

The Evolving Role of the Software Cost Estimator

Prepared for:
Joint Software & IT Cost Forum 2020

Presented By:
Kevin McKeel



September 15, 2020

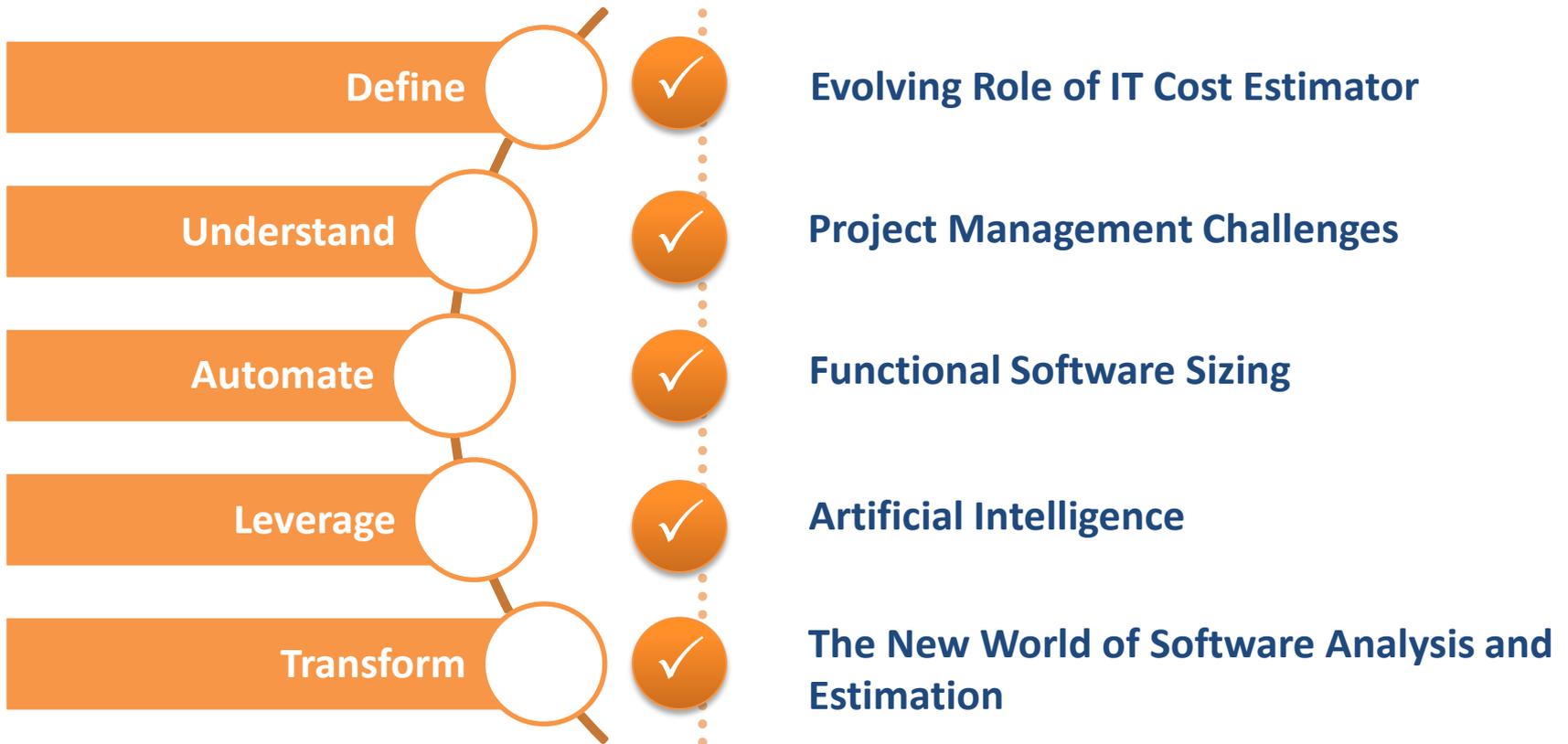
Abstract

The world of software estimation is struggling to keep pace with the changes in the speed of software delivery. More than 80% of major federal IT projects now using Agile processes, planners are under increasing pressure to keep up and add value. Providing accurate cost, schedule, and labor estimates is nearly impossible without a full understanding of the technology solution to be delivered and tools that reduce analysis cycle time. Federal IT Project Managers are simply not interested in funding 6-month Business Case Analyses, and often pose different questions to estimators than simply the long-range budget forecast.

A key aspect of this change involves functional size measurement. The industry has moved away from source lines of code analysis, and Agile projects speak in terms of features, epics, and user stories. Function points continue to be well-suited to Agile estimation due to being standardized and following a well-established set of rules that can be readily applied. However, functional sizing is a tedious and rigorous process. Fortunately, advances in Artificial Intelligence and Natural Language Processing can be utilized to cycle through hundreds of requirements or user stories and translate planned capabilities into software size. The analyst can then focus on adjusting the measurement and requirements elaborating.

By taking advantage of advances in computer science, we as estimators can continue to add value to projects by providing rapid estimates, identifying impacts of feature changes, responding to Project Manager requests, and advising our clients on technology alternatives.

Agenda



Software Estimator's Role

Traditional Role

- ❁ Waterfall acquisition and development processes
- ❁ Estimator trained in statistics, hardware cost estimation, CER development
- ❁ 4-6 Month analysis period
- ❁ Cost-centric
- ❁ Software size based on SLOC-based analogies, SME input, or functional sizing (if CFPS on staff)
- ❁ Inflexible cost models

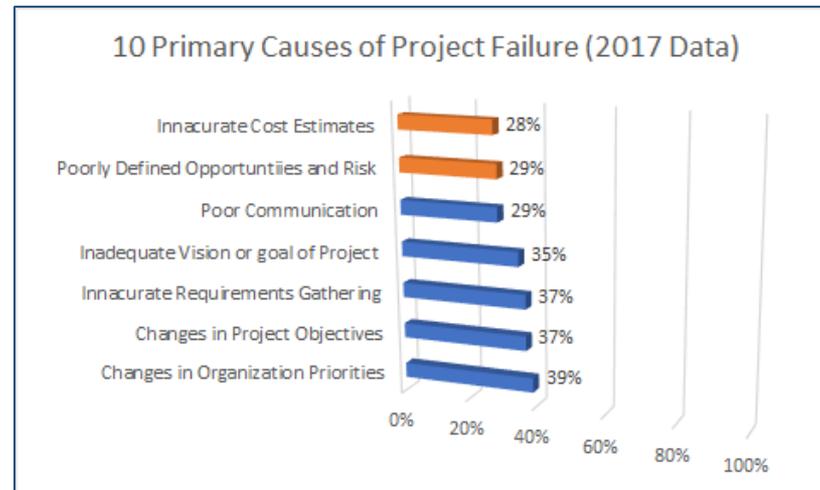
Evolving role

- ❁ Hybrid of Waterfall and Agile acquisition and development processes
- ❁ Estimator trained in Agile, functional size measurement, and Artificial Intelligence
- ❁ 4-8 Week analysis period
- ❁ Technology-centric
- ❁ Software size based on quick-sizing function point methods
- ❁ Flexible cost models



IT Project Management Challenges

- 🌀 Project Management failure rates¹
 - 66% of enterprise software projects exceed budget
 - 33% do not meet schedule
 - 20% fall short of expected performance
- 🌀 Two of the top six causes for IT project failures relate to inaccurate estimates and inadequate risk analysis²
- 🌀 Cost Estimators have direct influence on both



1. McKinsey 2. Finances Online

Agile Metrics

- 🌀 A common project management adage is that 80% of end users only use 20% of the software features
 - Agile addresses this through MVP concept
 - Focus on business value through continuous delivery pipeline



- 🌀 PWC argues that Agile projects are 28% more successful than traditional
 - Government agencies face challenges in adopting Agile and DevOps due to acquisition barriers
 - Cost estimators can assist their agencies by identifying alternatives and risk reduction strategies

Agile and Software Sizing

Agile Sizing Challenges

- User Story points are inherently difficult to utilize in an estimate due to lack of consistency across Agile teams and poor metrics collection
- User stories are frequently unknown beyond the next few PI
- Many user stories support research, spikes, and environment setup

Sizing Approaches

- Apply automated function point techniques to develop size estimates for each user story, feature, and epic
- Use proxy sizing when appropriate

Best Practices

- Collect user stories and any available artifacts describing functionality
- Remove non-functional requirements
- Include technical debt and refactoring user stories
- Utilize automated function point estimate where applicable, due to being a uniform standard
- When using proxy sizing (user stories, use cases), understand there is not a uniform standard and make sure to calibrate local data
- Use burn down charts and cumulative flow data when available

Sample Case Study

Background

- Federal program needs an Independent Life Cycle Cost Estimate for the next 3 years
- Program is modernizing a legacy system and reusing various components, adding COTS, and shifting to cloud hosting
- Agency has adopted Agile and DevOps but lacks maturity

Approach

- Gain Product Owner's approval by speaking in Agile terms (User Stories instead of requirements)
- Software size/effort based on function point sizing from backlog using AI/NLP software sizing
- Estimation team includes AWS SME who provides hosting estimates based on computing, storage, and migration requirements
- Deliver capacity-based estimates related to PIs and planned sprint teams

Best Practices

- Collect software delivery metrics
- Automate software sizing
- Utilize parametric models to model what-if scenarios
- Align deliverables to incremental funding model

Challenge

- Limited access to SMEs
- Epics and Features are not defined past the next two Program Increments
- Product Owner provides User Stories, though oversight agency will not accept user story or story point-based LCCes

Impact

- Analysis Team has aligned its delivery tempo to provide estimation support when most needed, not based on fiscal year cycle
- Estimator delivered agile, light weight deliverables that provide budget and acquisition alternatives
- Set up metrics program to support future estimates

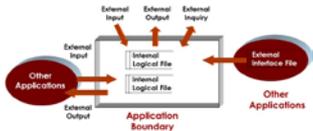
Observations

- Most Software projects can be estimated within weeks
- Estimator will need to synchronize deliverables to support program pivots and priority adjustments

Basic Estimation Approach

1. Develop Functional Size

- Collect vision and scope documents
- Collect backlog data (epics, features, and stories)
- Estimate via fast Function Point size
- Utilize Proxy Sizing
- Use analogy as last resort



2. Identify Process Maturity

- Identify Process Maturity
- Check alignment with Agile principles and best practices
- Confirm cross-functional team composition
- Collect and review Agile metrics



3. Evaluate Complexity

- Identify Cyber requirement
- Review System Architecture
- Determine software technology
- Review non-functional requirements and technical debt



4. Apply Productivity Factors

- Determine productivity
- Develop traditional software productivity measures (FP/month)
- Evaluate schedule against capacity
- Develop crosschecks
- Apply risk



Functional Size Measurement

Pros

- 🌀 Standardized methodology supported by IFPUG CPM
- 🌀 Based on user's perspective
- 🌀 Can be approximated from project requirements or User Stories
- 🌀 Supports estimation and benchmarking

Cons

- 🌀 Time-consuming
- 🌀 Complex business rules
- 🌀 Requires training to be proficient
- 🌀 Limited availability of CFPS

Solution: leverage NLP to build size measurement workflow, reduce counting effort, and serve as training tool

Artificial Intelligence (AI) and Natural Language Processing (NLP)



- AI is defined as the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
 - We will make the assumption that cost estimators have human intelligence, although this hypothesis has not been proven empirically
 - Cost estimating involves many repetitive tasks that can be streamlined through AI



- NLP is a subfield of linguistics, computer science, information engineering, and artificial intelligence concerned with the interactions between computers and human languages. NLP focuses on how to program computers to process and analyze large amounts of natural language data
 - Software requirements and User Stories are repetitive by nature
 - Challenge is aligning business rules to the natural language

Natural Language Processing

Natural Language Processing Enables Faster and Deeper FPA



Automating Previously Human-Dependent Functions

- ⦿ Natural Language Processing (NLP) enables computers to derive meaning from human or natural language input



Cutting-Edge Technology, Getting Smarter by the Day

- ⦿ NLP has made dramatic strides in the last decade with new tools and extensive research



Wide Use Across Government and Industry

- ⦿ Industries using NLP technology – defense intelligence, legal, healthcare



Requirements are excellent subjects for NLP analysis because they have a semi-structured construct

NLP and Functional Size Automation

Natural Language Processing – Requirement Example

#3.2 System shall update the Masterfile based on XXX calculations.

Req. #	Subject (noun)	Verb	Object (noun)	Prepositional phrase
3.2	System	shall update	Masterfile	based on XXX calculations

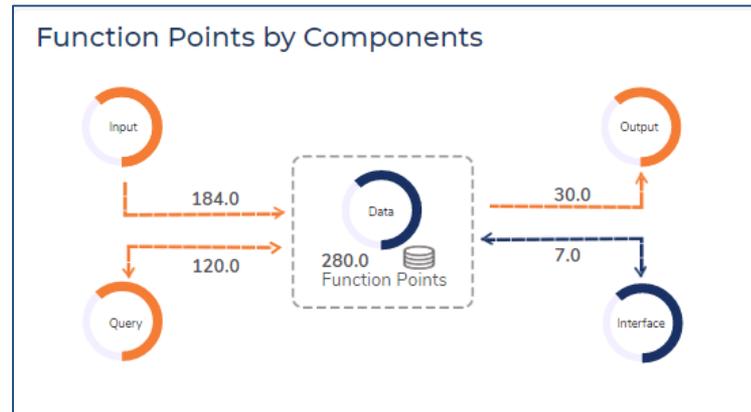
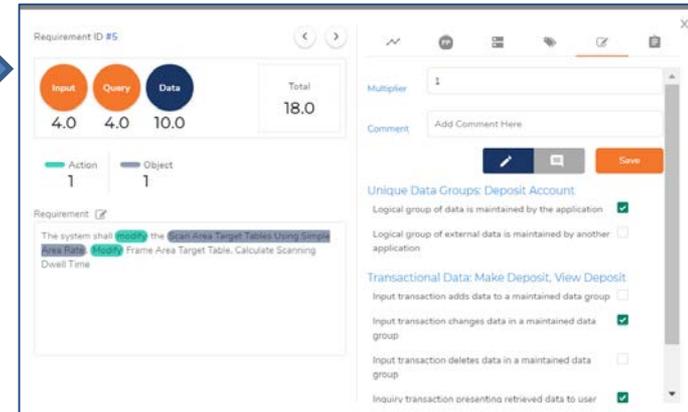
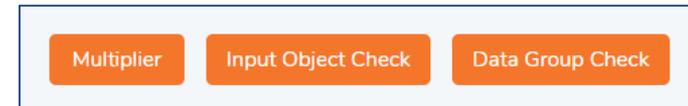
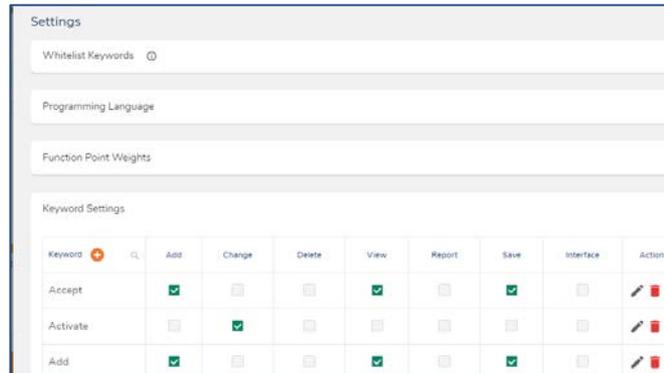
Req. #	Key Verb	Other Verb	Proper Noun	Noun	Subject	Object	Verb Phrase
3.2	update	based	System, Masterfile, XXX	calculations	System	Masterfile, XXX, calculations	update the Masterfile based on XXX calculations



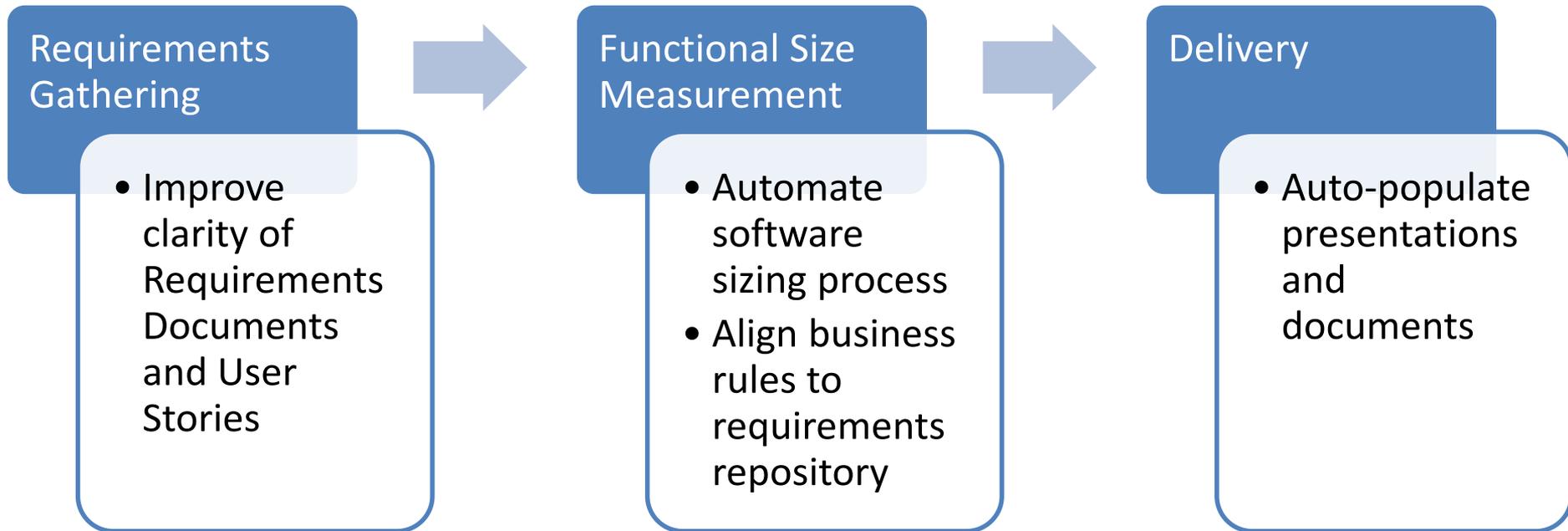
Requirements and User Stories are excellent subjects for NLP analysis because they have a semi-structured construct

Functional Sizing at a Glance

- Specific words or phrases are mapped to IFPUG data or transactional functions
- Business Rules are applied
- Analyst can revise process based on experience
- ROM-level software sizing produced, which then supports estimation or benchmarking activities
- Functional sizing for large projects can be completed in minutes!



Inject AI into the Estimator's Workflow



What does this mean to the Software Estimator?

- Estimation community should take advantage of learning opportunities:
 - ICEAA software estimation training courses
 - Software Cost Estimating Body of Knowledge (SCEBoK) due out in early 2021
<https://www.iceaaonline.com/scebok/>
 - Scaled Agile Framework <https://www.scaledagileframework.com/>
 - Agile and Scrum Master courses
 - AI, NLP, and Machine Learning groups
- When applying functional size measurement, leverage AI
- Streamline deliverables to meet client needs

Conclusions

- 🔗 As technology delivery has evolved, so must the Software Cost Estimator
- 🔗 Automated functional software sizing processes are being embraced
- 🔗 By applying lean practices to software estimation, cycle times can be significantly reduced
- 🔗 Traditional cost estimators can join the digitally transformed workforce and stay relevant

Thank You

Kevin McKeel
Managing Partner
CCEA/SAFe 5 Architect
703-592-6361
Kevin.mckeel@logapps.com

- 🌀 Logapps Webpage: www.Logapps.com/
- 🌀 Official Cadence Webpage: www.Logapps.com/cadence