

What Happened?

Let's take a look at a top 5 chemical company from 1970 to present

	1970	1980	1990	2000	Present
HQ E&I and Control Training (weeks)	12	5	2	0	0
HQ Design Engineers	1700	1500	500	50*	5*
HQ E&I Engineers	400	350	50	5*	0*
HQ Configuration Engineers	0	0	20	5*	2*
HQ Modeling and Control Specialists	100	75	10	5*	0*
Plant E&I Engineers	200	250	100	20*	10*
Plant Configuration Engineers	0	0	100	50*	20*
Plant Modeling and Control Specialists	20	20	20	10*	2*
Objectives	Quality	Quality	Quantity	Quantity	Cost

* Spin-off of original chemical business

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Real Time Expert Systems	0	0	20	0*	0*
Real Time Neural Networks	0	0	10	0*	0*
Offline Neural Network	0	0	20	0*	0*
Fuzzy Logic Optimization	0	0	2	0*	0*
Model Predictive Control	0	0	5	10*	10*
Real Time Optimization	0	0	1	1*	1*
Feedforward Control	10	20	100	50*	20*

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What Do We Need?

- Loops that are not islands of automation
 - Unit operation control for integrated objectives, performance, and diagnostics
 - High speed local control of pressure with ROU, CAS, and RCAS signals
- Engineer with process, configuration, control, measurement, and valve skills
- Virtual plants with increasing Fidelity (3 -> 7 chemical, 3->10 biological)
 - Product development, process design, real time optimization, advanced control prototyping and justification, process control improvement, diagnostics, training
- Smart wireless integrated process and operations graphics
 - Online process, loop, and advanced control metrics for plants, trains, and shifts
 - Yield, on-stream time, production rate, utility cost, raw material cost, maintenance cost*
 - Variability, average % of max speed (Lambda), % time process variable or output is at limits, % time in highest mode, % deadband, % resolution, number of oscillations
 - Process control improvement (PCI) benefits (\$)*
 - 3-D, XY, loop future response, data analytic, worm and correlated variables plots
- Coriolis flow meters, RTDs, and online and at-line analyzers every where possible
 - Real time analysis via probes or automated low maintenance sample systems
 - Automated time stamped entry of lab data into historian
 - Online material, energy, and component balances
- Control valves with < 0.2% resolution and < 0.4% dead band