ATT: Control & Instrumentation (C&I) system projects department/Projects director

RE: REDUCING COSTS AND MAXIMIZING PROJECT RETURNS BY **DOING MORE WORK UP FRONT**

Preamble

Architects Integrating Industry (**Ai2SA**), specializing in the specifications of Industrial Control & Information Systems, wishes to illustrate savings realized using "Front End Loading (**FEL**)" i.e. process where more works are done "upfront". The purpose of FEL is to develop a detailed definition of a project's **scope & specifications**, subsequently the FEL phase aims to mitigate the number of changes in the implementation phase thereby reducing costs and overall implementation time/risk while improving overall return on investment (ROI) vs. traditional project approach. Subsequently FEL aims to create a detailed plan and in essence an "instruction manual" for the System Integrator/Installers to follow during the Implementation phase of the project. **Envisaged savings utilizing FEL are found to be +/- 7 to 16% of overall project budget.**

Understanding the value of FEL in the context of project Cost, Time, Quality, Risk and Return on Investment (ROI)

The graphs below depict the traditional capital project stages (**RED**) versus using FEL approach (**BLUE**). A comparison of the overall ROI of the capital (i.e. new facility) using traditional method is found to cost more hence produce lower overall returns and take longer to realize returns (**DARK RED LINE**) than using FEL approach where overall project costs less hence equating to more returns and/or faster returns as project is delivered on or ahead of time (**DARK BLUE LINE**).

The graph also depicts cost of CHANGE & RISK (**ORANGE LINE**) i.e. as project is progressing changes later on project results in increased costs vs. changes made earlier. Looking at the graph from bottom to top, three different Key Performance Areas (KPAs) exist, namely: Progress, Cost and Quality. By scrutinizing each of the aforementioned graphs, the following is found.

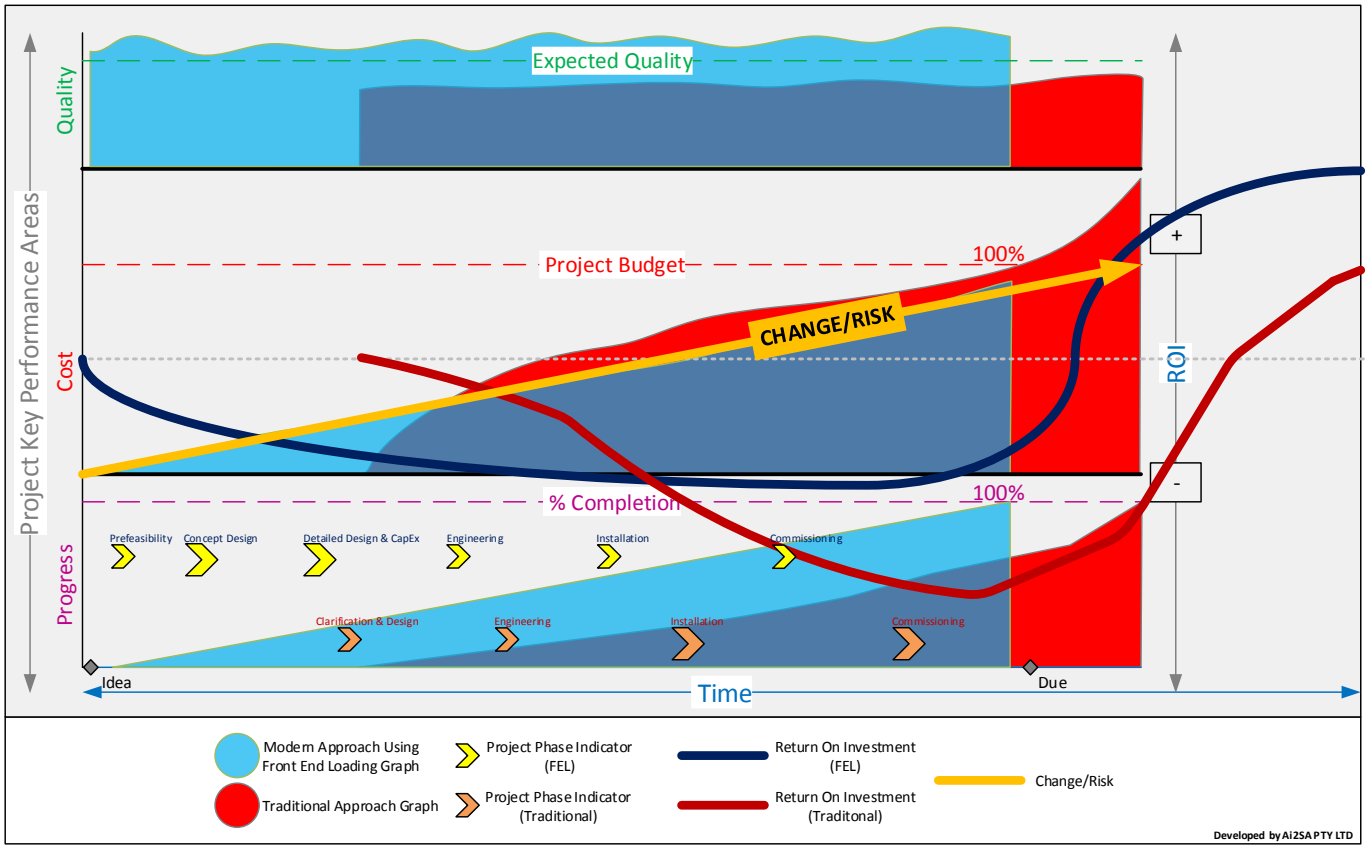
Progress: Traditionally, projects tend to progress unpredictably, exceed the start date and surpass the due date. Using Front End Loading, projects should begin earlier due to completing more work upfront, progress of the project inclines to be linear/predictable and most importantly, projects should be complete before or on the due date. Kindly note the relationships of the chevron arrow sizes depicts that more time is allowed for user inputs and value add requirements when following the FEL approach.

Project Budget: Traditionally, projects tend to exceed the budget (in terms of time and money), this has a significant effect on the overall ROI. By making use of FEL, project finances, cost control and cash flows are maintained in a systematic way so as to provide linear/predictable expenditure and optimized spending which in turn should result in a budget which is mostly under.

Quality: Traditionally, projects tend to not meet the client expected quality due to poor planning and lack of design, this in turn tends to create heavy cost burdens hence clients tend to reduce expectations. FEL strictly enforces Quality Control and Quality Assurance by making use of best-practice methodologies and Quality Inspections, this should result in project delivery which is within strict conformance with what was initially promised.

The table below is an extract of an actual project where Front End Loading was used. **Savings of 14,5% was realised** by investing 8,6% of the original budget in to FEL.

Project Phase	Amount	Comment
Initial Budget	**R 1 804 178,67**	Revision 1 Budget
Risk Assessment & Motivation	R 41 080,00	FEL 1 Cost
Concept Design & Invitation to tender	R 114 668,20	FEL 2 Cost
Total FEL Costs	**R 155 748,20**	
Final Budget	**R 1 384 497,17**	
Savings (incl FEL Cost)	**R 263 933,30**	Est 14,5% Savings



Ai2SA extensively utilizes FEL methodologies, processes, standards etc. by completing engineering deliverables and managing projects (see Project Management Value Proposition). FEL is divided into three (3) phases; FEL 1 (Concept Design), FEL 2 (Basic Design) and FEL 3 (Detailed Design). The deliverables of the respective aforementioned phases aim to reduce the project execution/implementation phase by bringing the design, project and financial planning forward (i.e. pre-project) thereby reducing change and risks. This allows the System Integrator to execute the project in a more focused and thorough manner. The table below depicts the typical deliverables per the FEL phases.

FEL 1 – CONCEPT DESIGN	FEL 2 – BASIC DESIGN	FEL 3 – DETAILED DESIGN
ASIS & Site Visit(s)	Location Drawing (GA's) & Block Diagram(s)	P&ID's
Needs Analysis	Process Descriptions and Flow Diagrams (PFD's)	FDS / IO
Risks/Opportunities	Philosophies/Design Basis	Bill Of Materials and Data Sheets
Market Studies	Instrument, Actuator, Load etc. List(s)	MCC Interface
Prelim Costing	Scope Specification	Equipment Specifications & Standards
Pre-feasibility studies	Technology Evaluation(s)	Method Statement, Project Planning and Resource Loading
	Budget/Quotes/Costing/Benefits	Risk Assessments
	Feasibility studies	Enquiry, NPV, POP and Project Scope

The following page contains some examples of FEL Deliverables.

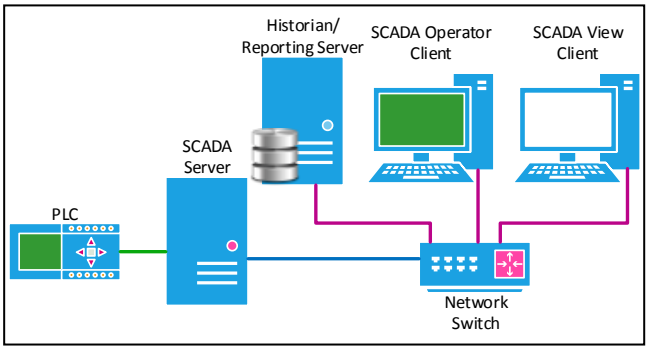


Figure 1: FEL 1: Network Block Diagram Example

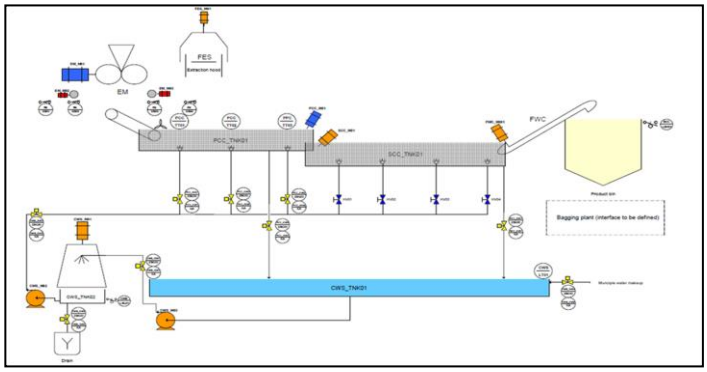


Figure 2: FEL 2: Process Flow Diagram (PFD) Example

Description	1st Budget	Tendered	Budgeted – Tendered
PLC Labour	R 428,954.03	R 208,155.00	R 216,799.03
Electrical Labour	R 241,956.18	R 126,188.00	R 115,768.18
SCADA Labour	R 211,421.93	R 60,205.00	R 151,216.93
Miscellaneous Cost	R 352,194.73	R 113,101.00	R 239,093.73
PLC Equipment	R 496,501.77	R 603,481.79	- R 106,980.02
Electrical Equipment	R 77,150.04	R 138,480.13	- R 61,330.09
Computers	R 0	R 134,886.26	- R 134,886.26
SUB TOTAL 1	***R 1,804,178.67***	***R 1,384,497.17***	***R 419,681.51***
Risk Assessment & Motivation			R 41,08
Concept Design & Invitation to Tender			R 114,668.20
SUB TOTAL 2			***R 155,784.20***
TOTAL			**R 263,933.31**
			15%

Figure 3: FEL 2: Costing/Budget/Savings Example

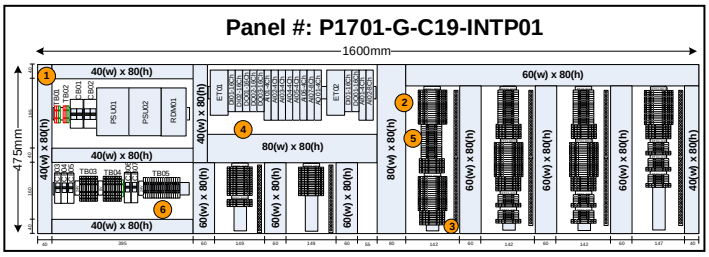


Figure 4: FEL 2: Panel GA Example

Figure 5: FEL 3 Standards/Specifications TOC Example

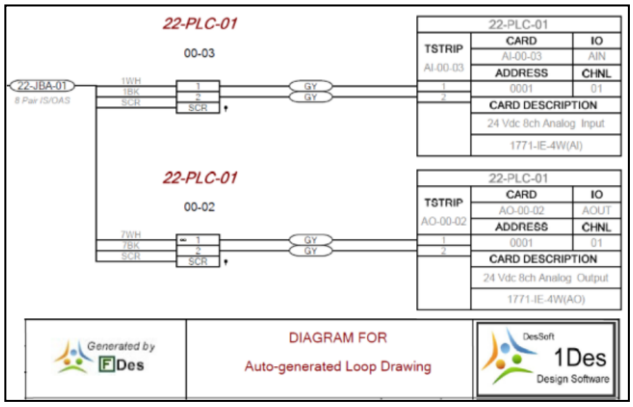


Figure 6: FEL 3: Loop Drawing Example

The table shows some of our FEL references.

#	Industry(s)/Sector(s)/Type(s)	Category	Region	I/O Count
1	Steel Manufacturer	Smelting	Pakistan	800
2	Refinery	Refining	Gauteng	7000
3	Nuclear	Nuclear	North West	500
4	Chome Mining, Smelting and Pelletising & Sintering	Mining & Smelting	Gauteng	2000
5	Platinum Mine	Mining & Smelting	North West	1000
6	Manganese Mine	Mining & Smelting	Northern Cape	1500
7	Coal Mine	Mining & Smelting	Mpumalanga	3500
8	Glass Manufacturing Plant	Glass	Gauteng	3500
9	Zinc Mine	Mining & Smelting	India	1500
10	Chrome Processing Plant	Mining & Smelting	North West	1000
11	Drinking Water Treatment Plant	Water	Free State	2000
12	Iron Mine	Mining & Smelting	Gauteng	20000
13	Chrome Processing Plant	Mining & Smelting	North West	6000
14	Power Utility	Energy-electricity	Mpumalanga	8000

Conclusion

Ai2SA throughout the years has been making extensive use of FEL principles and methodologies and completing deliverables in the Control, Information and Instrumentation space. While FEL is used extensively in Civil, Mechanical, Building and Construction Industries, Ai2SA is one of the very few Control, Information and Instrumentation companies to make use of FEL.

Please feel free to contact the author should you require any more clarity re enclosed.

Petrus Klopper, Managing Director