

# Use of Software Metrics in Agile Software Development (ASD) Process

Computer Science and Engineering Department  
University of Moratuwa

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K.V. Jeeva Padmini  
Dr. H. M. N. Dilum Bandara  
Dr. Indika Perera

# Research Contributions

- Goal – find how industry use software metrics in Agile projects
- Found following through a combination of literature survey, face-to-face interviews, online questionnaires & subject experts
  - Metrics used in ASD & Traditional Software Development (TSD)
  - Captured several new metrics
  - Most used Agile-specific metrics
  - Most used tools in Agile
  - Recommendations for metrics & tools

# Research Background

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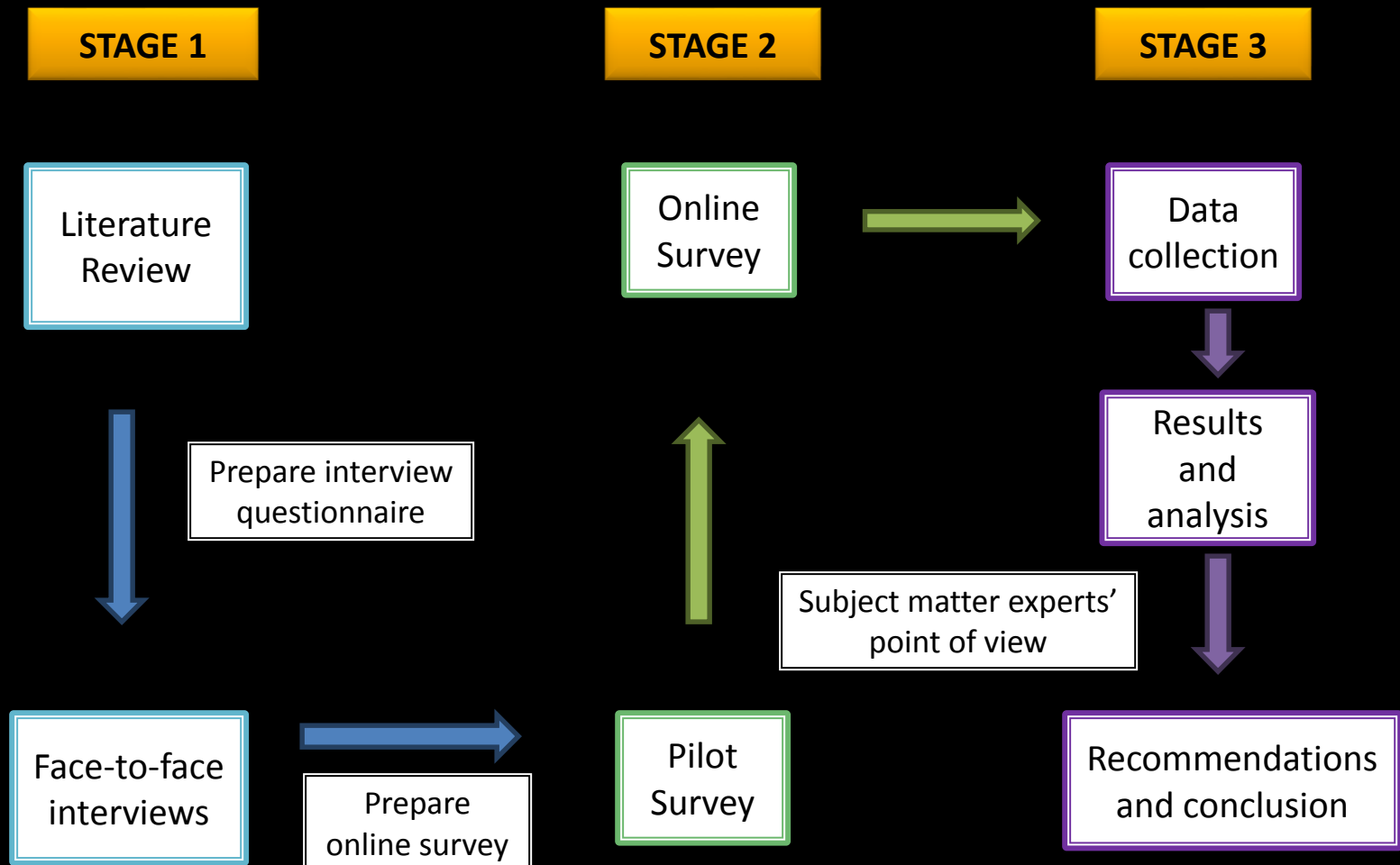
- ASD process is preferred method for modern software development
- Many established metrics available for TSD process
- Very little work exists on use & suitability for ASD process
- Most of metrics & methods from conventional lifecycle models can't be used without adapting accordingly  
(Reiner R. Dumke, 2008)

# Research Question

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What are the important metrics and their usage in projects based on ASD process?

# Research Methodology



# Selected Companies

#	Company Name	#	Company Name
1	99x Technology Ltd	14	Informatics Holdings Ltd
2	Aeturnum Lanka (Pvt) Ltd	15	Infosoft Lanka (Pvt) Ltd
3	Aepona Int Lanka (Pvt) Ltd	16	Innovative-e Pvt Ltd
4	Millennium Information Technologies (Pvt) Ltd	17	John Keells Computer Services (Pvt) Ltd
5	Content Management and Solutions (Pvt) Ltd	18	Sim Centric Technologies (Pvt) Ltd
6	Dialog Business Services (Pvt) Ltd	19	Leapset (Pvt) Ltd
7	Mubasher (Pvt) Ltd (DirecFN)	20	Netstarter (Pvt) Ltd
8	eBuilder Technology Centre (Pvt) Ltd	21	Pearson Lanka (Pvt) Ltd
9	Embla Solutions (Pvt) Ltd	22	Ridgecrest Asia (Pvt) Ltd
10	Exilessoft (Pvt) Ltd	23	ShipXpress (Pvt) Ltd
11	Hemnette Web Solution (Pvt) Ltd	24	Cambio healthcare system (Pvt) Ltd
12	HSenid Business Solutions (Pvt) Ltd	25	Virtusa (Pvt) Ltd
13	IFS R and D International (Pvt) Ltd	26	Zone 24x7 (Pvt) Ltd

# Metrics Collected from Literature Survey & Face-to-Face Interviews

#	Metric name	Source
1	Sprint level effort burndown	Interview
2	Customer satisfaction survey	Interview
3	Defect slippage rate	Interview
4	Defect removal efficiency	Interview
5	Cost of quality	Interview
6	Requirements clarity index	Interview
7	Defect density	Interview
8	Defect severity index	Interview

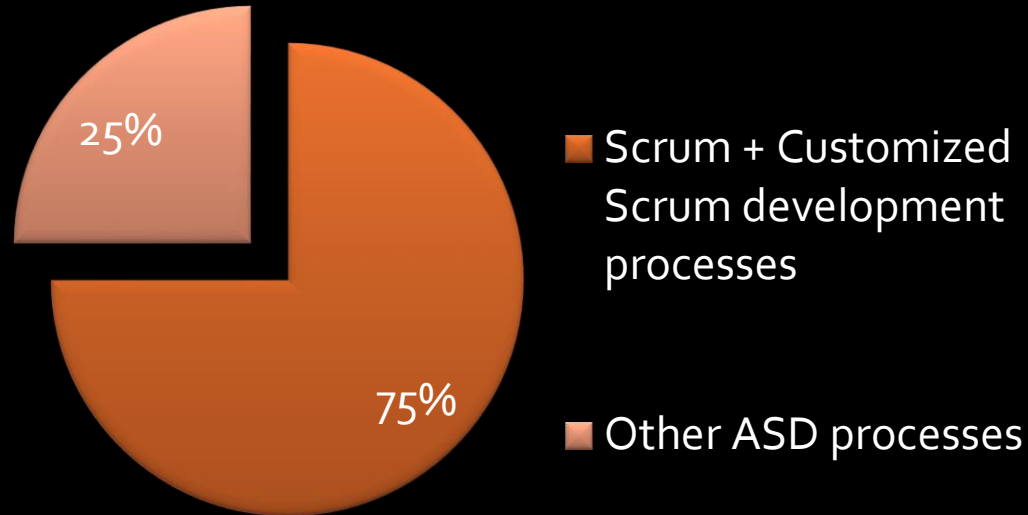
#	Metric name	Source
9	Effort variance	Interview
10	Cost of poor quality	Interview
11	Time to find a defect	Interview
12	Thumbs up rule	Interview
13	Non compliance index	Interview
14	Top hill view	Interview
15	Code coverage	Interview
16	Build breaker	Interview

# Metrics Collected from Literature Survey & Face-to-Face Interviews (Cont.)

#	Metric name	Source	#	Metric name	Source
17	Fault correction time to "Closed" state	Interview and (Mannila, 2013)	25	Definition of done check list	(Mannila, 2013)
18	Delivery on time	Interview and (Mannila, 2013)	26	Smoke test cycle time	(Mannila, 2013)
19	Technical debt	Interview and (Mannila, 2013)	27	Regression test cycle time	(Mannila, 2013)
20	Open defect severity index	Interview and (Mannila, 2013)	28	Percentage of adopted work	(Downey & Sutherland, 2013)
21	Unit test coverage for the developed code	Interview and (Mannila, 2013)	29	Percentage of found work	(Downey & Sutherland, 2013)
22	Velocity	Interview and (Downey & Sutherland, 2013)	30	Accuracy of estimation	(Downey & Sutherland, 2013)
23	Work capacity	Interview and (Downey & Sutherland, 2013)	31	Accuracy of forecast	(Downey & Sutherland, 2013)
24	Focus factor	Interview and (Downey & Sutherland, 2013)	32	Targeted value increase (TVI+)	(Downey & Sutherland, 2013)
			33	Success at scale	(Downey & Sutherland, 2013)
			34	Win/Loss record	(Downey & Sutherland, 2013)

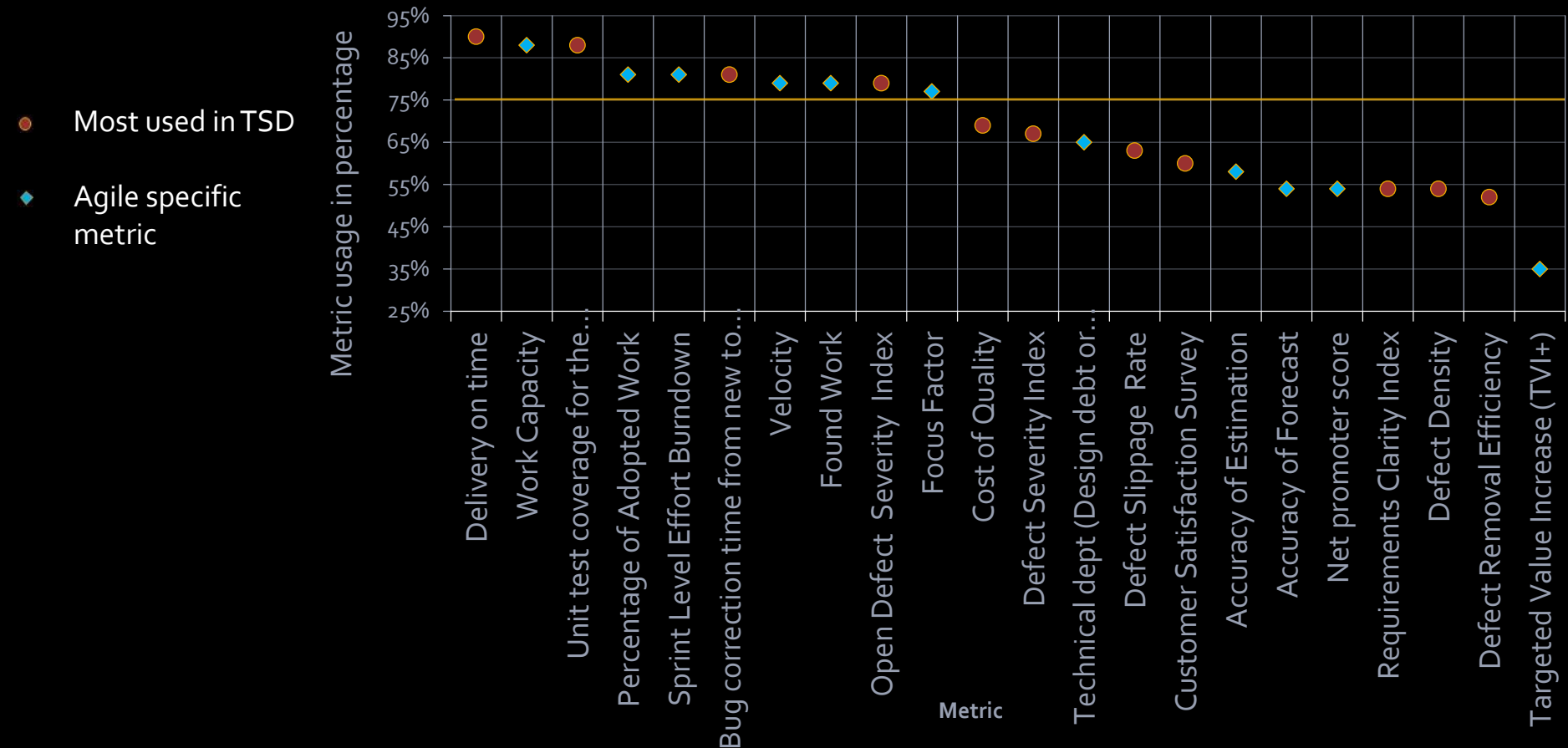


# Use of Agile Methodology



- Scrum development process was the most practised ASD methodology
- 75% of Scrum & customized scrum development processes

# Metric Distribution Based on SDLC Process



- 10 metrics are used more than 75%
- 4 metrics identified as mostly used in the TSD using in ASD as well
- Remaining 6 are Agile specific metrics

# Research Objectives & Findings

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- Research objectives
  - Identify a set of software metrics suitable for ASD process
  - Identify how those software metrics used in projects based on ASD process
  - Identify benefits of use of software metrics

# Recommended Metrics to Use in ASD

Metric Category	Measure/ Metric Name
Product quality	Unit test coverage for the developed code
	Bug correction time from "new" to "closed" state
	Open Defect Severity Index
Team productivity	Work Capacity
	Percentage of adopted work
	Velocity
	Sprint level effort burndown
	Percentage of found work
Predictability	Delivery on time
	Focus factor

# Research Objectives & Findings (Cont.)

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- Research objectives
  - Identify a set of software metrics suitable for ASD process
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# Software Metrics Usage in ASD Process

- Metrics most used in both ASD & TSD process:
  - *Delivery on time, Unit test coverage for the developed code, Bug correction time from "new" to "closed" state, and Open defect severity index metrics*
- Agile-specific metrics mostly used in ASD process:
  - *Work capacity, Percentage of adopted work, Sprint-level effort burndown, Velocity, Percentage of found work, and Focus factor*
- Metrics identified as most used in TSD process but comparatively less usage in ASD process:
  - *Requirement clarity index (54%), Defect density (54%), and Defect removal efficiency (52%)*

# Newly Identified Metrics

- Following metric identified during face-to-face interview sessions
  - Thumbs Up Rule
    - Used to measure customer satisfaction at the end of each sprint
  - Non Compliance Index
    - Used to check projects whether they run according to their company standards
  - Top Hill View
    - Used to analyse the project progress with all the scrum masters in projects after meeting every 6 months time

# Research Objectives & Findings (Cont.)

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- Research objectives
  - Identify a set of software metrics suitable for ASD process
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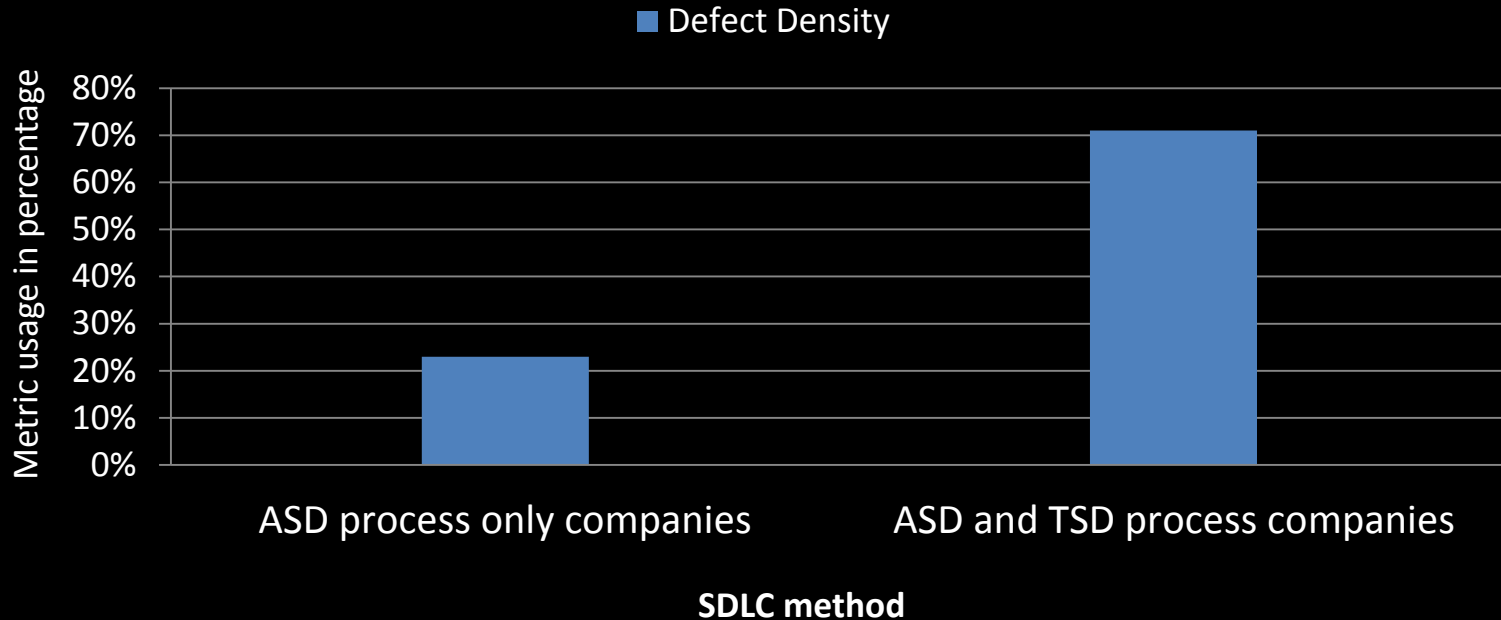


# Benefits of Metrics Usage in ASD Process

- Metrics can be used to:
  - Track project progress & project health
  - Monitor quality aspect of the project or product
  - Helps team to forecast & manage project better
  - Identify areas needs to be improved
  - Improve estimation
  - Improve development process
  - Brings alignment to across cross-functional teams working in the same project

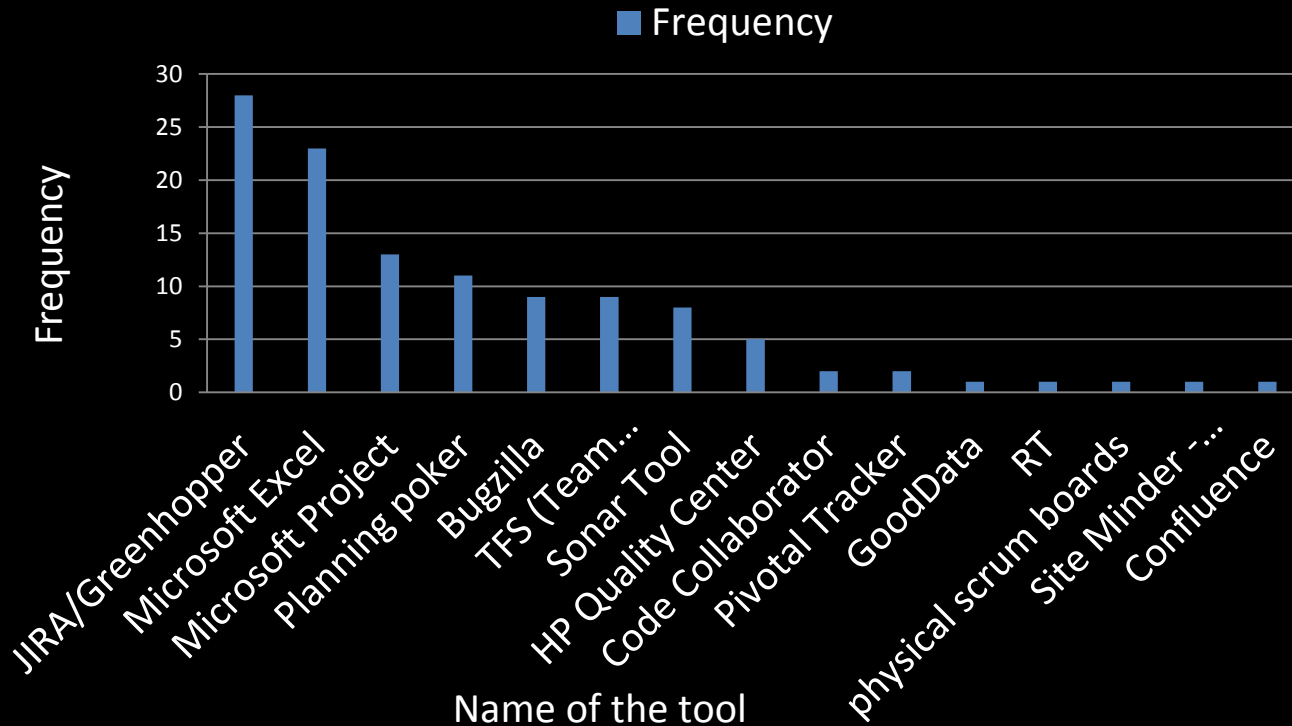
# Defect Density

Comparison of metric usage in ASD only and ASD and TSD companies



- Not used frequently by the Agile process only companies
- TSD and ASD process companies used it frequently

# Tool Used in ASD



- JIRA/Greenhopper was most frequently used tool
- Microsoft Excel was the second best tool
- ASD process only companies most use JIRA/Greenhopper with supportive tools
- ASD & TSD process companies use Microsoft excel as primary tool

# Recommended Tool to Use in ASD

- Recommended to use JIRA/Greenhopper tool with supportive tools in ASD process
- Following metrics can be measured in JIRA/Greenhopper tool
  - Directly
    - Work Capacity
    - Percentage of Adopted work
    - Sprint-Level Effort Burndown
    - Velocity
    - Percentage of Found work
  - Indirectly
    - Focus Factor
    - Open Defect Severity Index
    - Unit Test Coverage for the Developed Code
    - Bug Correction Time from New-to-Closed state

# Summary

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- We analysed the usage & benefits of software metrics
- Identified 10 recommended metrics to be used in ASD process
  - 6 agile specific metrics + 4 common metrics
- 10 metrics focuses on product quality, team productivity, & predictability
- 3 metrics identified during face-to-face interview sessions
  - Thumbs Up Rule, Non Compliance Index, Top Hill View
- JIRA/Greenhopper tool is recommended tool to use with supportive tools in ASD process

# Key References

- Downey, S., and Sutherland, J. (2013). Scrum Metrics for Hyperproductive Teams:. System Sciences (HICSS), 2013 46th Hawaii International Conference on. Hawaii: IEEE.
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- Sutherland, J. (2009). Fully Distributed Scrum: Replicating Local Productivity and Quality with Offshore Teams. (pp. 1 - 8). Big Island, HI: System Sciences, 2009. HICSS '09. 42nd Hawaii International Conference