ISSN: 2473-4901
v10 n6231

Infusing Economic Analysis Tools in a Senior-Level Agile Methodology Based Capstone Experience

Stuart L. Wolthuis
stuart.wolthuis@byuh.edu
Faculty of Mathematics and Computing
Brigham Young University – Hawaii
Laie, HI 96762

Abstract

This writing shares insights of how economic analysis tools and methods are infused into a a senior-level information system capstone class. Students who understand the SDLC, after completing software engineering classes focused on the serial Waterfall Methodology, now apply Agile Methods in a Scrum Framework in a capstone experience. A Planning Phase, three Sprints and a final presentation overlay an underlying theme of how to successfully manage finances in an information system development project. Key economic document templates are provided as a resource for educators wanting to infuse and enhance their course content with deeper and more meaningful economic analysis. With this type of rigorous economic analysis approach to software development, students will differentiate themselves with insightful skills over and above other students entering the competitive job market as software developers.

Keywords: Agile, Scrum, Financial Management, Economic Analysis, Capstone IS

1. INTRODUCTION

Senior technology capstone projects typically focus on the methodology, collaboration, and teamwork that contribute to developing software. The IS2020 competency model for undergraduate information systems identifies "collaboration and teamwork" as one of eleven critically important foundational competencies (IS 2020, 2020). The ACM/IEEE/AAAI standard for software engineering states "skilled software engineers will additionally demonstrate expertise in communication and collaboration" in a team environment (Software Engineering, Version Gamma, 2023). The ACM standard cited the Future of Jobs report by the World Economic Forum saying that complex problem solving would be in high demand over content skill.

Many other critical skills and knowledge areas are defined by the IS2020 and CS2023 standards. A review of each area reveals one skill that is grossly lacking any discussion – the ability to evaluate and manage cost, also referred to as economic analysis.

Lazić, et.al. (2009) conclude that understanding the cost of creating quality software is essential to increase the reliability of software. Furthermore, they observe that little has been done in the software industry to realize these benefits. Even less has been done in classes at the undergraduate level to educate technology students on this essential proficiency.

A key problem in software development is the successful management of project finances: funding, development costs, operational costs, Return on Investment (ROI), Break Even Point (BEP), and Net Present Value (NPV) are some of the financial jargon technology students face, and may not sound familiar.

In the capstone class highlighted in this discussion, basic economic analysis techniques are taught and students apply them to their own Agile software development project.

Every class meeting begins with a stand-up Scrum meeting discussing three basic things (The Scrum Guide, 2020):

1. What did you do yesterday? or what is going well? (Adjusted based on class meeting schedule).

2. What will you do today?

3. Any issues with getting work done?

Economic analysis is typically not covered in computer science or information technology curriculums unless there is a software engineering course that covers economic feasibility as part of project management. A popular software analysis and design textbook covers economic analysis basics over five pages (Dennis, et al., 2021). The author has used this textbook, including previous editions (2nd, 4th, 5th) since 2008.

As mentioned previously, none of the common standards address one of the most important aspects of software development and one of the most difficult areas to master, and probably the most essential to prevent software development failure.

Economic analysis and financial management of the software development project are key to ensuring that the project stays within budget and is completed on time without cost overruns. Unfortunately, short or long-term financial management of a project is typically not addressed in software development projects or capstone experiences due to complexity and non-availability of tools (Omitaomu et al., 2005).

Significant numbers of software projects have failed due to poor understanding and planning. Notable examples include the California Department of Motor Vehicles attempt to modernize their registration and licensing system. This project started in 1987 and had a cost overrun of $45M in 1993 when it was cancelled (Singh et al., 2015). Other significant failures outside the United States include Canada's attempt to design a single portal for 1,500 websites and Australia's Queensland Health Payroll System is currently at AUD 1.2B and started at AUD 6M. Dennis (2021) observes a 1996 General Accounting Office study reporting failure rates of 53 percent for U.S. government information system projects.

This discussion shares years of refinement on how financial management is infused in a Senior level Capstone Software development project-based class. From initial economic analysis to final project assessment, financial management is made an integral part of this capstone class using the Agile Methodology in a Scrum framework.

2. PREREQUISITES FOR THE CAPSTONE CLASS

Students majoring in information systems and information technology at a private university are required to take Project Management/Practice as a capstone class. Prerequisites for this class include two semesters of Software Engineering (SE), using Dennis' 2015 Systems Analysis & Design, An Object-Oriented Approach with UML textbook and a semester of database. The university has approximately 3,000 students and 11% of those students major in IS/IT, and CS. Computer Science students have the option to take the Capstone class as an elective.

In the Software Engineering I and II classes, a team project is the largest part of a student's grade.

Software Engineering I
20% = HW assignments
10% = Quizzes
35% = Group Projects
05% = Attendance
30% = Comprehensive Final
(two parts, multiple choice exam and practical creating UML diagrams)
100% Total

Software Engineering II
32% = Four Exams & Final
10% = Attendance
43% = Group Projects
15% = Homework
100% Total

The software engineering classes use the Systems Development Life Cycle as a framework for the structure of the class. Software Engineering I covers the first two phases of the SDLC, planning and analysis. The Software Engineering II class covers the second two phases, design and implementation. By necessity, these classes use a serial implementation of the steps in each phase of the SDLC. For example, the first team project in SE I requires four deliverables including a Systems Request, Technical Analysis, Cost Benefit Analysis, and Organizational Analysis (see Appendix A for details and all project rubrics). The first team project in SE II requires project teams to create a database schema and description, part of the SDLC design phase.

Additionally, the SE I and SE II courses use an object-oriented foundation with UML diagrams –

students learn how to create and draw these documents and models as part of class assignments and group projects.

Ideally, students will take SE I and SE II consecutively so that they continue with the same team and project for two semesters. If this isn't possible, teams are adjusted in SE II.

3. DETAILS OF THE CAPSTONE CLASS

The capstone class uses Agile (Scrum) as the methodology platform. This would not be possible unless the students were familiar with the deliverables taught in SE I and SE II. These deliverables include the cost benefit analysis, functional, structural, and behavioral models for SE I. In SE II students are require to build DB models, HCI models, Physical Architecture models, construction and test plans, implementation and assessment.

In the capstone class, students are organized into teams (different than the teams they had in SE I and SE II). This is purposely done so that students can create a productive team with diverse students. Teams are setup usually in groups of four with no two students from the same country or ethnic background. This ensures that groups will communicate in English, the established teaching language of the university.

On day one the students are given a detailed explanation of how Agile works using Scrum. The instructor has already divided the class into teams (based on experience in SE I and SE II). They are given an overview of the purpose and learning outcomes for the class. SE I, SE II and Capstone materials are available in the GitHub repository: Stuart9296/SoftwareEconAnalysis.

The grading criteria breaks out as follows for the Capstone Agile class:

10% Attendance

15% Individual Project Assessment

75% Group Projects (IS project)

The assignments for the class include using the Agile methodology with Scrum as the framework and begin with rigorous planning. This includes typical high-level Agile documentation, such as a vision statement and objectives, critical to a successful project. Students also forge their user stories and make a backlog of at least 30 user stories, 10 back-end, 10 front-end, and 10 for supervisor/managers.

Projects in the Capstone class are separated into five deliverables: Planning documents, Sprint 1 documents, Sprint 2 documents, Sprint 3 documents, and Final Presentation documents.

The following bulleted list includes all the required documentation for planning.

- Planning Documents (for Agile)
- - Vision Statement (one sentence)
- - Project Objectives (3 or 4)
- - Scope Boundaries (Only local or only senior citizens)
- - Reciprocal Agreements (with service providers)
- - Backlog (list of system features)
    - 30 user stories [10 for back-end, 10 for front-end, 10 supervisor/mgt]
    - As a (role), I want (benefit), so I can (goal).
- - System Request & Feasibility Analysis (Tech, CBA, Organizational)
    - Tech: Familiarity with business area
    - Tech: Familiarity with the technology medium
    - Tech: Project Size
    - Tech: Compatibility with current HW/systems
    - CBA: (cost benefit analysis), (plan vs actual) discuss and provide spreadsheets
    - Organizational considerations
- - Project Plan (in MS Project or SmartSheet [GANTT Chart]) that includes:
- -- Development Methodology using Scrum
- ---(Planning, Sprint 1, Sprint 2, Sprint 3)
- --- Resource Allocation (assign team members to tasks)
- --- Plan vs. Actual costs & Cost Benefit Analysis (spreadsheet)

True to the Agile methodology the students use this first assignment as the planning documentation and adjust their plan with each Sprint (Waja, et al., 2021). The next section will explain the use of different economic analysis tools used in the capstone class. Students usually take about two weeks to complete this assignment. Each Sprint follows and includes all the documentation (models, diagrams, updated planned vs actual costs) to support the user stories.

The Capstone class culminates with a final presentation, to include a working prototype.

Students are required to discuss their project and must include:

- Tell us why your project is a great idea
- Overview (Activity Diagram / Use Case Diagram)
- Cover finances, planned vs actual AND Cost Benefit Analysis
- Demonstrate your prototype
- Conversion Strategy
    - Style, Location, Modules based on risk, cost, and time
- Organizational Change Management Plan policy, adoption, training
- Post Implementation Activities: system support/maintenance, assessment

4. ECONOMIC ANALYSIS TOOLS

The economic analysis tools employed in the capstone class include these basic ideas:

- determine what you're worth

- conduct a cost benefit analysis

- track planned vs actual labor costs

- assess the project cost

Determine What You're Worth
Ninety percent of students on campus work while studying at Brigham Young University - Hawaii. They earn a minimum wage, and may earn a small raise if they supervise other students. Typically, students are not well informed about the actual earning potential associated with their major (Wiswall & Zafar, 2015).

On the first day of the capstone class, students individually search what they would receive as a starting hourly wage as a graduate for positions in software engineering: project manager, systems analyst, business analyst, infrastructure analyst, change management analyst, and programmer. Annual salaries are converted to hourly wage (simply divide by 2080, work hours in a year). These values are averaged across all students and job types and used as input for other analysis.

The appendix shows a sample spreadsheet of "what you're worth" as an IS/CS/IT graduate, see Appendix B, Figure 1. The average salary, far right column, will be used to calculate labor cost for each team's project.

Conduct a Cost Benefit Analysis
A cost benefit analysis (CBA) is an essential input for decision makers to determine if a project is a Go or No-Go. Current interest rates and inflation rates are used in the CBA to add realism to the exercise. Students use skills developed in SE I to create a CBA for their new Agile project. Their estimates are based on user stories and reviewed by the course instructor for accuracy and adjusted if needed.

Understanding Return on Investment (ROI), Break Even Point (BEP), and Net Present Value (NPV) adjusted to a short time period to support the Agile methodology are critical. For example, the equation for NPV is usually applied over several years for projects managed with the Waterfall Methodology, using Scrum in a semester requires the period (n) to be divided by 12 since the period used is a month.

Monthly NPV = (amt)/(1 + int_rate)^(n/12), this value is defined as the Monthly NPV. Here, amt is the amount of investment today. In a summer or spring semester (half the length of a full semester) students compute the Weekly NPV instead of the Monthly NVP.

ROI is computed using the standard formula:

(Total benefits – Total Costs) / Total Costs, no adjustment for a short duration project typical of Agile is require.

The BEP is computed using the Monthly NPV and is executed the first month the project has a positive cash flow. Students are required to add a few months of operations to their CBA to show a positive cash flow. BEP follows this equation:

(Monthly NPV – Cumulative NPV) / Monthly NPV

Again, this is adjusted to a Weekly NPV for a short semester.

Track Planned vs Actual Labor Costs
Each team is required to create a spreadsheet to track planned and actual costs. Tab 1 of the spreadsheet is used to estimate the planned labor cost of the team's project using the average salary calculated on day one, see Appendix B, Figure 1. Tab 2 tracks the actual hours and labor costs incurred each week. Tab 3 shows a summary of cumulative planned and actual costs and a line chart showing this relationship.

An example provides students with a visual template on how this spreadsheet should be organized and created, see Figures 3, 4, and 5 in Appendix B.

Assess the Project Costs

When the semester project is complete students are required to assess their project by self-reflection. As Dennis et al. (2021) recommends assessment should evaluate both the team's efforts, specifically collaboration and team communication, and the actual project. As part of this evaluation students are expected to discuss the project's planned cost and explain any discrepancy when compared to the actual costs.

The final exam is in the form of a final presentation which includes a prototype demonstration of their information system. Students have the choice of creating a prototype with a programming language or a software prototype tool, such as Balsamic. Emphasis is placed on understanding and discussing their project's financial performance during the development period – which could be 7 weeks or 14 weeks (Spring or Fall semester).

5. CONCLUSIONS

An integration of economic analysis tools with Agile based software development has created a transformative educational environment for students studying computer science and information technology. Students who complete this capstone class become familiar with introductory economic analysis tools and the processes required to effectively manage software development projects.

The ability to understand how to forecast costs and plan labor and other expenses for a project provide students with marketable critical thinking skills that otherwise would not be realized.

Their understanding of these concepts are discussed and reviewed weekly as they explain their planned vs actual costs to the instructor. These costs are documented in a spreadsheet and updated weekly (see Figures 3, 4, and 5 in Appendix B).

In recent years, many graduates have stated that their capstone class set them apart from other students and enabled one to be selected as a top four intern out of 350 at the number one ranked Fortune 500 company.

The software development landscape is littered with projects that failed miserably due to cost overruns and poor economic planning. By refining and expanding focused economic analysis we address a critical need that prepares future software developers with the ability to navigate the complexities of project management. The ultimate result is more financially successful and viable software projects.

6. REFERENCES

CS2023: ACM/IEEE-CS/AAAI Computer Science Curricula. Retrieved 12 Aug 2024 from: https://doi.org/csed.acm.org/

Dennis, A., Wixom, B., & Tegarden, D. (2021). *Systems analysis and design: An object-oriented approach with UML*. John Wiley & sons.

IS2020 A Competency Model for Undergraduate Programs in Information Systems. Retrieved 27 June 2024 from https://www.acm.org/binaries/content/assets/education/curricula-recommendations/is2020.pdf

Lazić, L. J. U. B. O. M. I. R., Kolašinac, A., & Avdić, D. Ž. E. N. A. N. (2009). The software quality economics model for software project optimization. *WSEAS transactions on computers*, (1), 21-47. http

Omitaomu, O. A., Smith, L. D., & Badiru, A. B. (2005). The ENGINeering Economic Analysis (ENGINEA) software: enhancing teaching and application of economic analysis techniques. *Comput. Educ. J*.

Singh, H. P., Kumar, V., & Agrawal, A. (2015). Demystifying information technology projects success and failure factors: The cases of california DMV and bancoitamarati bank. *Mumukshu Journal of Humanities*, *7*(1), 493-499.

Software Engineering (SE) Version Gamma from the CS2023 ACM/IEEE-CSAAAI Computer Science Curricula. Retrieved 12 Aug 2024 from https://csed.acm.org/wp-content/uploads/2023/09/SE-Version-Gamma.pdf

The Scrum Guide 2020. Retrieved 13 Aug 20214 from Scrum https://www.scrum.org/resources/scrum-guide

Waja, G., Shah, J., & Nanavati, P. (2021). Agile Software Development. *International Journal of Engineering Applied Sciences and Technology*, *5*(12), 73-78. DOI: https://doi.org/10.33564/IJEAST.2021.v05i12.011

Wiswall, M., & Zafar, B. (2015). How do College Students Respond to Public Information About Earnings?. Journal of Human Capital, 9(2), 117-169. DOI: https://doi.org/10.1086/681542

APPENDIX A

Project Rubrics for SE I and SE II classes

Project 1: SE I

1. Cover Sheet, 10%
Project Name
Class, Semester (CIS 305, Fall 2023)
Names of Group Members
2. System Request of your IS Project (see page 45 abt 1 page), 20%
- Project Sponsor, Business Need, Business Requirements, Business Value, Special Issues or Constraints
3. Complete an Executive Summary of your project (abt 1 page), 20%
- See template in Canvas files
4. including a Feasibility Analysis of your IS Project in the Executive Summary, 30%
   - Tech: Familiarity with business area (Risk is High, Med, Low)
   - Tech: Familiarity with the technology medium (Risk is High, Med, Low)
   - Tech: Project Size (Risk is High, Med, Low)
   - Tech: Compatibility with current HW/systems (Risk is High, Med, Low)
   - Economic:
     - CBA: (cost benefit analysis), discuss (abt a paragraph, bullet format allowed) and provide
       - Discuss ROI, BEP, Dev Cost, Op Cost (this information calculated in the CBA spreadsheet
     - CBA spreadsheet (like page 50), customize to your project
   - Organizational considerations (abt a paragraph)
5. Introduce Each member of your team (2 or 3 sentences per team member), 20%
- Include a picture, job (PM/SA/BA/IA/CMA/Prog, see p. 18), a few sentences on each person's actual experience/skills (that apply to this project)
Put all of the above in order into ONE seamless document.
Also submit #4 separately (Spreadsheet, so I can see your equations).

Project 2: SE I

1. Cover Sheet
2. Create your WBS (list of tasks required to complete your project, see page 55) by development phase (PADI)
3. Create a deliverable showing your IS project's Gantt Chart, use Microsoft Project
Identify all major tasks
Include the phases of Planning, Analysis, Design & Implementation
Identify tasks, start, stop, duration, predecessors, resources, milestones
Demonstrate this part in class, and upload to Canvas
Note 1: Start at the beginning of this semester (Planning & Analysis), add next semester (Design & Implementation)
Note 2: Add 4 months of Operations (after implementation)

Project 3: SE I

1. Cover Sheet
2 . Prepare the following functional model deliverables:
   Activity Diagram (p. 133)
   Use Case Diagram(s) (p. 155)
   3-9 Use Case Descriptions (p. 143)

Project 4: SE I

1. Cover Sheet
2. Prepare the following
Structural model deliverables:
   Class Diagram (p. 185)
   Object Diagram (p. 185) includes sample data

CRC Cards for all classes (p. 174)

Project 5: SE I

- Presentation time: up to 10 minutes
- Prepare a presentation regarding your team's project:
  - PPT or similar media
- Introduce your team, give an overview of the project
  - Why is it amazing, important?
- You should include previous project deliverables
  - Activity Diagram (don't forget the data flows)
  - Especially finances
  - Others IF you have time
- Include in your presentation and explain the following
- Structural model deliverable
  - Class Diagram (p. 185)
  - Use Case Diagram (p. 125)
- Behavioral model deliverables
  - Sequence Diagram (p. 205)
  - Communication Diagram (p. 216)
  - Behavioral State Machine (p. 222/224)
  - CRUDE analysis (p. 232)
- Dress for success – not the beach
  - Guys, collared shirts, slacks
  - Gals, business casual (slacks or skirts/dress)

Project 0: SE II (this project is a surprise and is due today)

Your client called, they want a "good faith" deliverable, proof that you're making progress
- Make a DFD (Data Flow Diagram) of the client's business model, showing that you understand the process and data flow (in Visio)
- Make a DD, data dictionary; all class names, attribute names, method names with definitions, types, signatures (a spreadsheet works well for this)
- page 1, cover sheet
- page 2, DFD (Activity Diagram)
- page 3, DD (Data Dictionary)

Include your Class Diagram.

Project 1: SE II

Cover Sheet
1. System Request (p. 45) and alternative matrix (p. 275) the alternative matrix should evaluate three alternatives: In-house development, Out-source, and Packaged software.
   So people who are not familiar with your project can understand the basics
2. Executive Summary & Feasibility Analysis of your IS Project, ie p. 45-53
3. Supporting Economic Feasibility Analysis, ie p. 50
4. Package diagrams of your design, include attributes, methods, and relationships – ie p. 267
5. Specs for each method (p. 314-318)
6. Write an RFI seeking internet connectivity from an ISP, (274 - 1 page is enough)
   See the RFI template in: Files > Project Folder > Request for Information Template
7. Introduce your team (pics and professional background)
   John is a systems analyst with 3 years experience in C#, 2 years experience in Java and 1 year in PHP. Include several lines for each person on your team.
   Show roles: PM, SA, BA, IA, CMA, Prog., Champion, Sponsor

Project 2: SE II

Cover Sheet
Create DB deliverables:
- DB Layer (p. 358 or 359)

- Explain your design, in detail; tables, DAM classes, and objects.
- Explain and justify your database format selection
(sequential, relational, object-relational, OOD or O-persistence)

Project 3: SE II

1. Cover Sheet
Create HCI deliverables
2. WND (see p. 375)
3. Interface Template (see p. 378, 379)
-- include font sizes, styles, colors (using hex); background and foreground colors (using hex); % of screen being used, etc, be very specific
4. Discuss, in a written format, how your team will use the design principles (p. 369) to guide your design

Project 4: SE II

Cover Sheet
Prepare Physical Architecture Layer deliverables
- Deployment Diagram (p. 435-11)
Test Plan
- Test Summary Table (table, p. 472-12)
- Class (method) Contracts (p. 475-12), do at least 4
Documentation
- Outline of documentation types (see p. 464-12)
- One Sample Help Topic Page (p. 379-10, follow your HCI template)

Project 5: SE II

Prepare a PowerPoint presentation regarding your team's project:
Introduce your team
- Dress Sharp: Guys collared shirts and slacks/sulu; Ladies dress professional
Overview of project, why is this project a great idea
In detail, present: activity diagram, use case diagram, sample home page
Conversion Strategy: page 486
Pick one from each dimension (your team should have 3)
Change Management Plan: pages 489-501
- identify the:
1. sponsor of change, who and why?
2. change agent, who and how will they help?
3. potential adopters, who are they?
- what is your change management plan? There are four parts:
    1. Revising management policies,
    2. Assessing the cost and benefit models of potential adopters,
    3. Motivating adoption,
    4. Enabling people to adopt through training, what kind?
- Post-Implementation Activities
1. System Support
2. System Maintenance
3. Project Assessment

ISSN: 2473-4901
v10 n6231

APPENDIX B
Capstone Class Figures

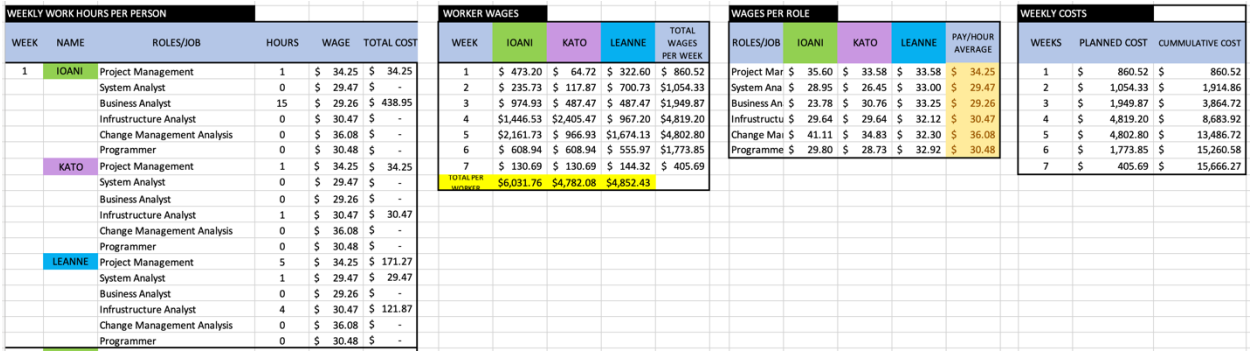
4 Aug 2015 - quick research on pay rates for IS teams: ROLES/JOBS	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6	Student 7	Student 8	pay/hr Average
Project Manager	$ 38.94	$ 27.40	$ 40.81	$ 46.15	$ 32.58	$ 27.66	$ 47.11	$ 31.00	$ 36.46
Systems Analyst	$ 25.00	$ 26.44	$ 30.80	$ 38.94	$ 27.57	$ 26.62	$ 39.03	$ 27.00	$ 30.18
Business Analyst	$ 24.00	$ 37.50	$ 31.84	$ 36.53	$ 28.85	$ 26.72	$ 37.78	$ 23.00	$ 30.78
Infrastructure Analyst	$ 26.92	$ 29.22	$ 31.74	$ 31.74	$ 32.53	$ 32.53	$ 31.74	$ 20.00	$ 29.55
Change Management Analyst	$ 32.69	$ 25.48	$ 27.93	$ 27.93	$ 26.92	$ 31.02	$ 32.69	$ 29.00	$ 29.21
Programmer	$ 31.25	$ 24.38	$ 34.39	$ 38.46	$ 24.38	$ 24.68	$ 38.90	$ 23.00	$ 29.93
Average Team rates/hr:	$ 29.80	$ 28.40	$ 32.92	$ 36.63	$ 28.81	$ 28.21	$ 37.88	$ 25.50	

Figure 1. What You're Worth, 4 Aug 2015, instructor created with input from students pay/hr Average is the input for the Wage column in Tab 1 and Tab 2 below

	May	June	July	August	September	October	November	December	May
Month Counter	1	2	3	4	5	6	7	8	Total
Job Placement Revenue	$ -	$ -	$ 400	$ 400	$ 400	$ 420	$ 462	$ 500	
Decrease of Interuptions	$ -	$ -	$ 1,500	$ 1,650	$ 1,815	$ 1,997	$ 2,196	$ 1,500	
Time Savings	$ -	$ -	$ 1,200	$ 1,200	$ 1,200	$ 1,200	$ 2,000	$ 2,000	
Sponsor Support	$ 3,400	$ 3,400	$ 3,400	$ 3,400	$ 3,400	$ 3,400	$ 3,400	$ 3,400	
TOTAL BENEFITS:	$ 3,400	$ 3,400	$ 6,500	$ 6,650	$ 6,815	$ 7,017	$ 8,058	$ 7,400	
PV OF BENEFITS:	**$ 3,392**	**$ 3,383**	**$ 6,452**	**$ 6,585**	**$ 6,732**	**$ 6,914**	**$ 7,920**	**$ 7,256**	**$ 48,633**
PV OF ALL BENEFITS:	**$ 3,392**	**$ 6,775**	**$ 13,227**	**$ 19,812**	**$ 26,543**	**$ 33,457**	**$ 41,377**	**$ 48,633**	
AWS Servers (Cheap Servers)	$ 75	$ 75							
Labor	$ 3,500	$ 3,500	$ -	$ -	$ -	$ -	$ -	$ -	
TOTAL DEVELOPMENT COSTS:	$ 3,575	$ 3,575	$ -	$ -	$ -	$ -	$ -	$ -	
AWS Servers	$ -	$ -	$ 75	$ 75	$ 75	$ 75	$ 75	$ 75	
Operational Labor	$ -	$ -	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 3,000	
TOTAL OPERATIONAL COSTS:	$ -	$ -	$ 3,075	$ 3,075	$ 3,075	$ 3,075	$ 3,075	$ 3,075	
TOTAL COSTS	$ 3,575	$ 3,575	$ 3,075	$ 3,075	$ 3,075	$ 3,075	$ 3,075	$ 3,075	
PV OF COSTS:	**$ 3,566**	**$ 3,557**	**$ 3,052**	**$ 3,045**	**$ 3,037**	**$ 3,030**	**$ 3,022**	**$ 3,015**	**$ 25,326**
PV OF ALL COSTS:	**$ 3,566**	**$ 7,124**	**$ 10,176**	**$ 13,221**	**$ 16,258**	**$ 19,288**	**$ 22,311**	**$ 25,326**	
TOTAL PROJECT BENEFITS - COSTS:	**$ (175)**	**$ (175)**	**$ 3,425**	**$ 3,575**	**$ 3,740**	**$ 3,942**	**$ 4,983**	**$ 4,325**	
YEARLY NPV	**$ (175)**	**$ (174)**	**$ 3,400**	**$ 3,540**	**$ 3,694**	**$ 3,884**	**$ 4,898**	**$ 4,241**	**$ 23,307**
CUMULATIVE NPV:	**$ (175)**	**$ (349)**	**$ 3,051**	**$ 6,591**	**$ 10,285**	**$ 14,169**	**$ 19,067**	**$ 23,307**	
RETURN ON INVESTMENT:	**92.03%**								
BREAK-EVEN POINT:	**2.10**								

Figure 2. Sample CBA

ISSN: 2473-4901
v10 n6231



WEEKLY WORK HOURS PER PERSON

WEEK	NAME	ROLES/JOB	HOURS	WAGE	TOTAL COST
1	IOANI	Project Management	1	$ 34.25	$ 34.25
		System Analyst	0	$ 29.47	$ -
		Business Analyst	15	$ 29.26	$ 438.95
		Infrustructure Analyst	0	$ 30.47	$ -
		Change Management Analysis	0	$ 36.08	$ -
		Programmer	0	$ 30.48	$ -
	KATO	Project Management	1	$ 34.25	$ 34.25
		System Analyst	0	$ 29.47	$ -
		Business Analyst	0	$ 29.26	$ -
		Infrustructure Analyst	1	$ 30.47	$ 30.47
		Change Management Analysis	0	$ 36.08	$ -
		Programmer	0	$ 30.48	$ -
	LEANNE	Project Management	5	$ 34.25	$ 171.27
		System Analyst	1	$ 29.47	$ 29.47
		Business Analyst	0	$ 29.26	$ -
		Infrustructure Analyst	4	$ 30.47	$ 121.87
		Change Management Analysis	0	$ 36.08	$ -
		Programmer	0	$ 30.48	$ -

WORKER WAGES

WEEK	IOANI	KATO	LEANNE	TOTAL WAGES PER WEEK
1	$ 473.20	$ 64.72	$ 322.60	$ 860.52
2	$ 235.73	$ 117.87	$ 700.73	$1,054.33
3	$ 974.93	$ 487.47	$ 487.47	$1,949.87
4	$1,446.53	$2,405.47	$ 967.20	$4,819.20
5	$2,161.73	$ 966.93	$1,674.13	$4,802.80
6	$ 608.94	$ 608.94	$ 555.97	$1,773.85
7	$ 130.69	$ 130.69	$ 144.32	$ 405.69
TOTAL PER WORKER	$6,031.76	$4,782.08	$4,852.43	

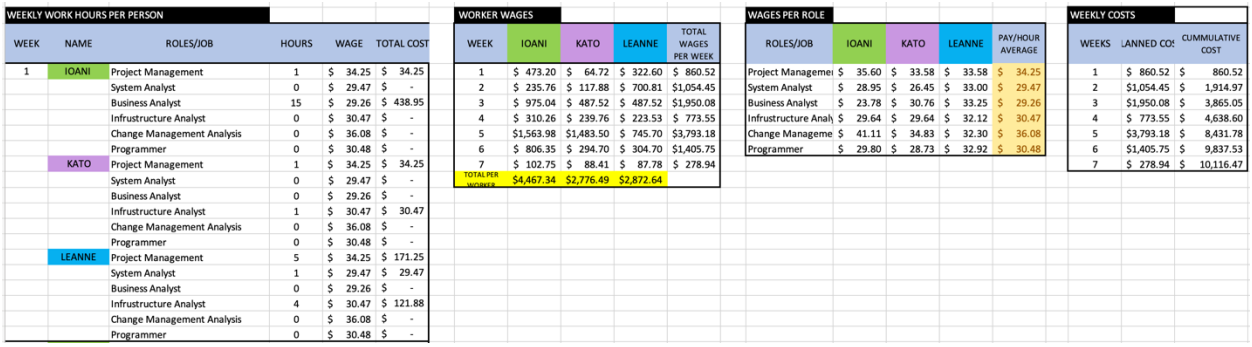
WAGES PER ROLE

ROLES/JOB	IOANI	KATO	LEANNE	PAY/HOUR AVERAGE
Project Mar	$ 35.60	$ 33.58	$ 33.58	$ 34.25
System Ana	$ 28.95	$ 26.45	$ 33.00	$ 29.47
Business An	$ 23.78	$ 30.76	$ 33.25	$ 29.26
Infrustructu	$ 29.64	$ 29.64	$ 32.12	$ 30.47
Change Mai	$ 41.11	$ 34.83	$ 32.30	$ 36.08
Programme	$ 29.80	$ 28.73	$ 32.92	$ 30.48

WEEKLY COSTS

WEEKS	PLANNED COST	CUMMULATIVE COST
1	$ 860.52	$ 860.52
2	$ 1,054.33	$ 1,914.86
3	$ 1,949.87	$ 3,864.72
4	$ 4,819.20	$ 8,683.92
5	$ 4,802.80	$ 13,486.72
6	$ 1,773.85	$ 15,260.58
7	$ 405.69	$ 15,666.27

Figure 3. Spreadsheet Tab 1: Planned labor cost 1st week



WEEKLY WORK HOURS PER PERSON

WEEK	NAME	ROLES/JOB	HOURS	WAGE	TOTAL COST
1	IOANI	Project Management	1	$ 34.25	$ 34.25
		System Analyst	0	$ 29.47	$ -
		Business Analyst	15	$ 29.26	$ 438.95
		Infrustructure Analyst	0	$ 30.47	$ -
		Change Management Analysis	0	$ 36.08	$ -
		Programmer	0	$ 30.48	$ -
	KATO	Project Management	1	$ 34.25	$ 34.25
		System Analyst	0	$ 29.47	$ -
		Business Analyst	0	$ 29.26	$ -
		Infrustructure Analyst	1	$ 30.47	$ 30.47
		Change Management Analysis	0	$ 36.08	$ -
		Programmer	0	$ 30.48	$ -
	LEANNE	Project Management	5	$ 34.25	$ 171.25
		System Analyst	1	$ 29.47	$ 29.47
		Business Analyst	0	$ 29.26	$ -
		Infrustructure Analyst	4	$ 30.47	$ 121.88
		Change Management Analysis	0	$ 36.08	$ -
		Programmer	0	$ 30.48	$ -

WORKER WAGES

WEEK	IOANI	KATO	LEANNE	TOTAL WAGES PER WEEK
1	$ 473.20	$ 64.72	$ 322.60	$ 860.52
2	$ 235.76	$ 117.88	$ 700.81	$1,054.45
3	$ 975.04	$ 487.52	$ 487.52	$1,950.08
4	$ 310.26	$ 239.76	$ 223.53	$ 773.55
5	$1,563.98	$1,483.50	$ 745.70	$3,793.18
6	$ 806.35	$ 294.70	$ 304.70	$1,405.75
7	$ 102.75	$ 88.41	$ 87.78	$ 278.94
TOTAL PER WORKER	$4,467.34	$2,776.49	$2,872.64	

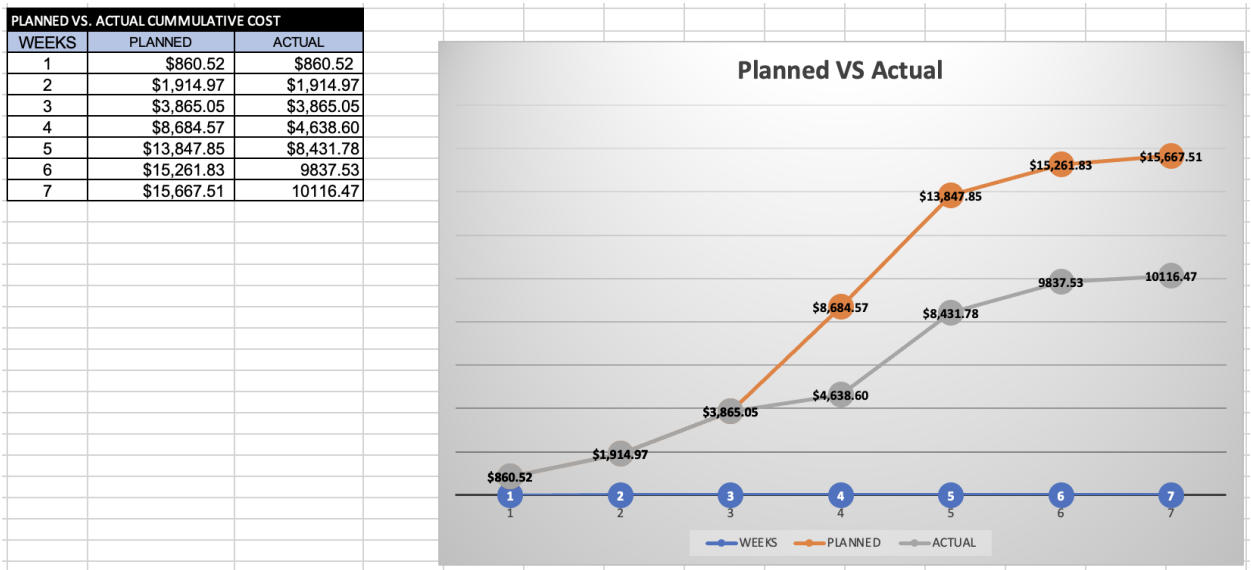
WAGES PER ROLE

ROLES/JOB	IOANI	KATO	LEANNE	PAY/HOUR AVERAGE
Project Manageme	$ 35.60	$ 33.58	$ 33.58	$ 34.25
System Analyst	$ 28.95	$ 26.45	$ 33.00	$ 29.47
Business Analyst	$ 23.78	$ 30.76	$ 33.25	$ 29.26
Infrustructure Anal	$ 29.64	$ 29.64	$ 32.12	$ 30.47
Change Manageme	$ 41.11	$ 34.83	$ 32.30	$ 36.08
Programmer	$ 29.80	$ 28.73	$ 32.92	$ 30.48

WEEKLY COSTS

WEEKS	LANNED COS	CUMMULATIVE COST
1	$ 860.52	$ 860.52
2	$1,054.45	$ 1,914.97
3	$1,950.08	$ 3,865.05
4	$ 773.55	$ 4,638.60
5	$3,793.18	$ 8,431.78
6	$1,405.75	$ 9,837.53
7	$ 278.94	$ 10,116.47

Figure 4. Spreadsheet Tab 2: Actual labor cost 1st week



PLANNED VS. ACTUAL CUMMULATIVE COST

WEEKS	PLANNED	ACTUAL
1	$860.52	$860.52
2	$1,914.97	$1,914.97
3	$3,865.05	$3,865.05
4	$8,684.57	$4,638.60
5	$13,847.85	$8,431.78
6	$15,261.83	9837.53
7	$15,667.51	10116.47

Figure 5. Spreadsheet Tab 3, summary information for 7-week Spring semester