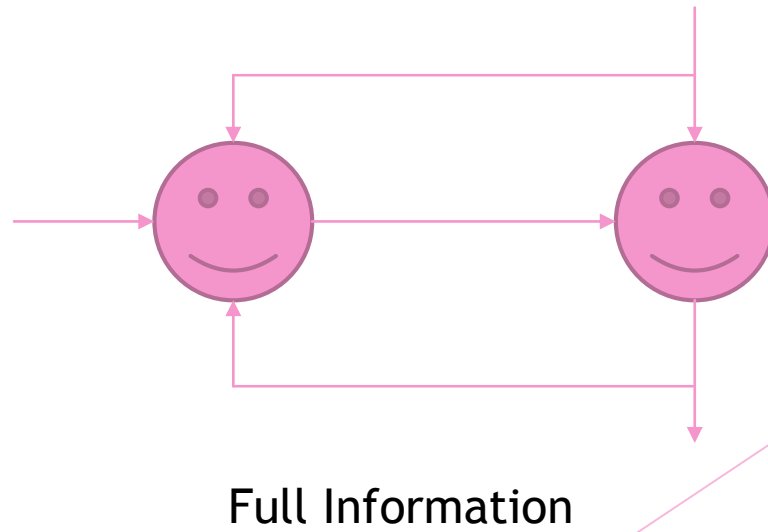
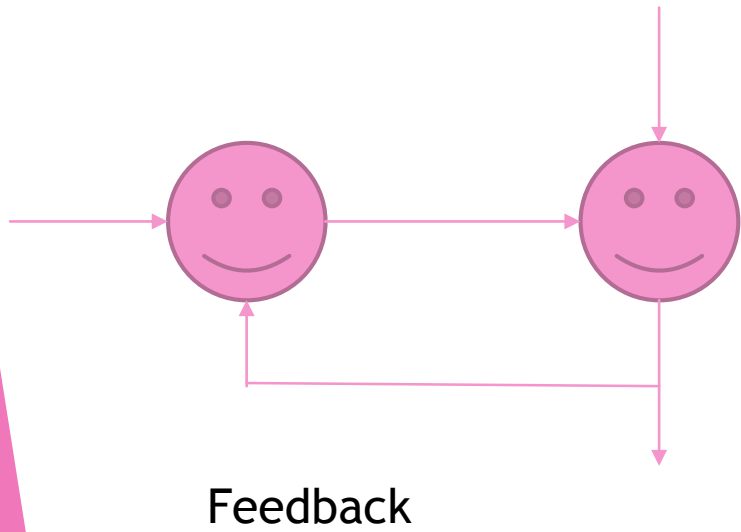
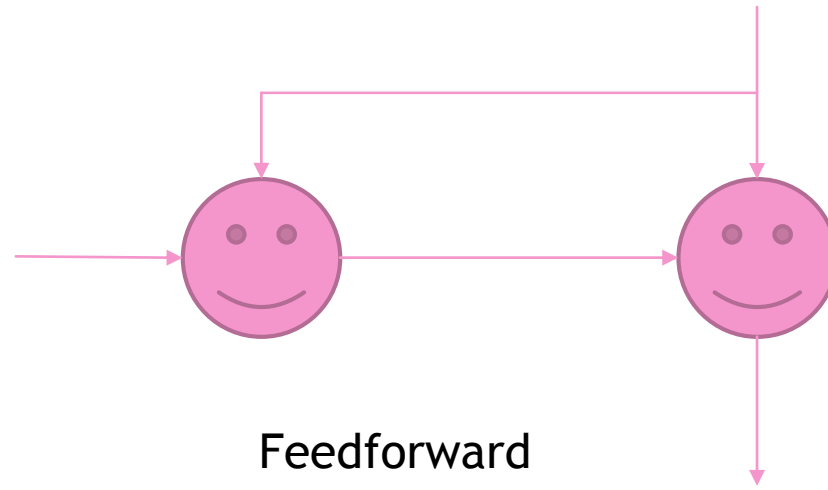
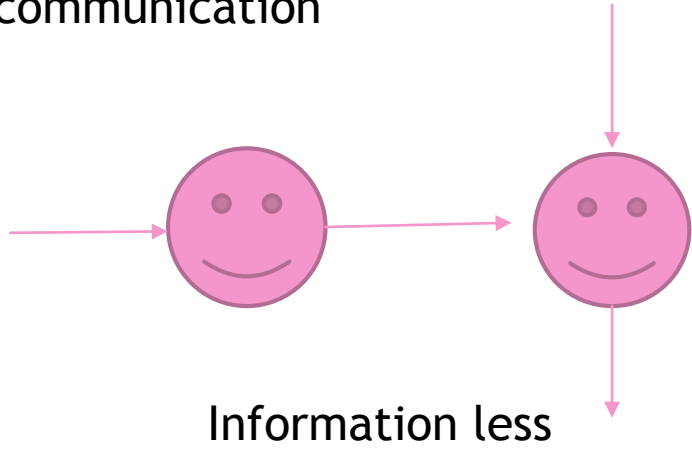
A new approach emphasizes the continual reciprocal development of product/process

The requirements communication occur in transition from scope definition for a product release, planning of the development project to the release of the product.

Organizations are now pushing towards a more joint model of interdependence during the design effort.

Phased decision-making is a widely used process to manage portfolios of new product development projects

Conventional construct identifies 3 models of communication



Research gaps in body of knowledge

1. Research has spoken about communication in general and its effect, the critical success factors are not been identified in the area of NPD
2. The literature lacks to create a link between feedbacks, reviews and communication structure with the success.
3. The literature has a very vague information on relation between feedbacks, reviews and the success of projects.

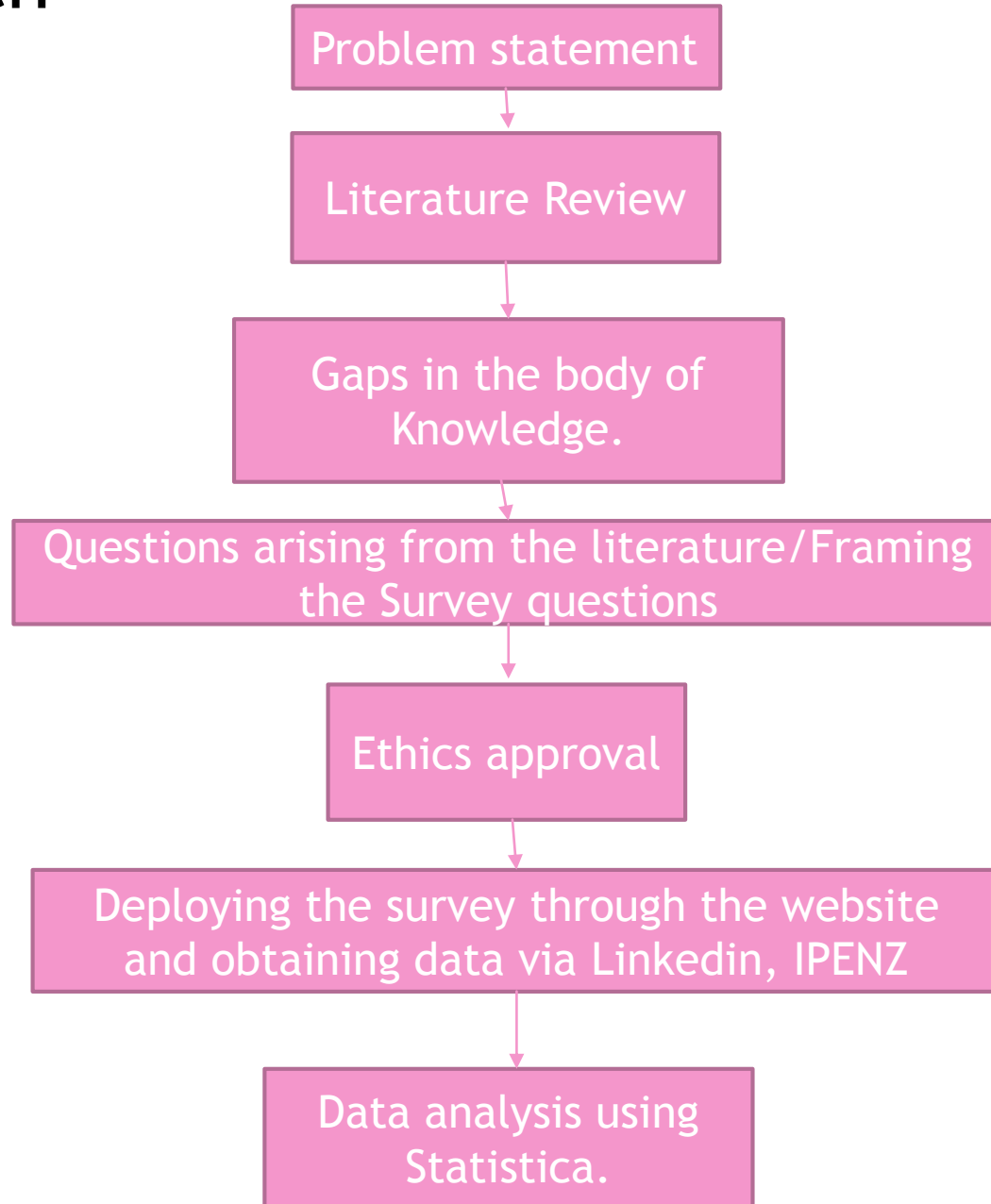
PURPOSE OF THIS PROJECT

To explore the Information flow interactions between engineers

To study the communication preferences of engineers

To study the positives and negatives of reviews, feedbacks and communication structures from an engineers point of view.

Approach



Survey Questions

1. **What percentage of communication you receive has the following?**
 - Lack of vital information/ badly specified information
 - Just right amount of Information required for performing the tasks
 - Too much detailing
2. **When do you prefer to receive feedback from other departments?**
3. **Which communication style do you prefer?**
4. **How often do you have to re do your work, because of lack of prior information regarding the capabilities of other inter-dependent teams?**
5. **How often do you have project reviews with interdependent teams?**
6. **What impact does project review have on performance?**
7. **How do pre-defined communication structures/ Protocols/ rules, impact the performance?**

Early provisional information

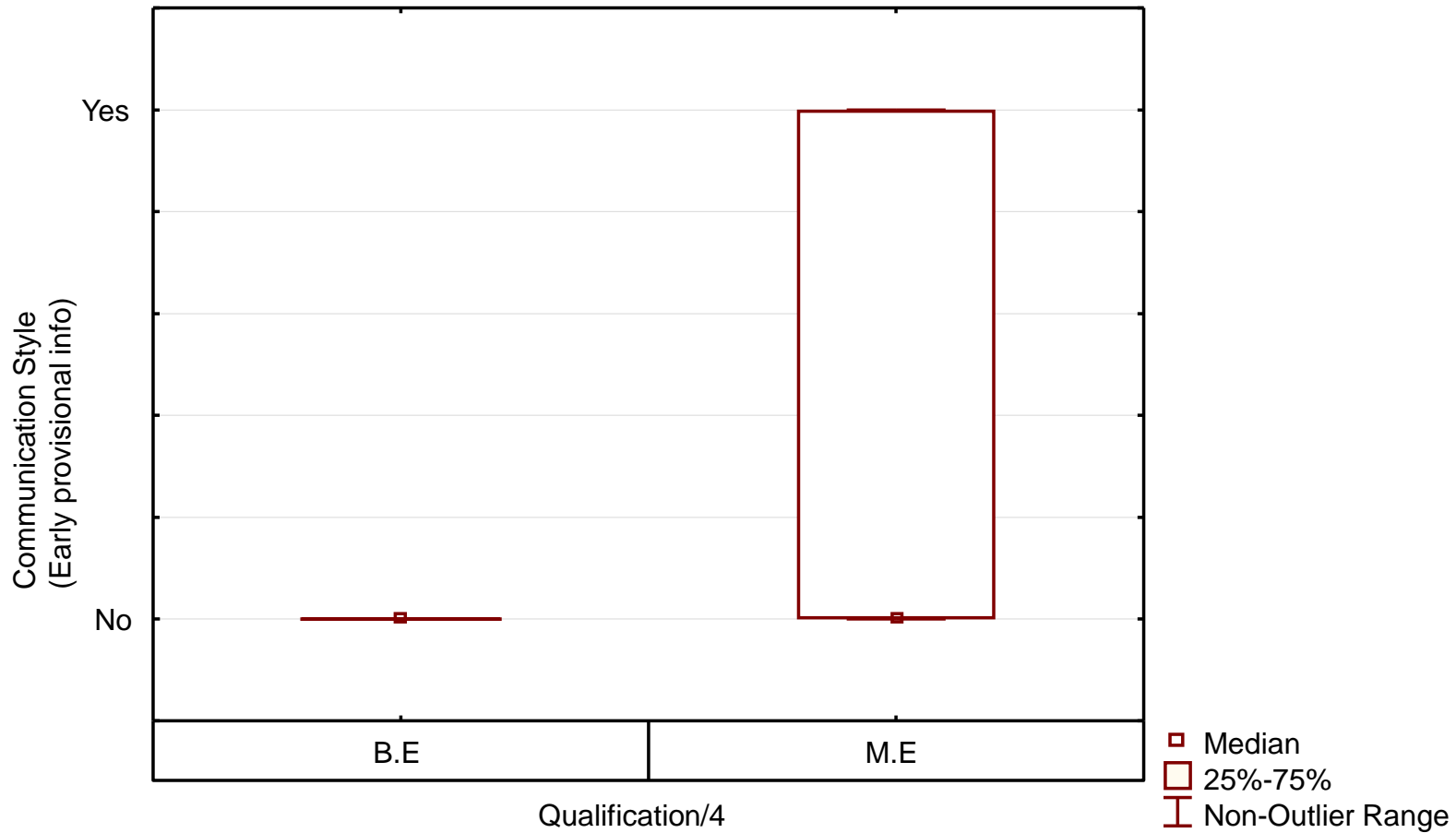
The Following 5 slides shows a few result on the communication style.

▶ **Which communication style do you prefer?**

Early Provisional Information

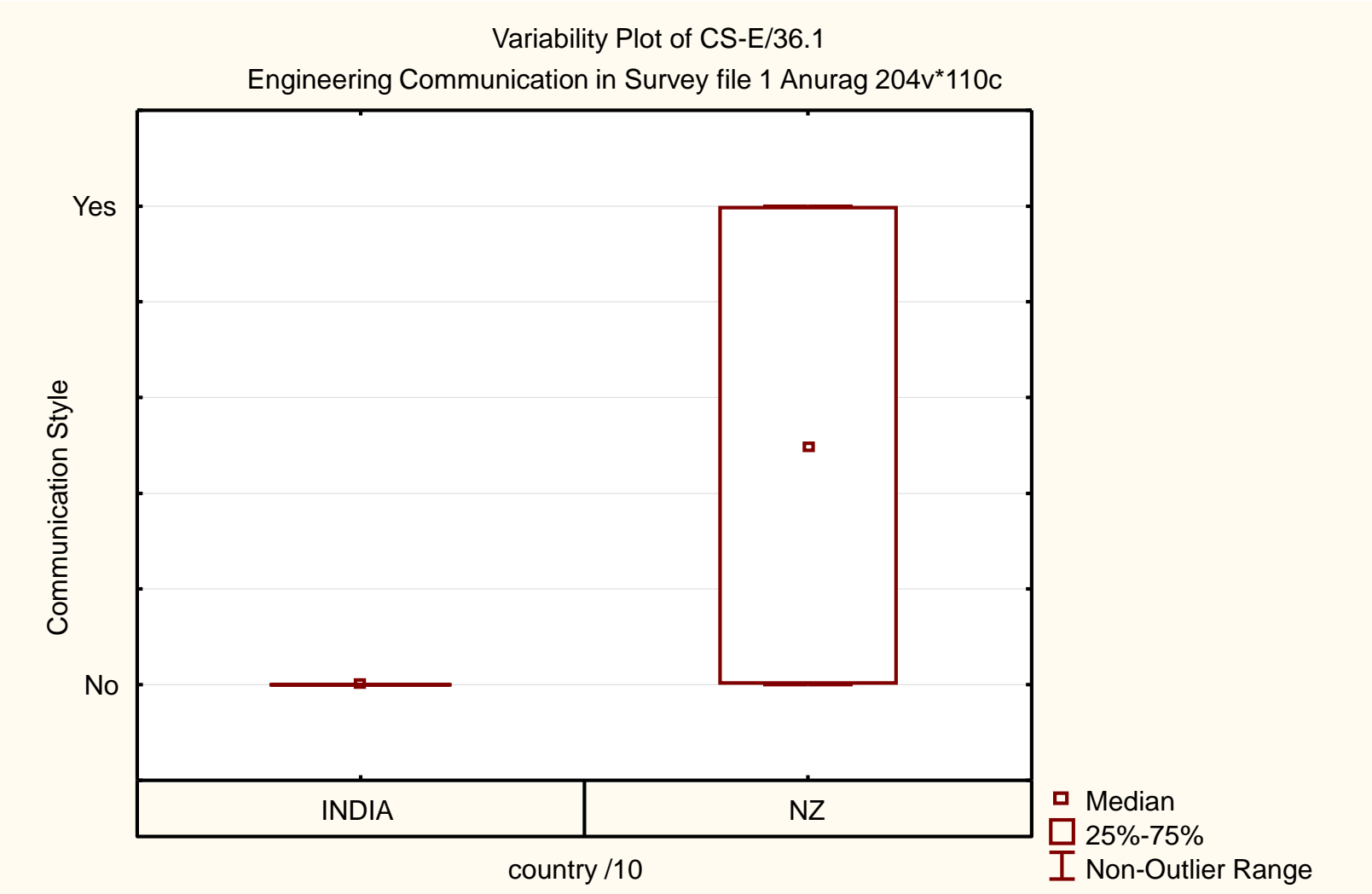
Complete Information

Variability Plot of CS-E/36.1
Engineering Communication in Survey file 1 Anurag 204v*110c



Graph1: communication style vs Qualification

Possible Reasons : Type of work, level of understanding, routine etc.

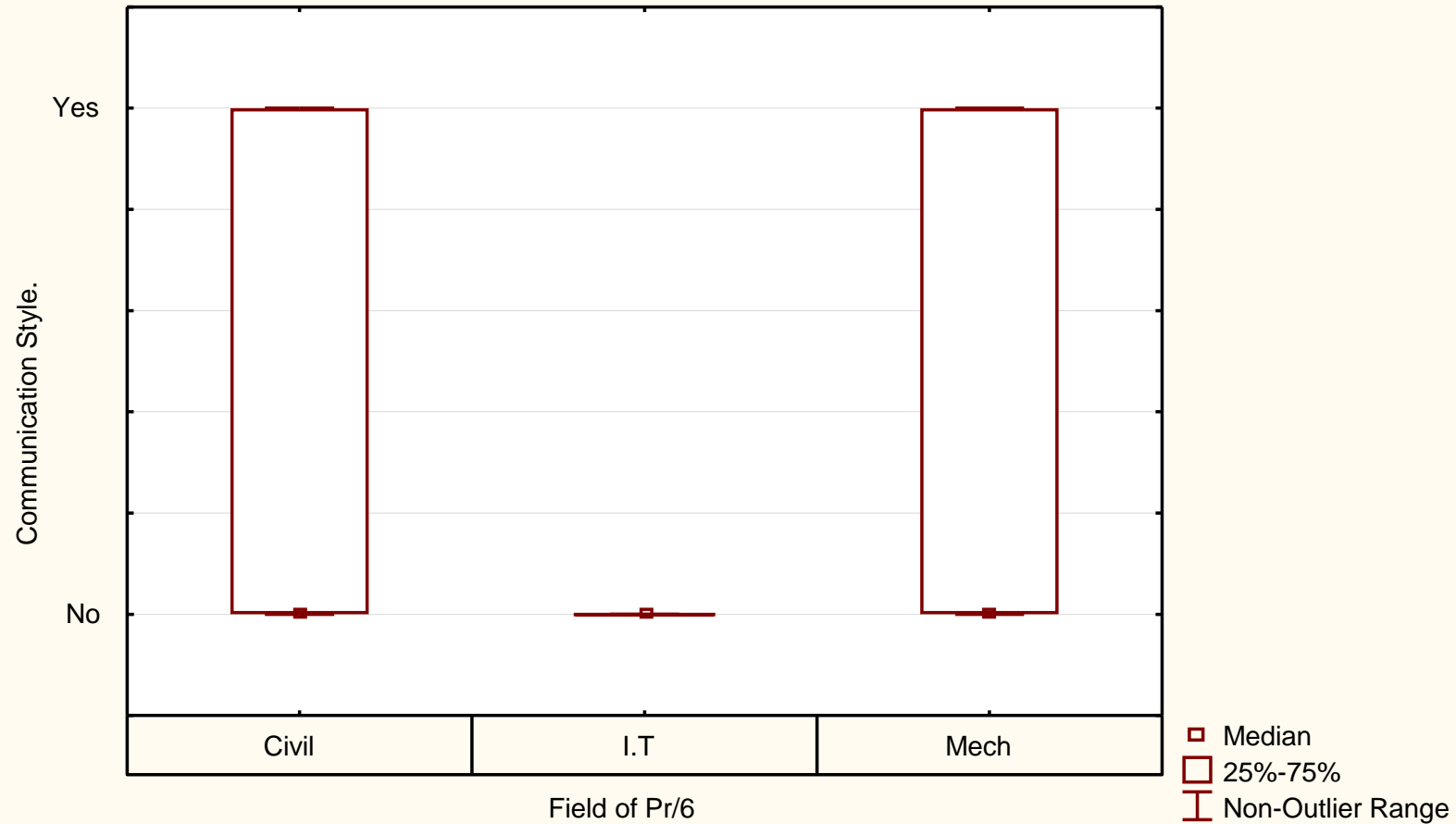


Graph 2: Communication Style vs Country

Possible reasons : cultural difference, educational style, organization size.

Variability Plot of CS-E/36.1

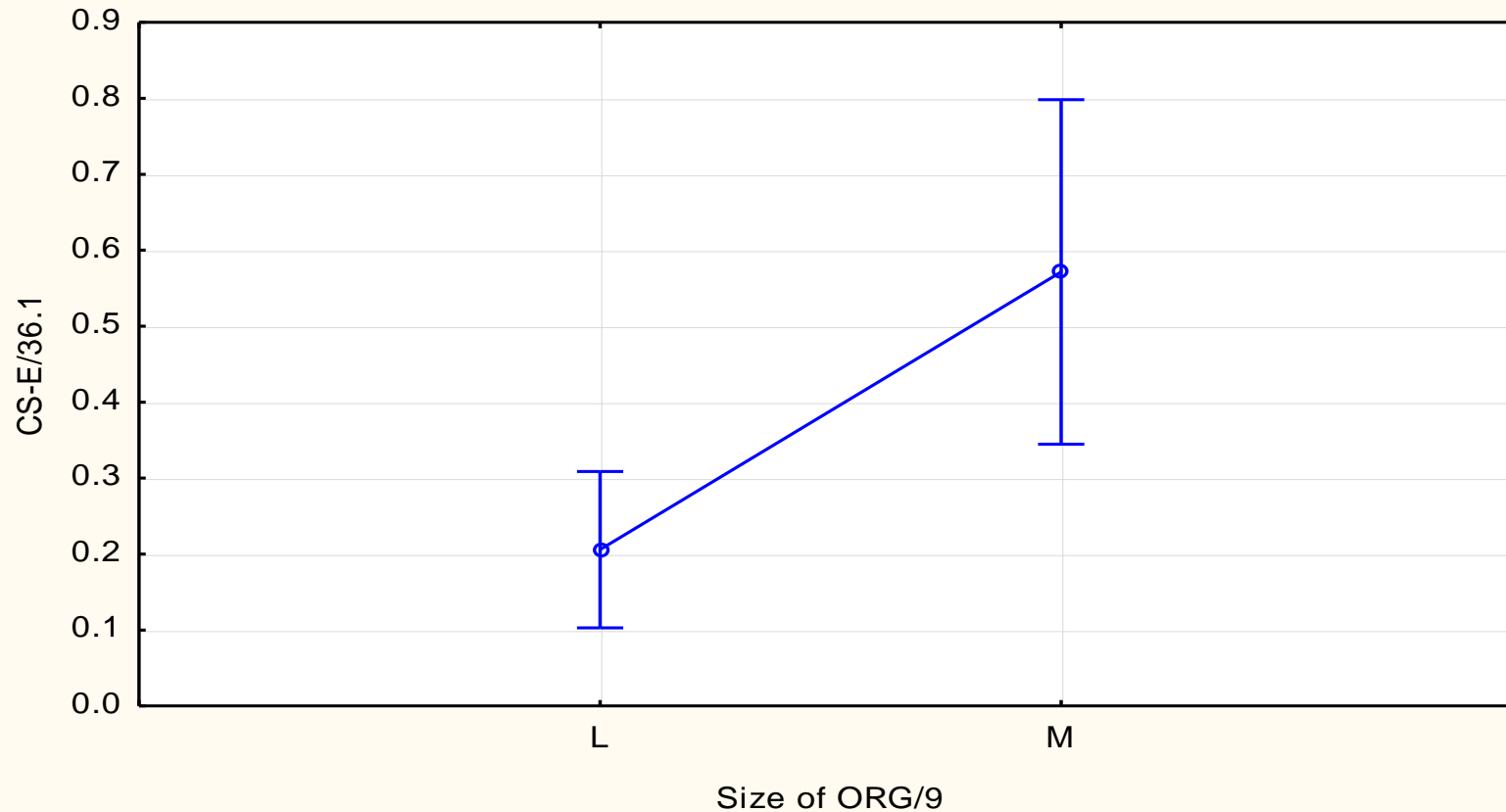
Engineering Communication in Survey file 1 Anurag 204v*110c



Graph 3: Communication style vs Field of Practice.

Possible reasons : Type of work, size of teams .

Size of ORG/9; LS Means
Current effect: $F(1, 80)=8.5319, p=.00453$
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals



Graph 4: Communication style VS Organization size

Possible Reasons : Misunderstandings due to the size, hard to stop flow of wrong information once it leaves the source.

Size of ORG/9; LS Means

Current effect: $F(1, 50)=6.1469, p=.01658$

Effective hypothesis decomposition

Vertical bars denote 0.95 confidence intervals

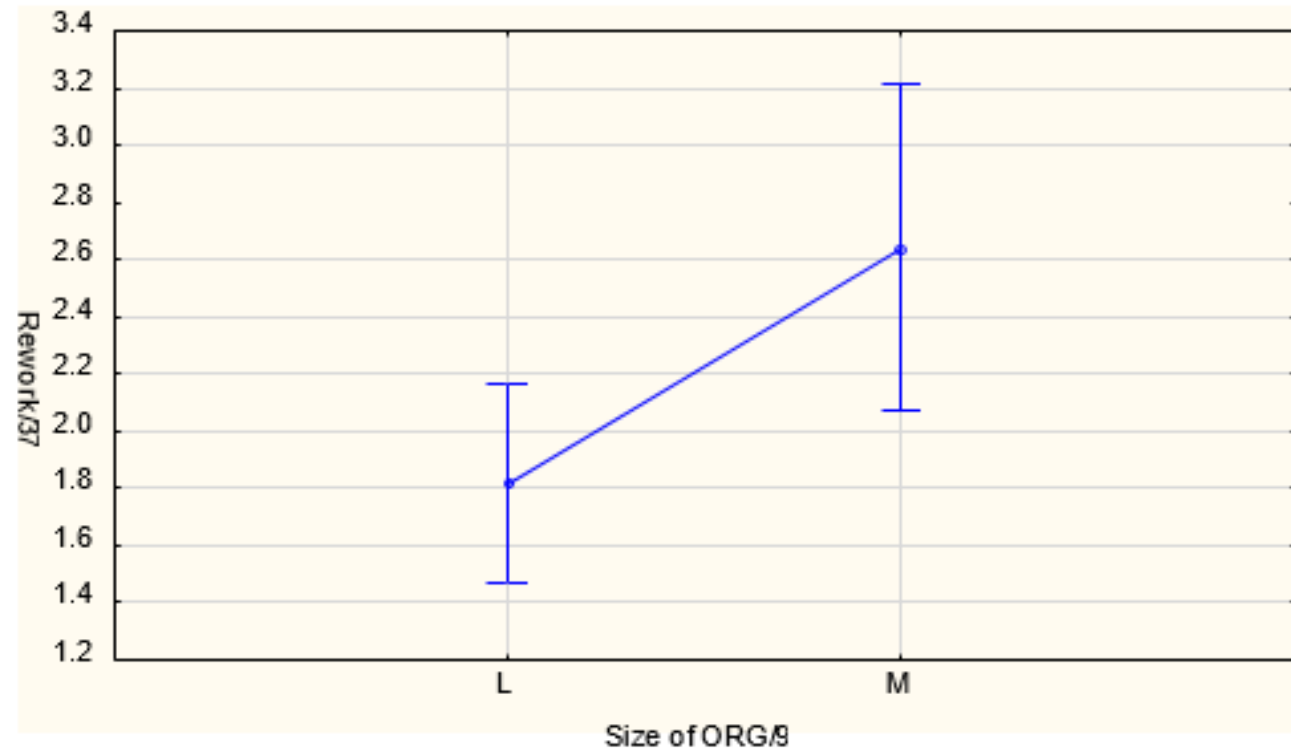
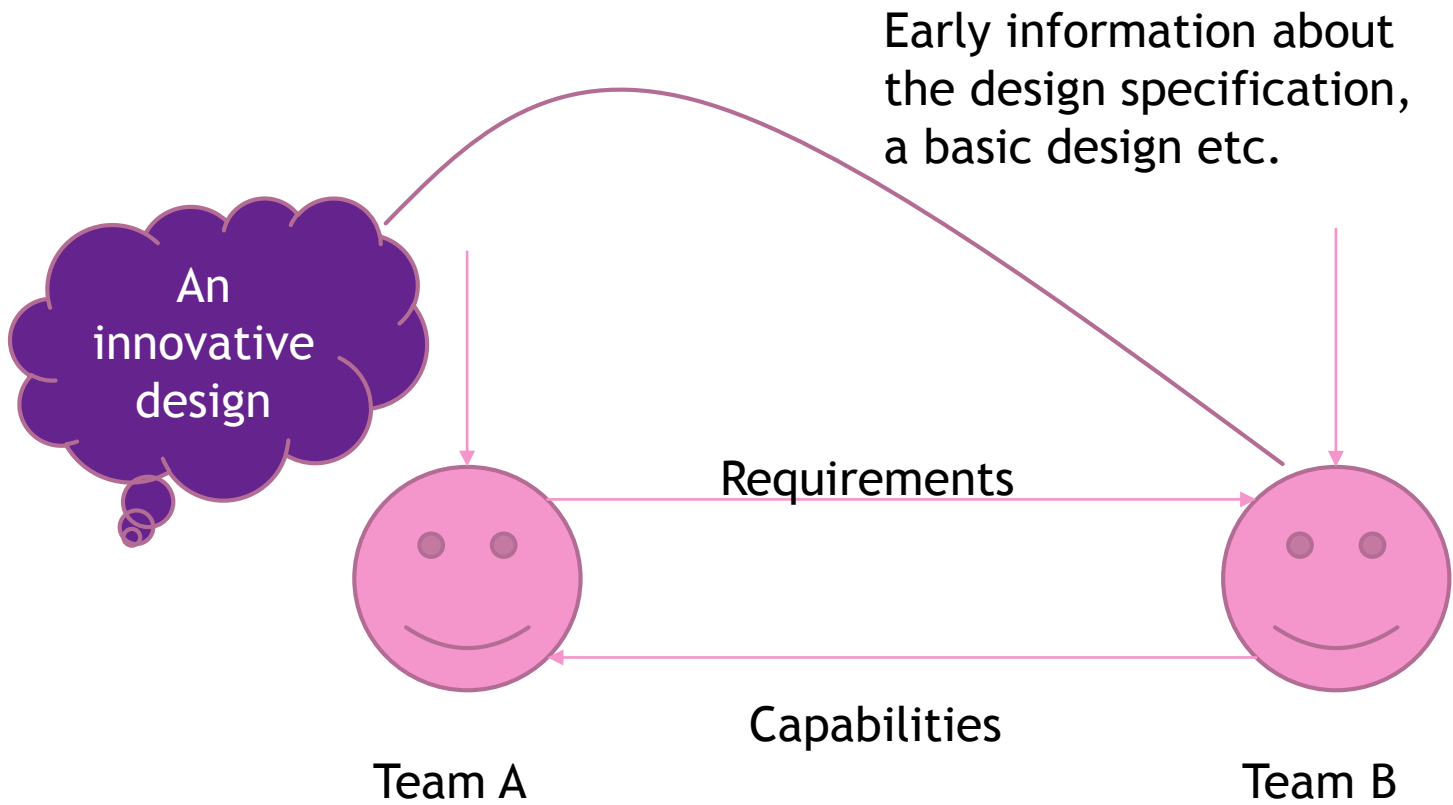


Figure 1: comparison of amount of rework in large and medium size organizations



Pros: The early design if communicated, will help the other teams to prepare in time for the changes and inform before the detailed design begins if cannot be produced.

Cons: Early information narrows the thinking, might lead to loss of ideas.

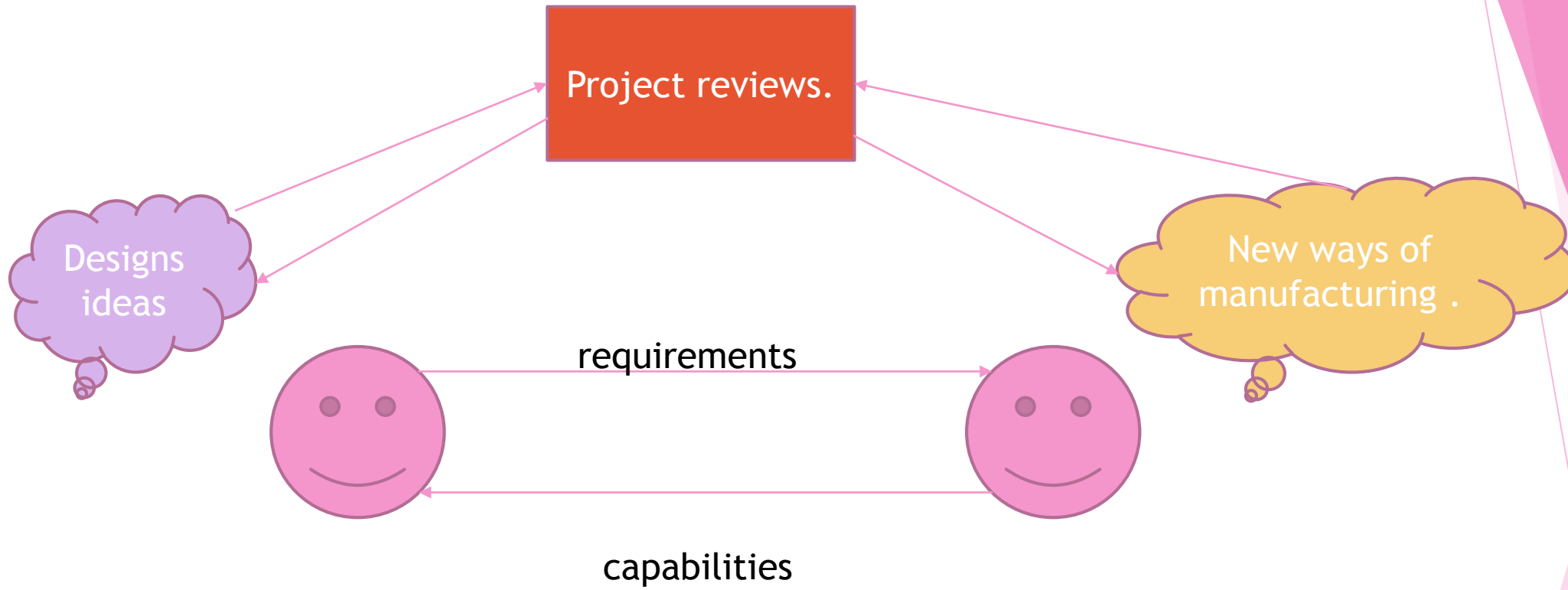
Project Reviews and Feedback.

The following few slides show the results about feedbacks and reviews in engineering teams.

When do you prefer to receive feedback from other departments?

How often do you have project reviews with interdependent teams?

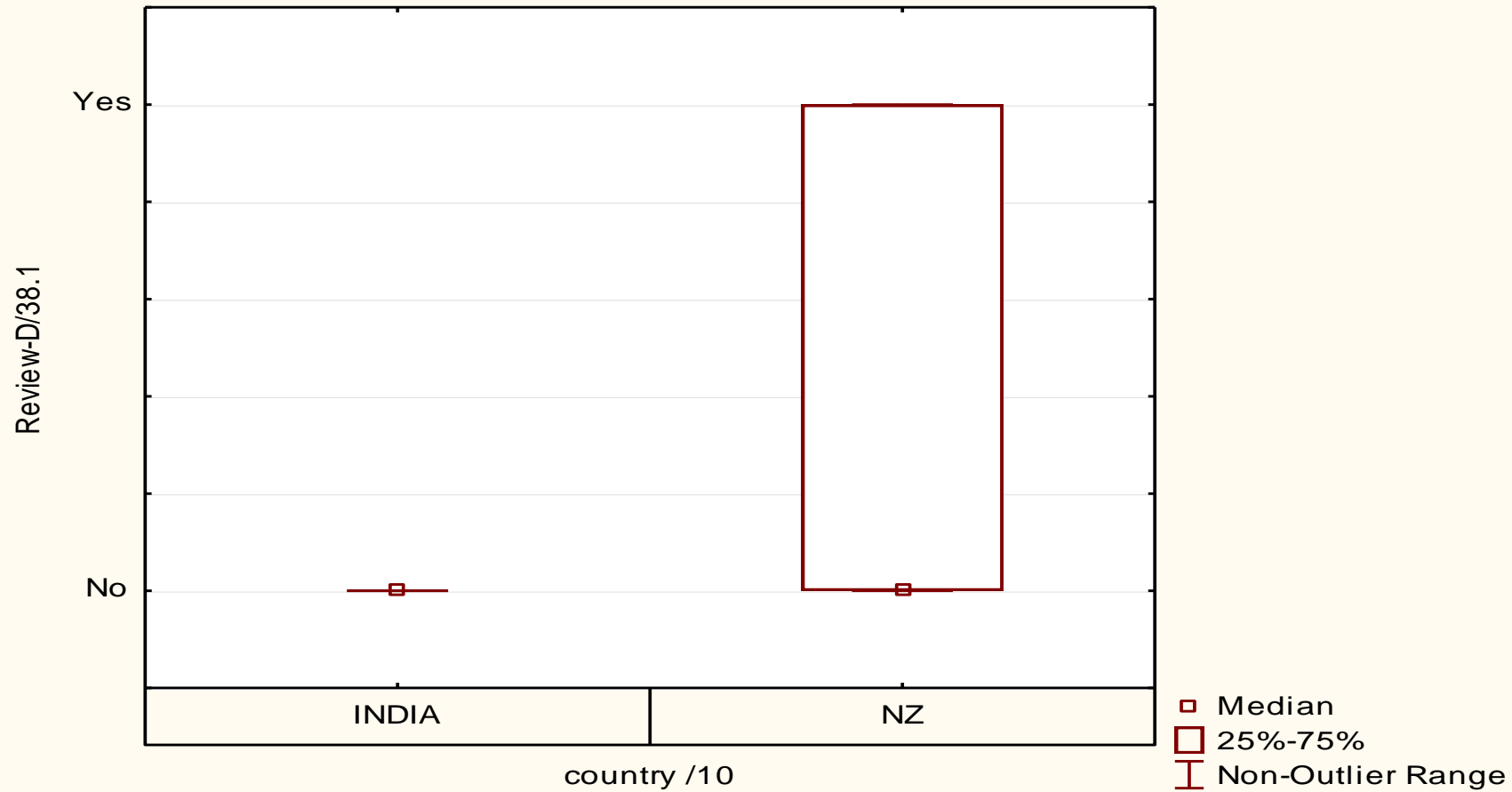
What impact does project review have on performance?



Pros: reduces misunderstanding, prevents corrective costs.

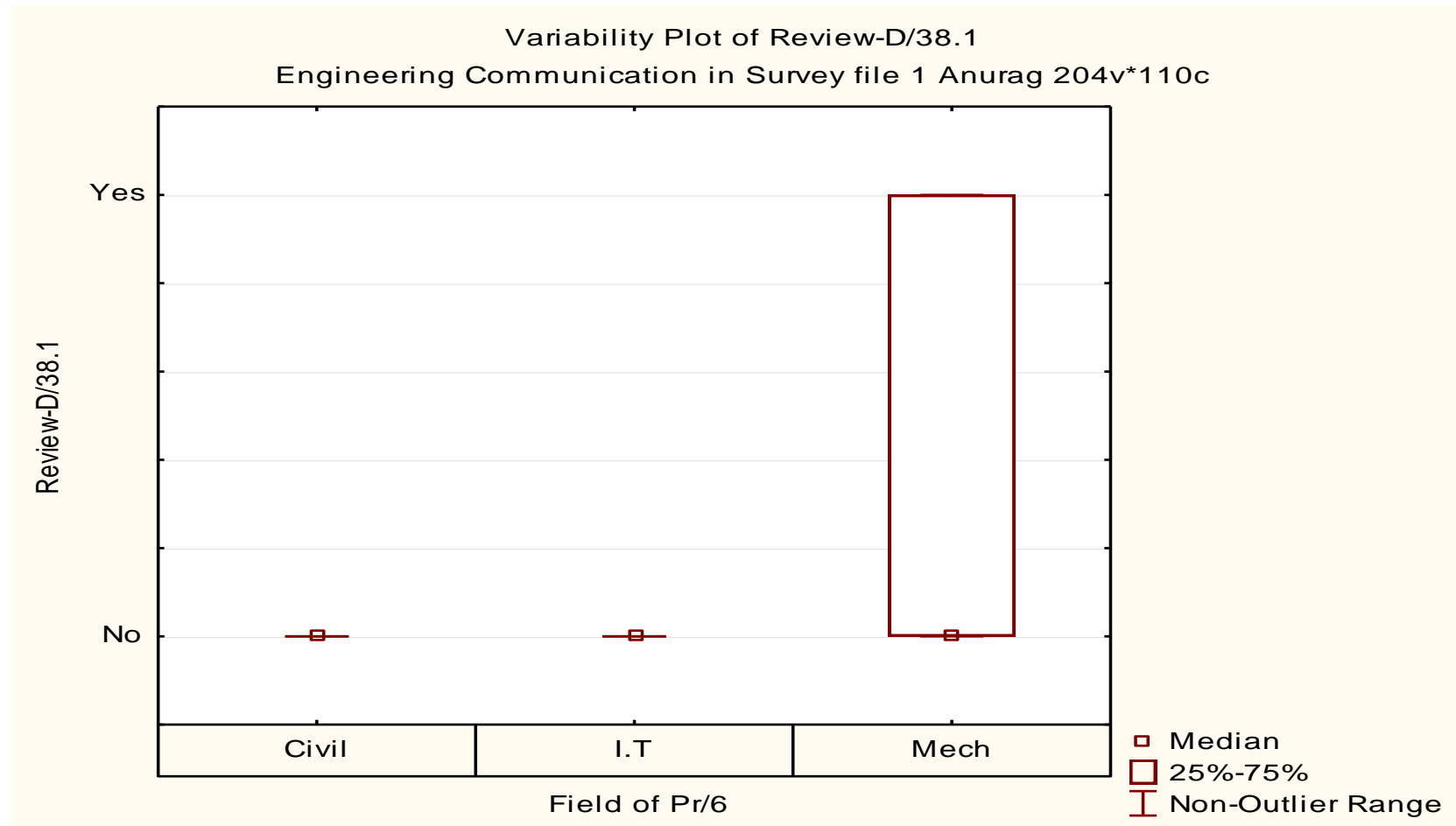
Cons: Sometimes to leads to wasting of productive time.

Variability Plot of Review-D/38.1
Engineering Communication in Survey file 1 Anurag 204v*110c



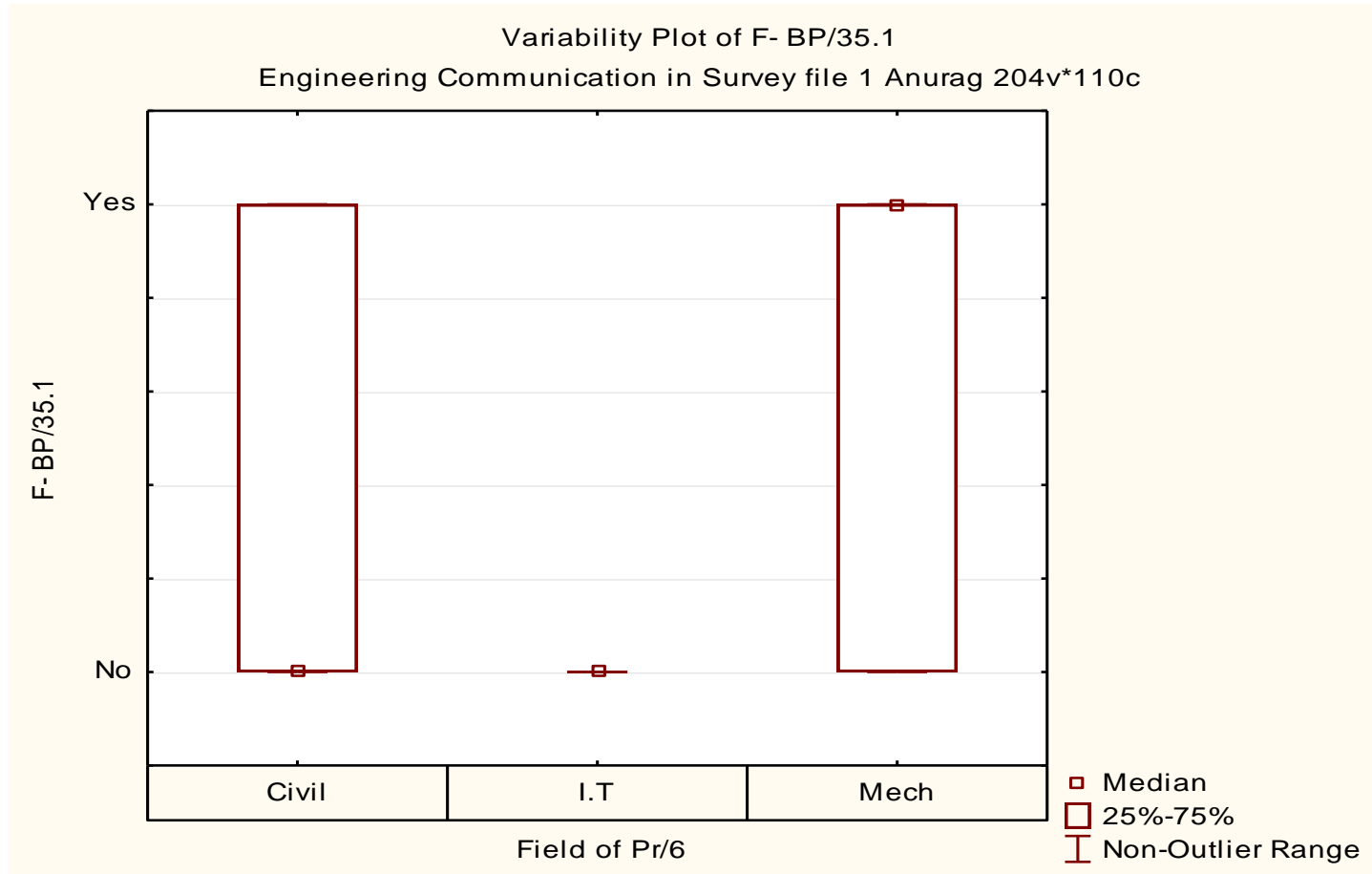
Graph 5: Reviews Vs Country

Possible Reasons : Type of tasks, size of teams .

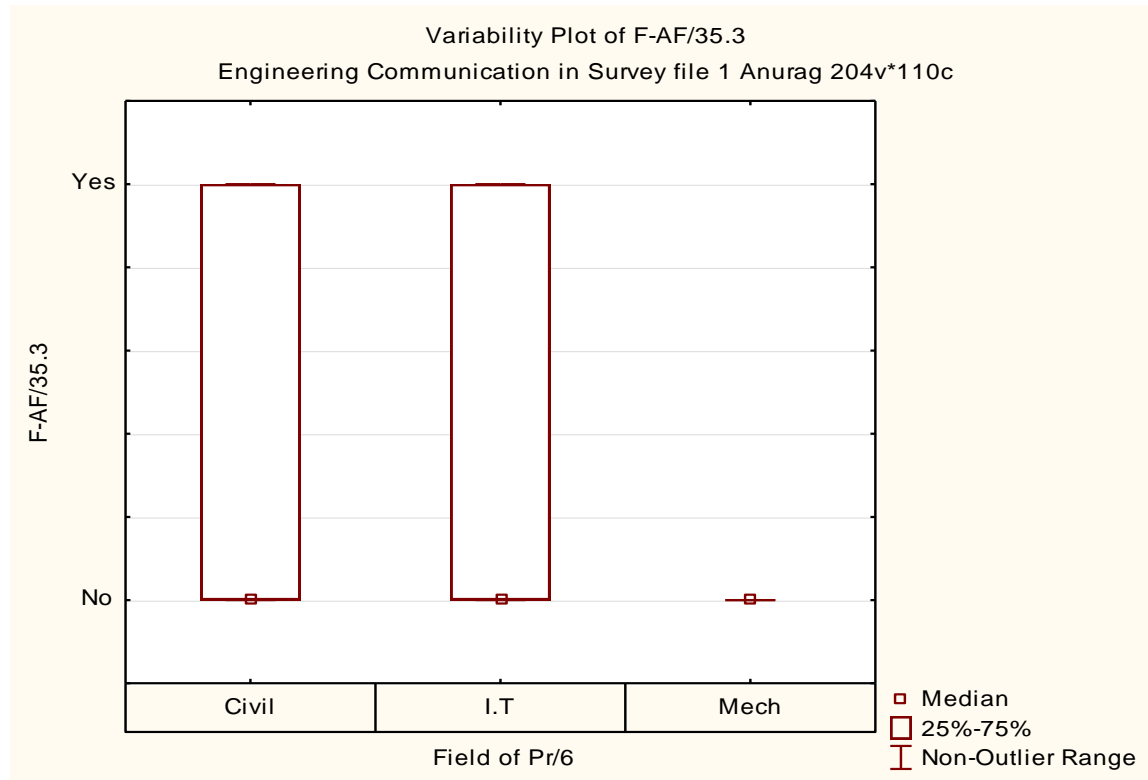


Graph 6: Reviews vs Field of Practice

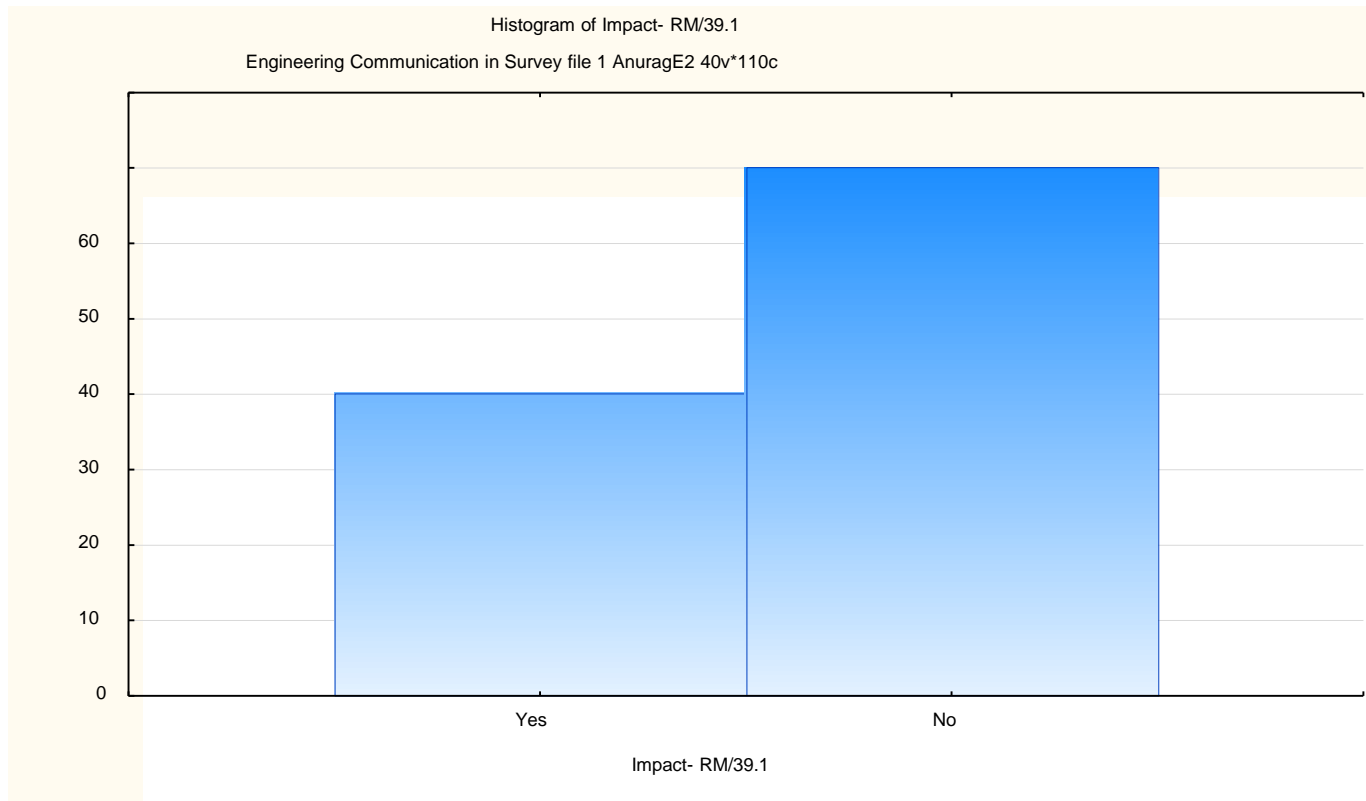
Possible reasons: Size of the projects, contribution of different teams.



Graph 7: Feedback Vs Field of Practice.

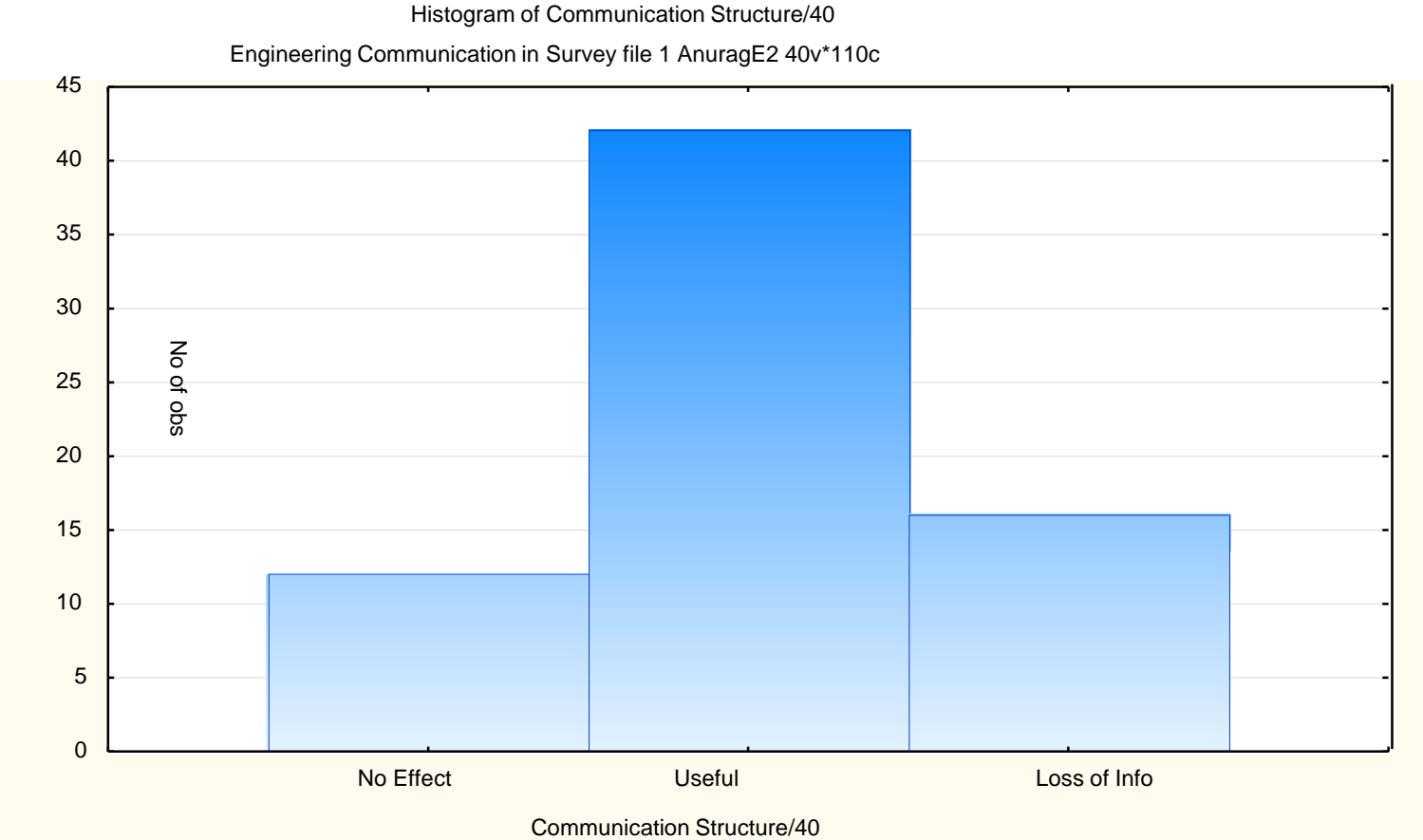


Graph 8: Feedback vs Field of Practice.



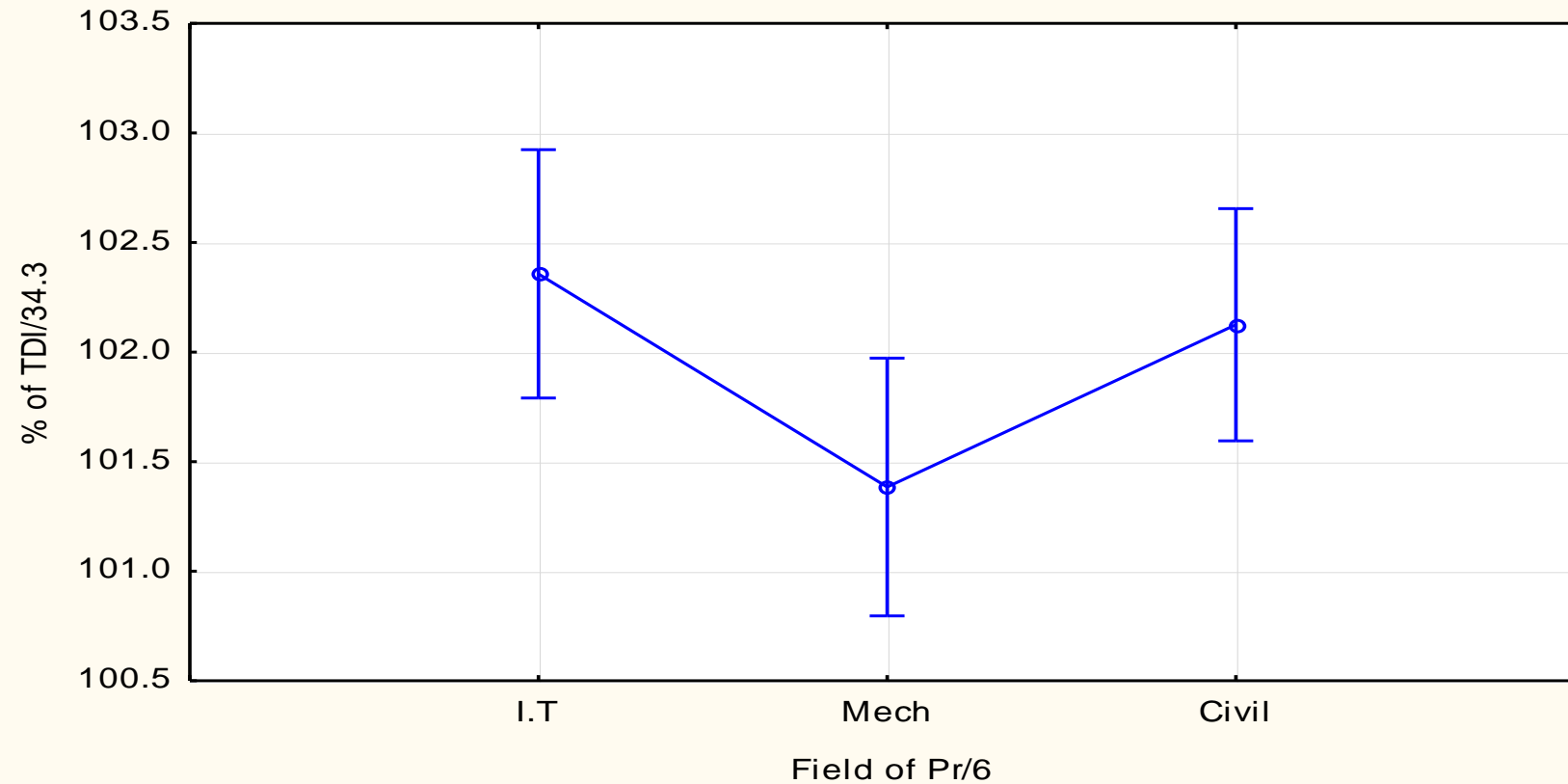
Graph 9: Histogram on usefulness of reviews.

The next Few Slides show a few general results

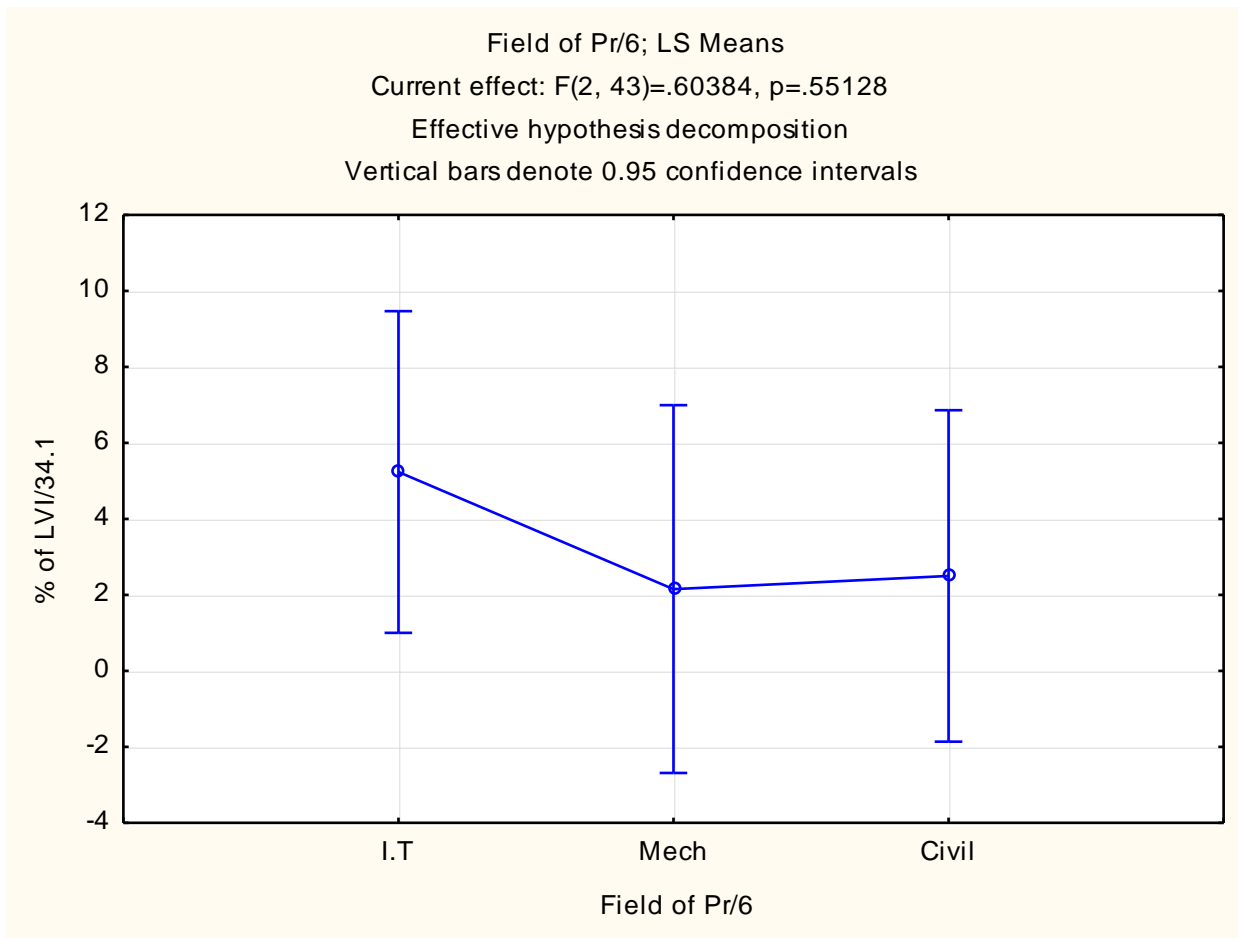


Graph 10: Histogram on effectiveness of communication structure.

Field of Pr/6; LS Means
Current effect: $F(2, 40)=3.1496, p=.05367$
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals



Graph 10:Percentage of detailed Information Vs Field of Practice.



Graph 11: percentage lacking information VS Field of practice

People say these are important but they dislike reviews because they feel they are a waste of time

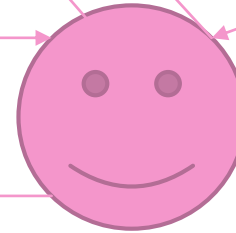
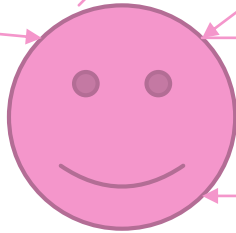
PURPOSE OF THIS PROJECT

To explore the Information flow interactions between engineers

Early information about the design specification, a basic design etc.

Project reviews.

Feedback : People tend to not like feedbacks after projects.



requirements

capabilities

Designers do not have the required information for designing .

The information is either too detailed or lacks vital information/ documentation is not right.

Conclusion

The results suggest the information flow between engineers varies depending on the size of organization and the country.

Reviews, feedbacks are very critical to development projects but are not well understood and structured, which causes a majority of them to dislike them.

Future questions for research.

Why are review process not liked by engineers, even when they are proven to reduce misunderstanding?

Why do mechanical engineers not like feedbacks after project?

New Documentation methods/techniques which do not result in wasting of productive time.

References

1. Funk, J.L., *Concurrent engineering and the underlying structure of the design problem*. Engineering Management, IEEE Transactions on, 1997. 44(3): p. 305-315.
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4. Brown, S.L. and K.M. Eisenhardt, *Product development: Past research, present findings, and future directions*. Academy of management review, 1995. 20(2): p. 343-378.
5. IEM, *Graduate Attributes and Professional Competencies* International Engineering Alliance, 2013.
<http://www.washingtonaccord.org/GradProfiles.cfm>(23 Nov 2013).
6. Cataldo, M. and K. Ehrlich. *The impact of communication structure on new product development outcomes*. in *30th ACM Conference on Human Factors in Computing Systems, CHI 2012, May 5, 2012 - May 10, 2012*. 2012. Austin, TX, United states: Association for Computing Machinery.