

Analyzing Resonance of Motivation in Software Development Process Training by Using FRAM (Work-in-progress)

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Software (SW) Project & Process

Failure (Success) factors of SW project have been analyzed.

- Restarts
- Time overruns
- Cost overruns
- Contents deficiencies
- ...

SW process plays an important role in SW projects.

-> Process reference/assessment models and templates.

- CMMI (Capability Maturity Model Integration)
- SPICE: Software Process Improvement & Capability dEtermination
- ...

CMMI-DEV Process Areas (staged/continuous)

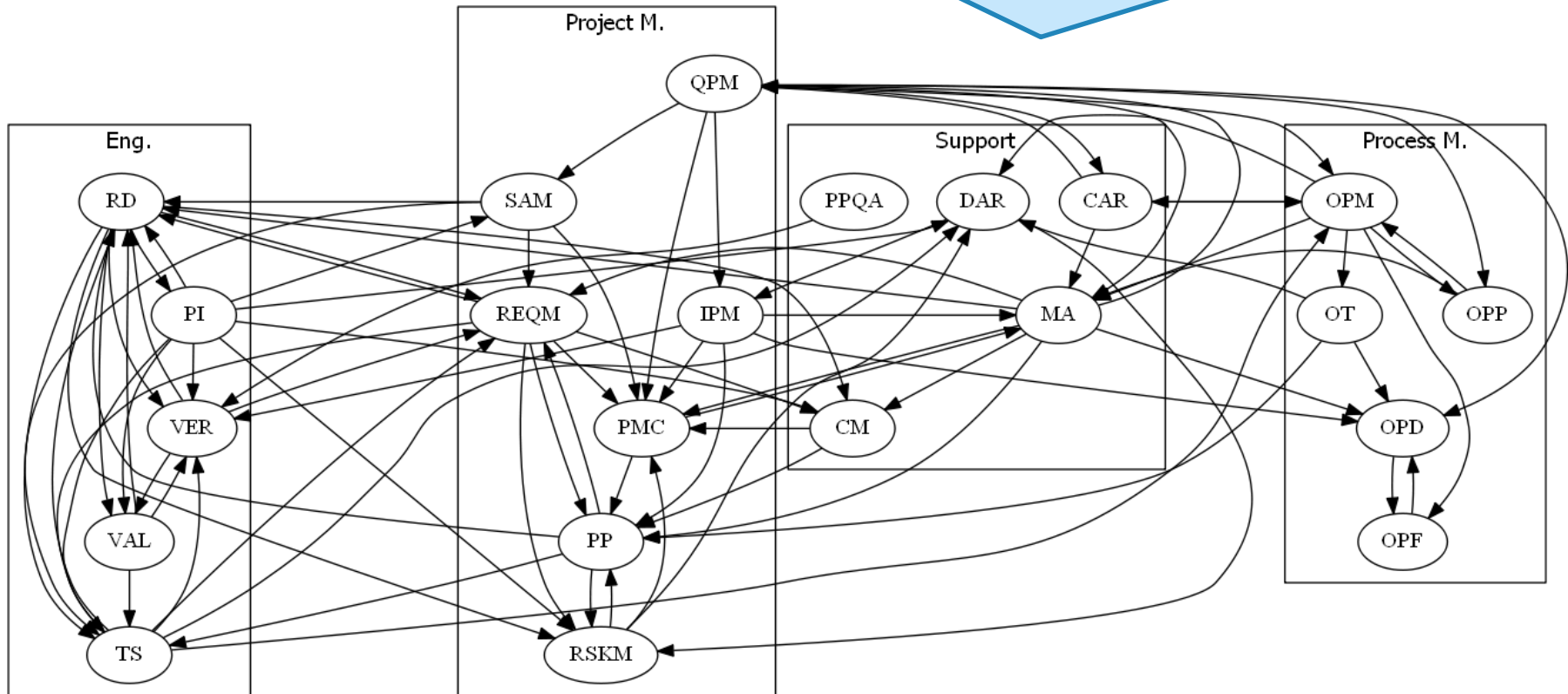
Maturity level	Process area name	Category
2:	Requirements Management (REQM)	: Project Management
2:	Project Planning (PP)	: Project Management
2:	Project Monitoring and Control (PMC)	: Project Management
2:	Supplier Agreement Management (SAM)	: Project Management
2:	Measurement and Analysis (MA)	: Support
2:	Process and Product Quality Assurance (PPQA)	: Support
2:	Configuration Management (CM)	: Support
3:	Requirements Development (RD)	: Engineering
3:	Technical Solution (TS)	: Engineering
3:	Product Integration (PI)	: Engineering
3:	Verification (VER)	: Engineering
3:	Validation (VAL)	: Engineering
3:	Organizational Process Focus (OPF)	: Process Management
3:	Organizational Process Definition (OPD)	: Process Management
3:	Organizational Training (OT)	: Process Management
3:	Integrated Project Management (IPM)	: Project Management
3:	Risk Management (RSKM)	: Project Management
3:	Decision Analysis and Resolution (DAR)	: Support
4:	Organizational Process Performance (OPP)	: Process Management
4:	Quantitative Project Management (QPM)	: Project Management
5:	Organizational Performance Management (OPM)	: Process Management
5:	Causal Analysis and Resolution (CAR)	: Support

Each process area : an abstract function?

Dependency among Process Areas/ Categories

There seem exist functional resonances among Process Areas

Node: Process Area, Arrow: Related Process Area (model component) , Box: Category



Process Areas: Functional View

Process area name

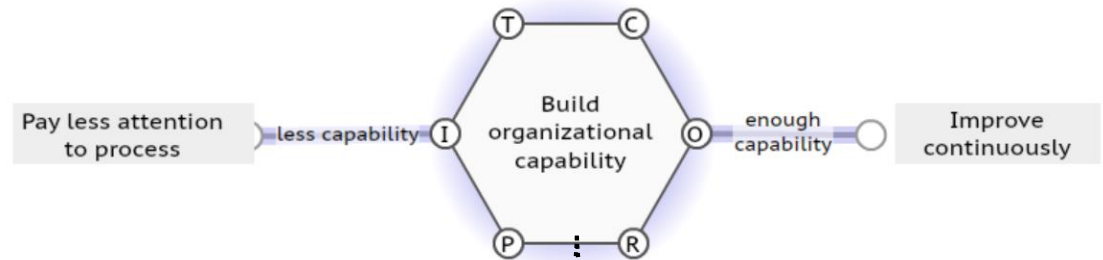
Functional view

Requirements Management (REQM)	> To Manage Requirements
Project Planning (PP)	> To Plan Project
Project Monitoring and Control (PMC)	> To Monitoring and Control
Supplier Agreement Management (SAM)	> To Manage Supplier Agreement
Measurement and Analysis (MA)	> To Measure and Analyze
Process & Product Quality Assurance (PPQA)	> To Assure Process & Product Quality
Configuration Management (CM)	> To Manage Configuration
Requirements Development (RD)	> To Develop Requirements
Technical Solution (TS)	> To Solve Technical Problems
Product Integration (PI)	> To Integrate Products
Verification (VER)	> To Verify
Validation (VAL)	> To Validate
Organizational Process Focus (OPF)	> To Focus on Organizational Process
Organizational Process Definition (OPD)	> To Define Organizational Process
Organizational Training (OT)	> To Train Organization Member
Integrated Project Management (IPM)	> To Manage Integrated Product
Risk Management (RSKM)	> To Manage Risk
Decision Analysis and Resolution (DAR)	> To Analyze and Resolve Decision
Organizational Process Performance(OPP)	> To Establish & Maintain Performance
Quantitative Project Management (QPM)	> To Quantitatively Manage Project
Organizational Performance Management (OPM)	> To Manage Performance
Causal Analysis and Resolution (CAR)	> To Analyze and Resolve Causes

Sample: Model & Template

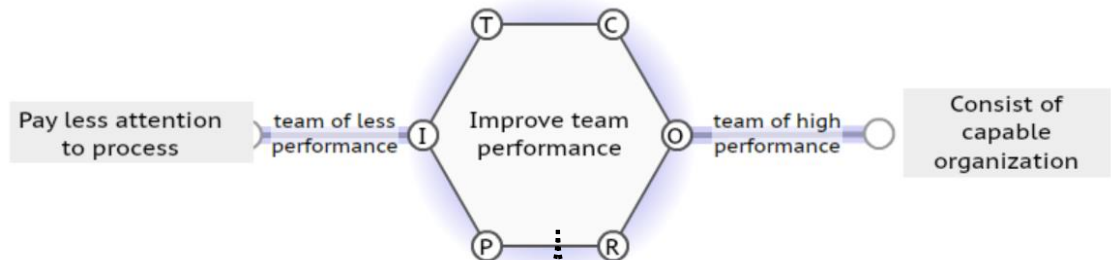
CMMI

- *Builds organizational capability*



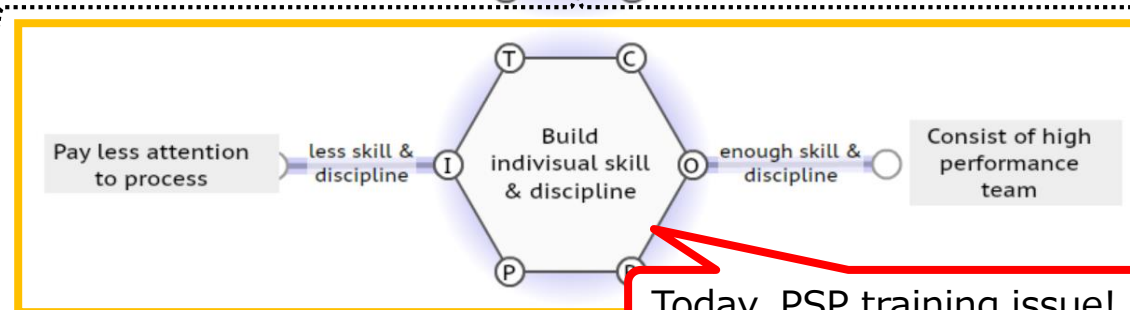
TSP

- *Improves team performance*



PSP

- *Builds individual skill and discipline*



PSP staged structure

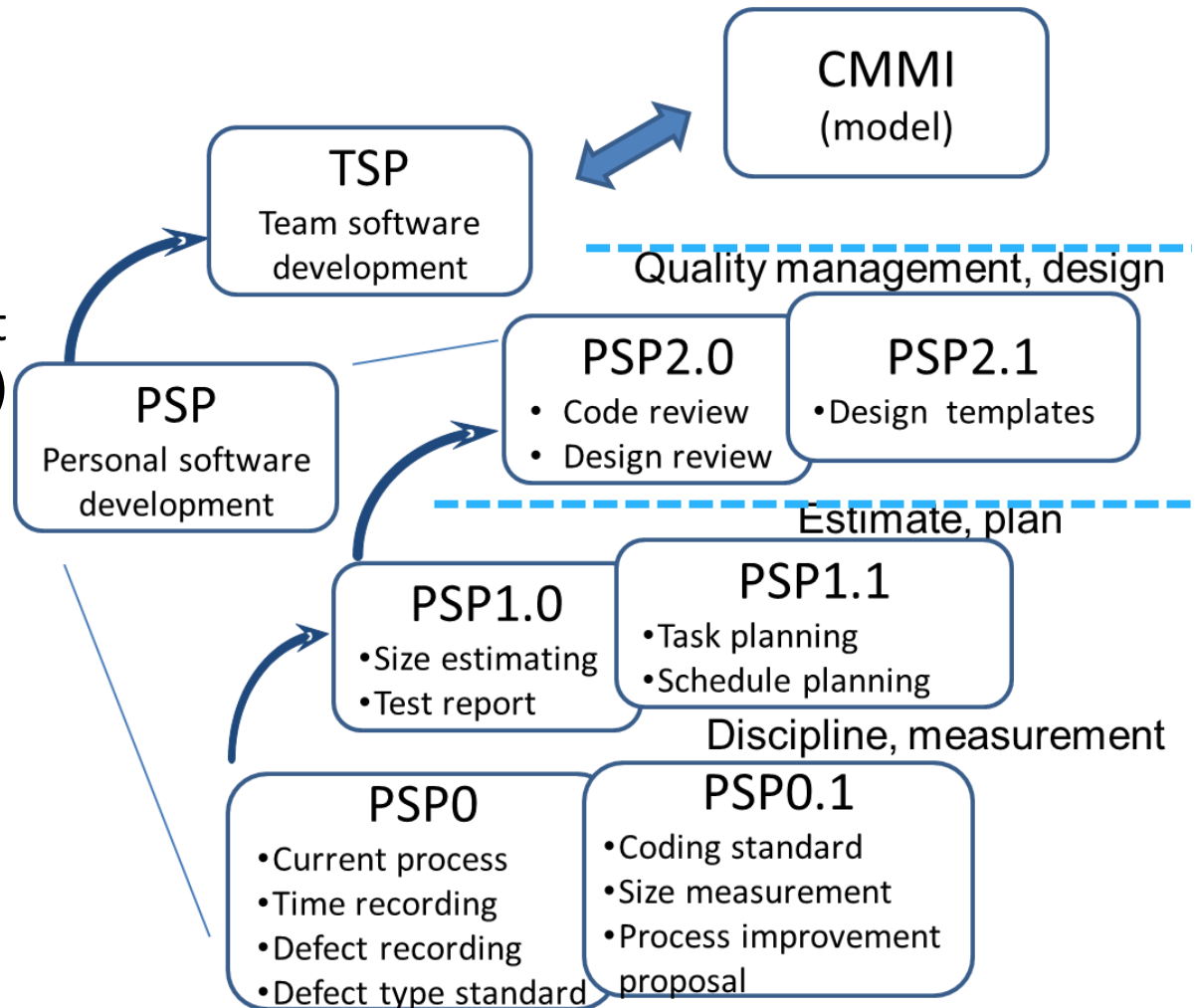
PSP course structure (8-program version)

– PSP for planning

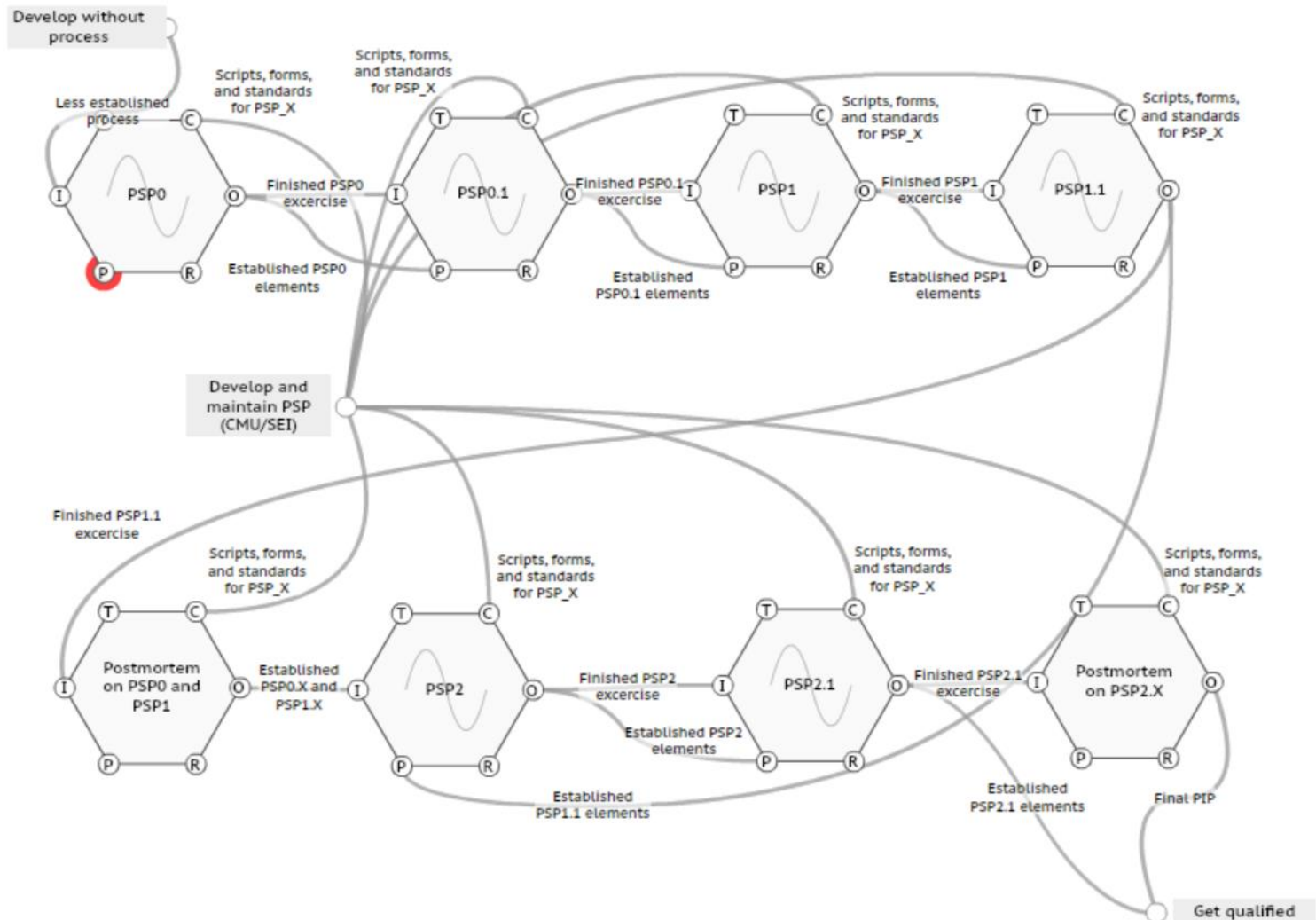
- PSP0*: measurement (2 program exercises)
- PSP1*: estimate (2)

– PSP for quality

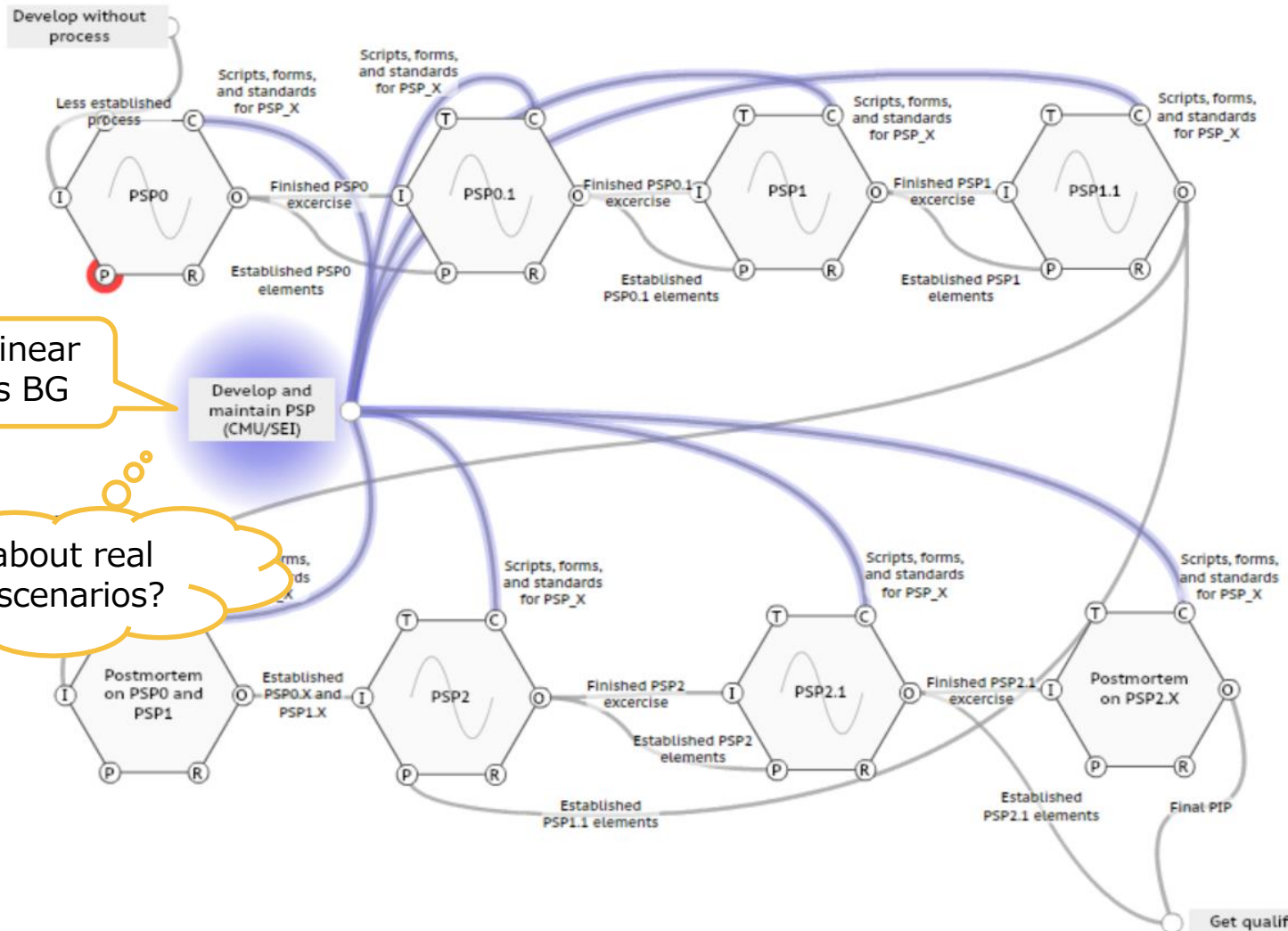
- PSP2*: quality (4)



PSP: Initial Model



PSP: Initial Model



Almost linear
w/o this BG

How about real
world scenarios?

Kyutec(Kyushu Institute of technology (grad.)) Case

Achievement & problem of PSP course

- Size and time estimation
 - Lower error rate, better balance between +/-
- Quality
 - Process defect removal rate \geq about 80%
 - 190 defects/KLOC \rightarrow 25 defects/KLOC
- Productivity
 - Almost the same before/after the course
- **Course completion rate**
 - PSP-Planning: 100% after 2010
 - PSP-Quality: about 20% (= < 50%, industry)

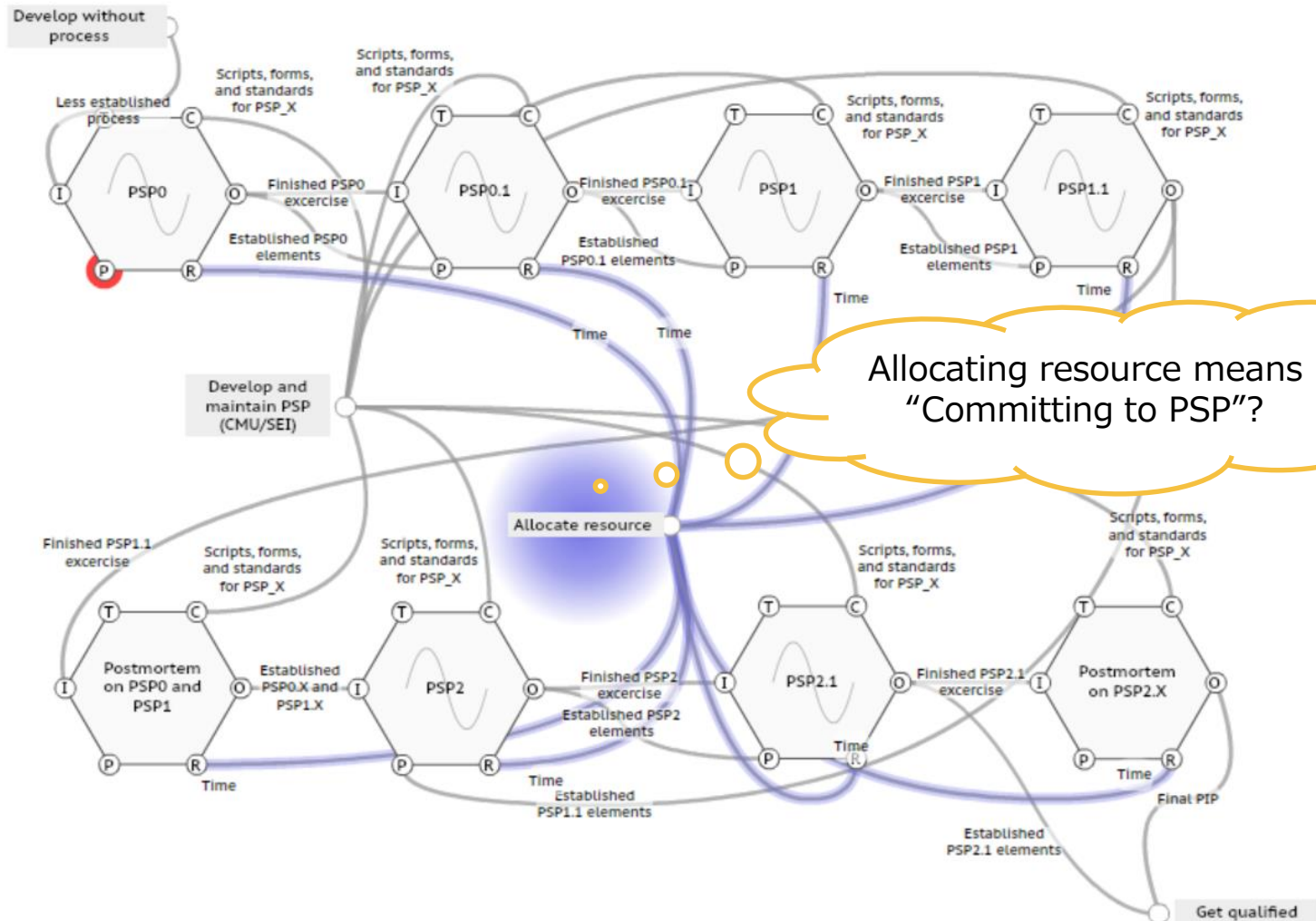
Factors for PSP Course Incompletion

- Lack of Programming Skill
 - Resolved by adequate guidance
- Heavy workload
 - (Lec. 3h + Exc./Report 7h(ave.)) × 10 times
- Lack of time management skill
 - Tradeoff between classwork and research activity
- Motivation (our focus)
 - Needed in introducing new method in general
 - How to motivate? Intuitive Tacit knowledge?

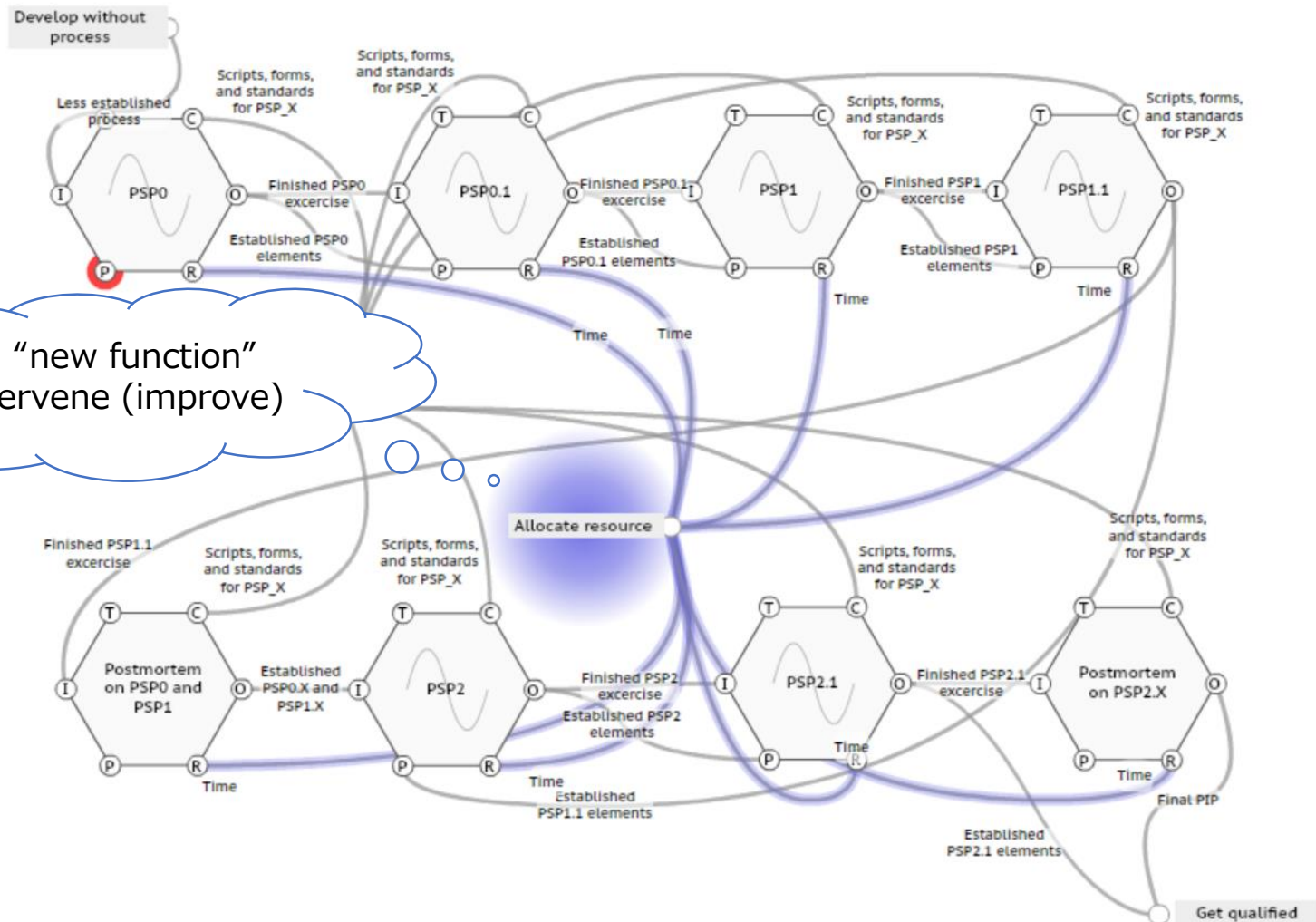


- Formalize motivation process in PSP course
- Establish “better” PSP course management

PSP: Simple Model w/ Commit. view

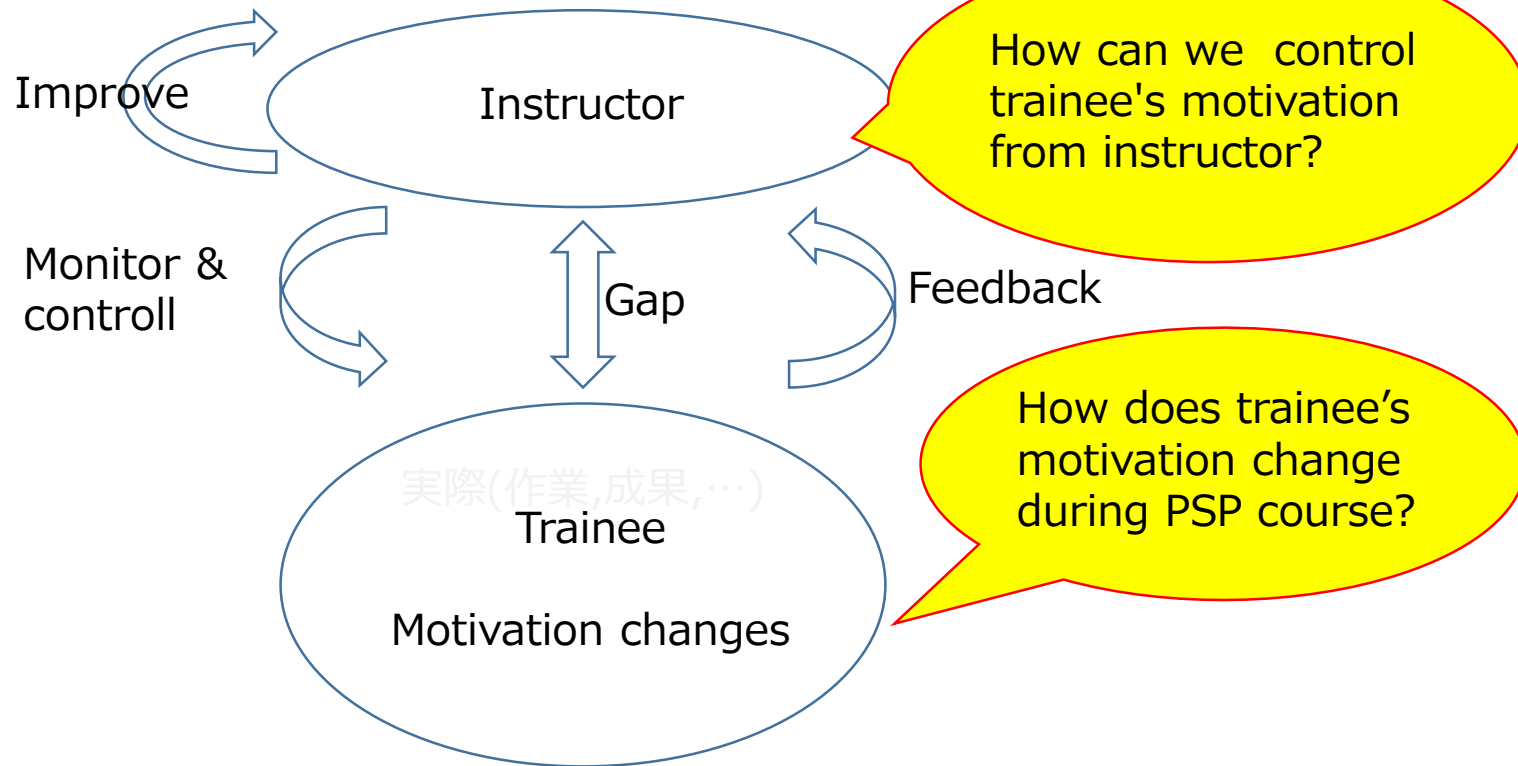


PSP: Simple Model w/ Commit. view



PSP training case

- Structure for motivation control



State Transition Model of Motivation Process

- State Transition Model (proposed by Kyutec Prof.)
 - Regards an individual/organization as a state machine
 - Formalizes motivation process by states and operations
- State
 - the state S_f of factor f is discrete with significant granularity
- Operation
 - The operation O affects some states
 - ✓ Explain the importance, praise performance, ...
- State transition
 - Non-deterministic
- Scenario
 - Sequence from initial state S_0 to final S_n .
 - ✓ Succeeded scenario : results in establishing new technologies or methods
 - ✓ Failure scenario : results in failure

Factors of Motivation Process

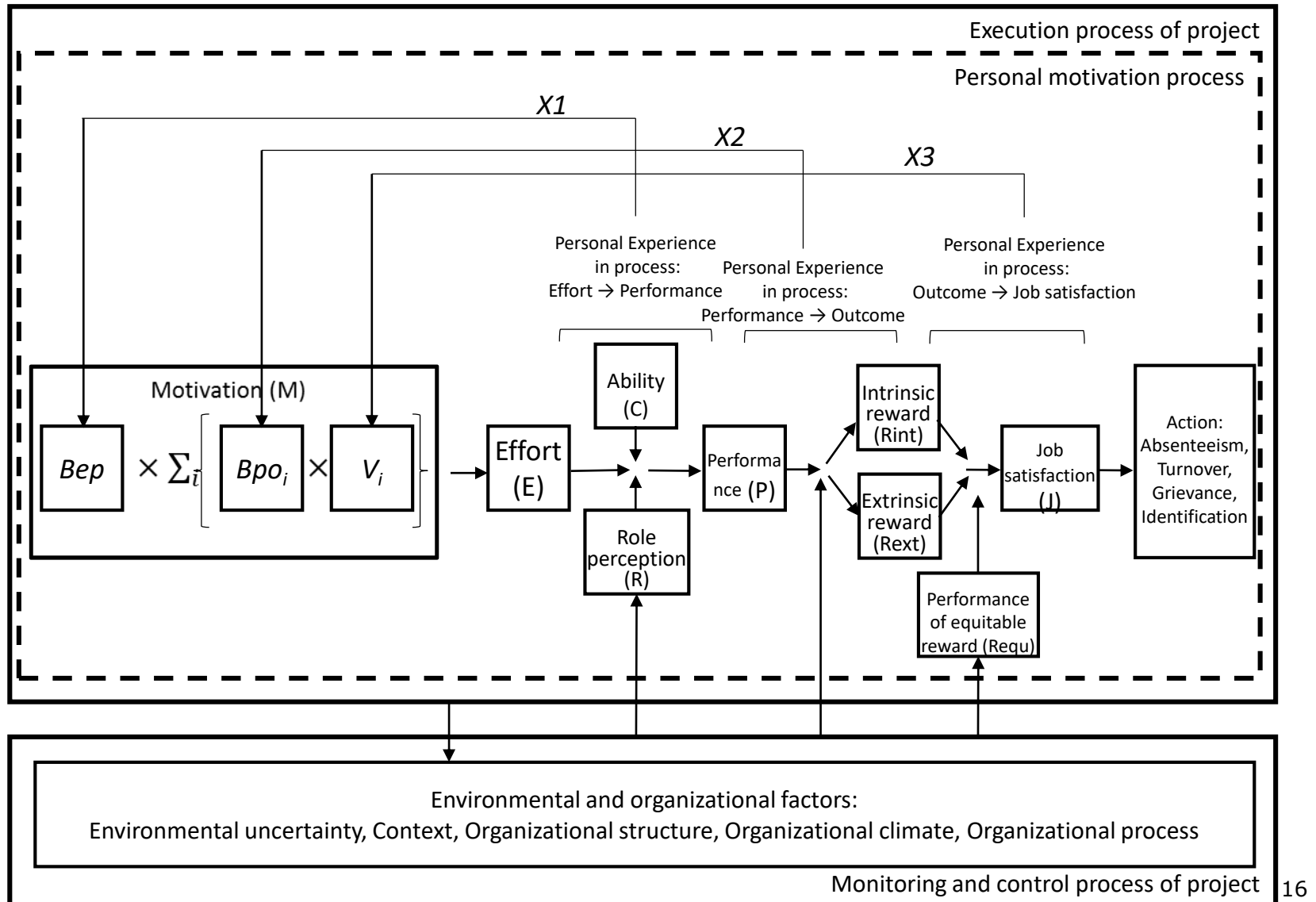
Factor	State value set
Bep^{*1}	{VeryHigh, High, Low, Unknown}
Bpo^{*2}	{High, Low, Unknown}
Valence V^{*3}	{High, Low, Unknown}
Effort E	{VeryHigh, High, Low, Unknown}
Ability C	{VeryHigh, High, Low, Unknown}
Role Perception R_i ($i=1..87$)	{Perceived, NotPerceived, Unknown}
Performance P_j ($j=1..10$)	{Accomplished, NotAccomplished}
Assignment A_j ($j=1..10$)	{NotGiven, Given, PlanningCompleted, Completed}
Intrinsic Reward	{Given, NotGiven}
Extrinsic Reward	{Given, NotGiven}
Job Satisfaction	{HighLevel, LowLevel}

*1: Bep is the person's belief concerning the probability that performance P at that level will be achieved if effort E performing at that level is made.

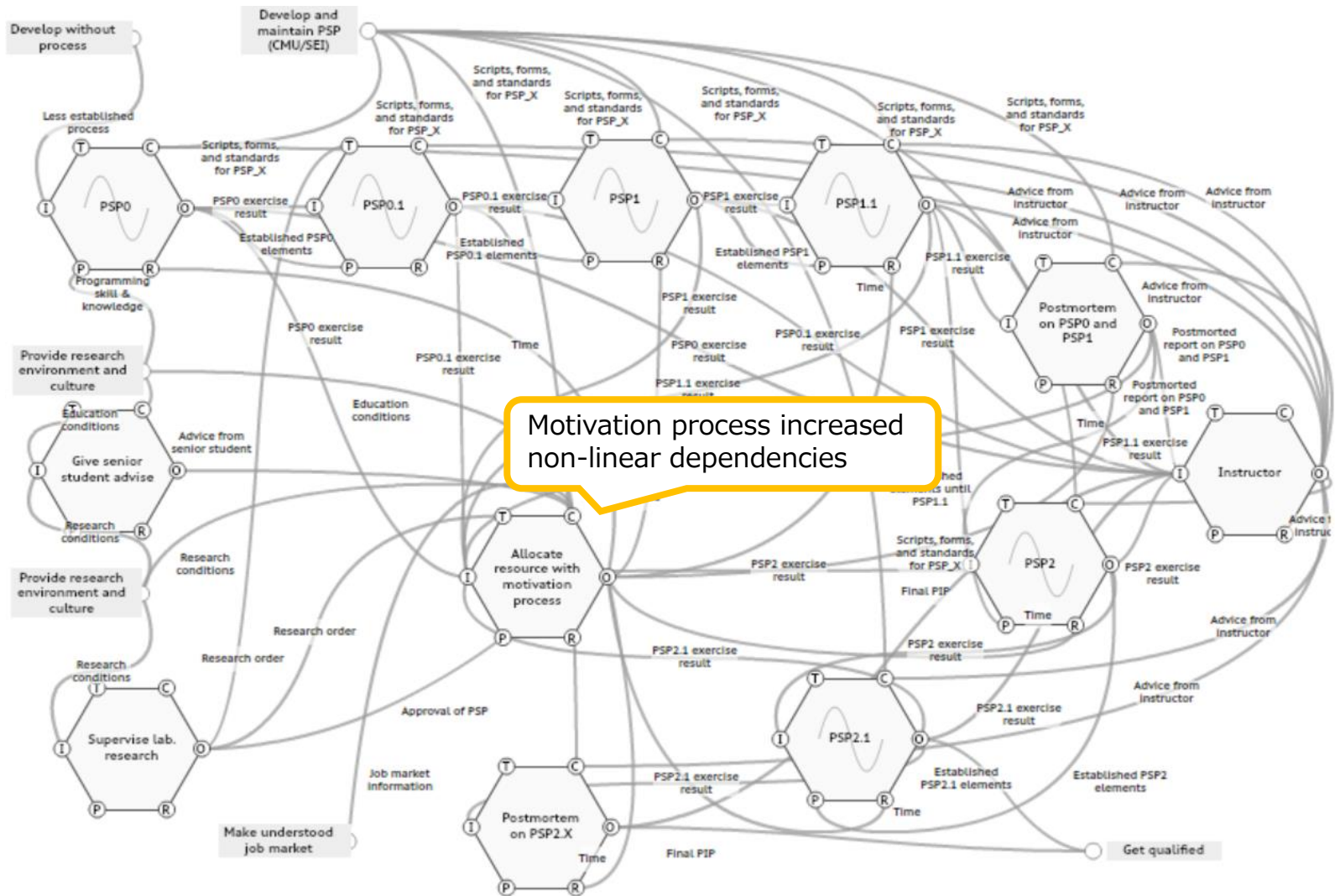
*2: Bpo is a person's subjective probability that P at the intended level will lead to an outcome O .

*3: V is a valence that represents the degree of personal emotion or preference for O .

Structure of Motivation Process

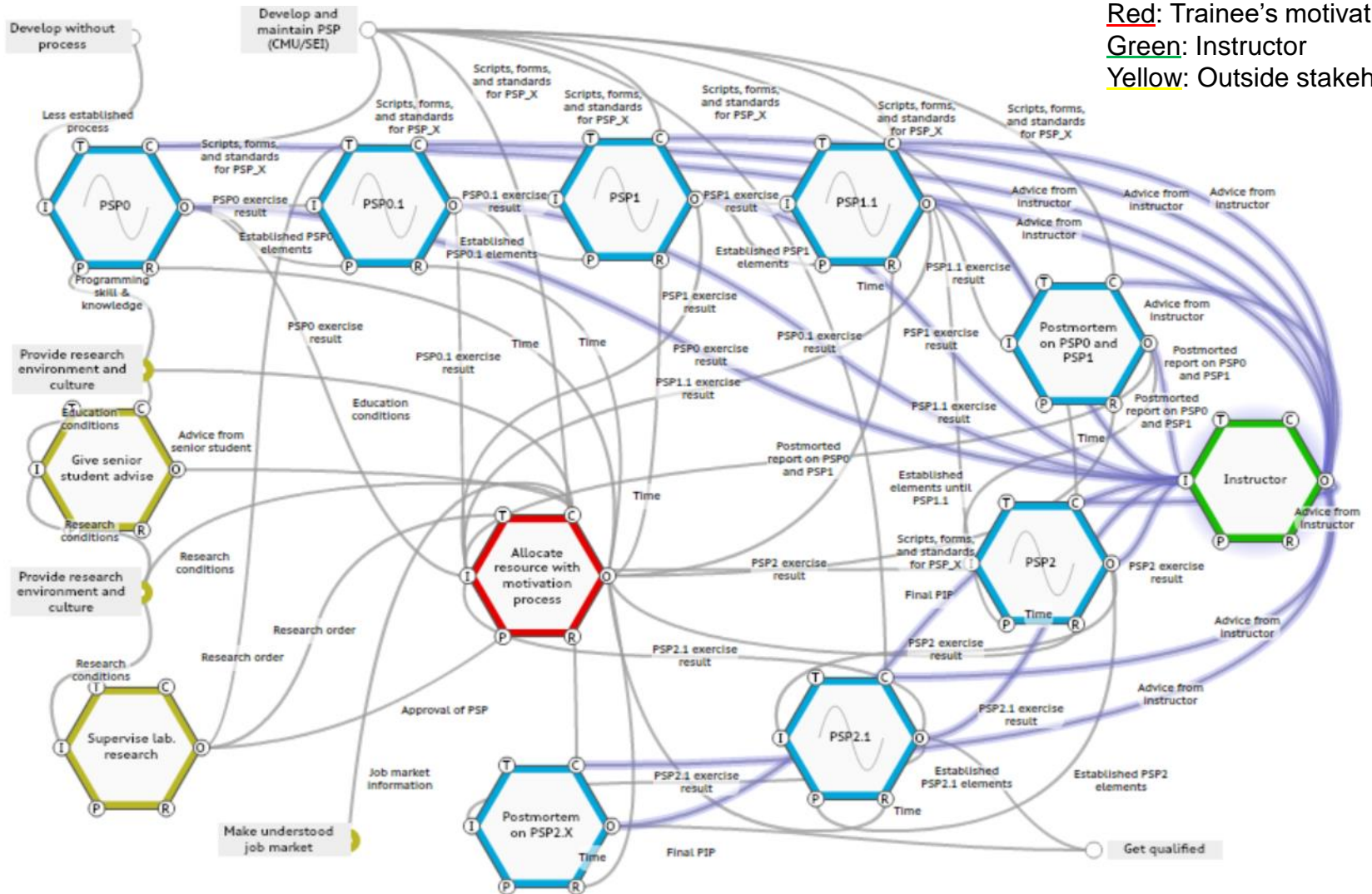


Adding Function w/ Motivation



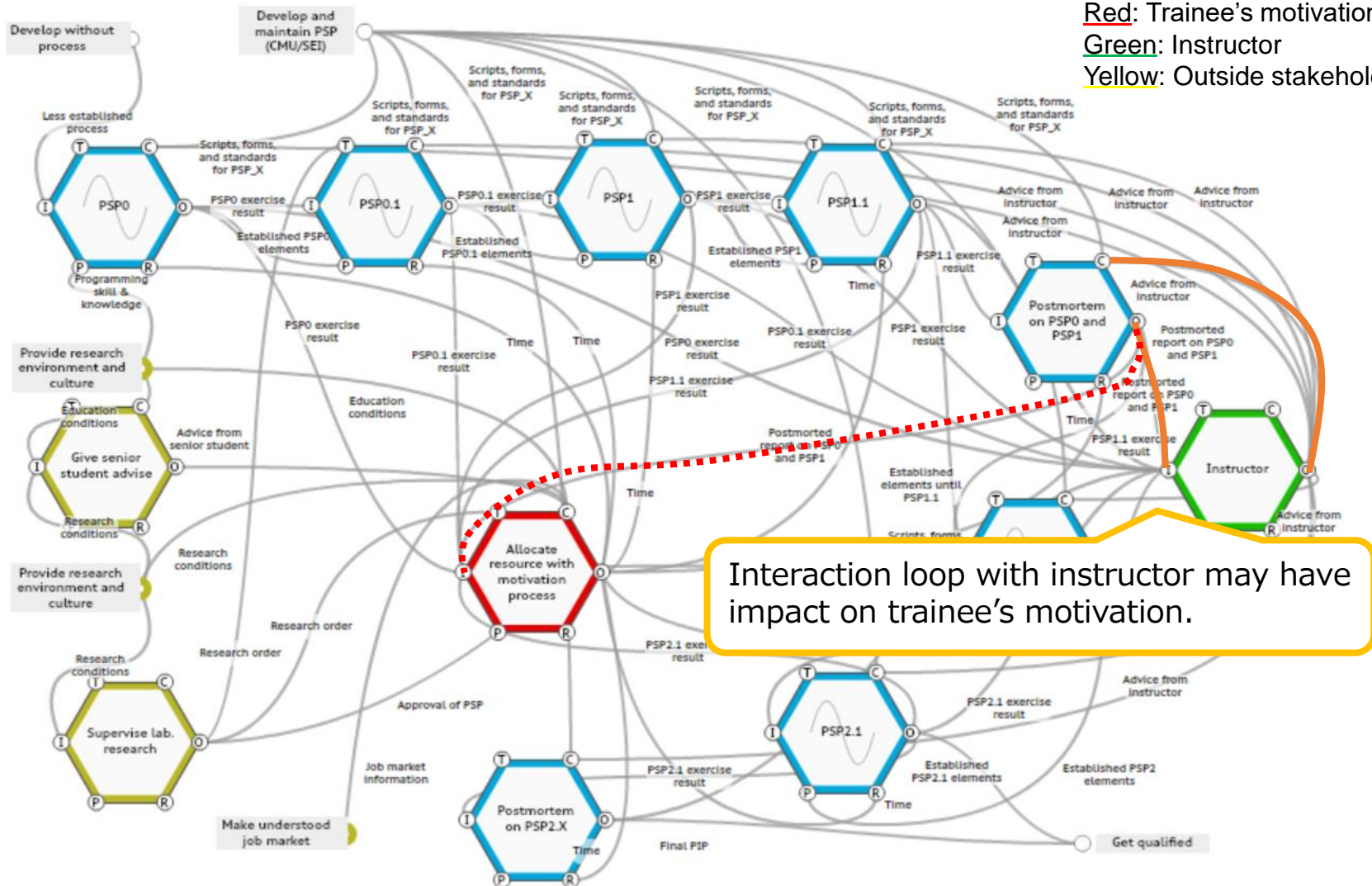
Instructor: No Impacts on Motivation?

Blue: PSP course
 Red: Trainee's motivation
 Green: Instructor
 Yellow: Outside stakeholders



Clue Example

Blue: PSP course
 Red: Trainee's motivation
 Green: Instructor
 Yellow: Outside stakeholders



Direct impacts from outside course?

Blue: PSP course

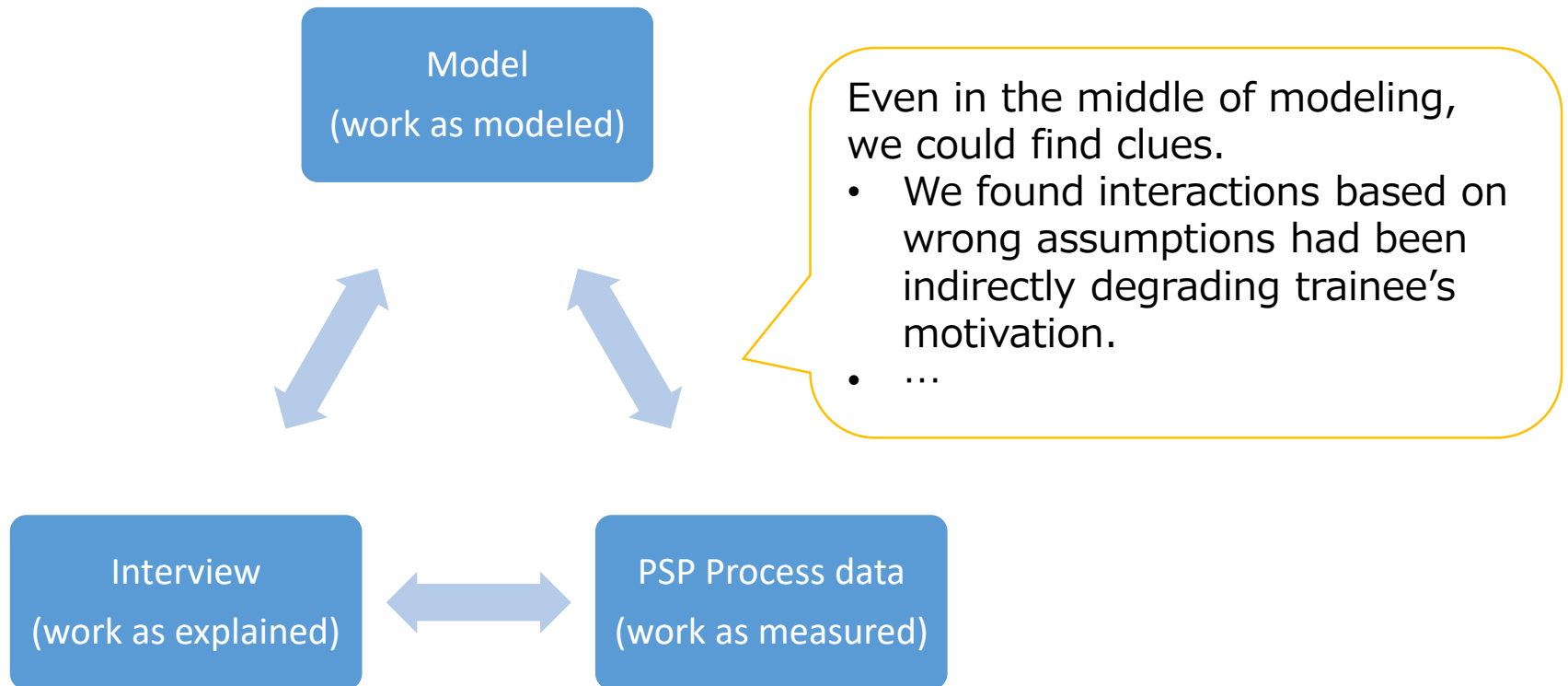
Red: Trainee's motivation

Green: Instructor

Yellow: Outside stakeholders



Elaboration



Concluding Remarks

- FRAM model combined with motivation process model made our eyes more widely opened.
 - Enabled higher resolution, uncovered stakeholders, ...
 - Gave clues for detailed review on course management .
- Even in the middle of modeling, we could examine our issues and propose improvements
 - Modify wrong assumptions, inconsistencies, ...
 - Reconsider system boundary.
- Future work
 - Elaboration on modeling, data collection (interview)