



## รายการอ้างอิง

### ภาษาไทย

ก่อเกียรติ เก่งสกุล “ปัญญาประดิษฐ์ และ ระบบผู้เชี่ยวชาญ” ภาควิชาคอมพิวเตอร์  
คณะวิศวกรรมศาสตร์ สถาบันเทคโนโลยีพระจอมเกล้าธนบุรี พ.ศ. 2534  
บรรเลง ศรีนิล “เทคโนโลยีพลาสติก” สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น)

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## ภาคผนวก ก

### ระบบฐานกฎของการเลือกกรรมวิธีการผลิตผลิตภัณฑ์พลาสติก

โปรแกรมระบบผู้เชี่ยวชาญสำหรับการเลือกกรรมวิธีการผลิตผลิตภัณฑ์พลาสติกได้แบ่งกลุ่มของระบบฐานกฎออกเป็น 12 กลุ่มดังต่อไปนี้

#### ก.1 กฎเกี่ยวกับการติดต่อผู้ใช้ (User Interface)

ตัวอย่างของกฎเกี่ยวกับการติดต่อผู้ใช้นี้ดังต่อไปนี้

##### ก.1.1 ข้อ Rule R\_Initialization

**IF**

Product Typical is precisely equal to Cups , Trays , Open containers , Caps , Covers , Closures , Hoods, Housings, Autoparts, Complex shapes , Thickness changes, Linear shapes, Pipe, Profiles, Sheets, Panels , Laminates, Tanks or Drum

**THEN** Initialization is confirmed.

**And** Product Typical is assigned to Product Typical

##### ก.1.2 ข้อ Rule Typical Product

**IF**

There is no evidence of Initialization

**And** Product Typical is assigned to Product Typical

**THEN Typical Product** is confirmed.

n.1.3 **Rule Shape Product**

**IF**

There is evidence of Typical Product

**And** Requirement of Product Shape is precisely equal to Sheet , Pipe , Open hollow bodies, Enclosed hollow bodies, Rod, Profile, Film or Molded products

**THEN Shape Product** is confirmed.

n.1.4 **Rule Molded Product**

**IF**

Requirement of Product Shape is precisely equal to Open hollow bodies, Molded products

**THEN Molded Product** is confirmed.

**And** GeoBosses is assigned to GeoBosses

**And** GeoHoles is assigned to GeoHoles

**And** GeoInserts is assigned to GeoInserts

**And** GeoRibs is assigned to GeoRibs

**And** GeoThreads is assigned to GeoThreads

**And** GeoUndercuts is assigned to GeoUndercuts

**And** Show Geometry of product

**And** Size Product is assigned to Size Product

**And** Check Size Volume is assigned to Check Size Volume

**And** Check Size Rate is assigned to Check Size Rate

**And** Check Size Tolerance is assigned to Check Size Tolerance

**And** Check Size Finishing is assigned to Check Size Finishing

**And** Strength Part is assigned to Strength Part

## ก.2 กฎเกี่ยวกับรูปร่างของผลิตภัณฑ์ (Product Shape)

### ก.2.1 ชื่อ Rule Product Shape

**IF**

Use the **Testmultivalue** execute to find all plastic processor methods which produce product shape requirement

**THEN** Product Shape is confirmed.

**And** Use **AtomNameValue** to construct a multi-value containing the name of all the processor which corresponding product requirement

### ก.2.2 ชื่อ Rule Bosses

**IF**

Requirement of bosses is precisely equal to YES

**And** Use pathern mathing to fine processors which can not creat bosses

**THEN** Bosses is confirmed.

**And** Delete Processors which can not creat bosses

### п.2.3 30 Rule Ribs

**IF**

Requirement of ribs is precisely equal to YES

**And** Use pathern mathing to fine processors which can not creat ribs

**THEN** Ribs is confirmed.

**And** Delete Processors which can not creat ribs

### п.2.4 30 Rule Threads

**IF**

Requirement of threads is precisely equal to YES

**And** Use pathern mathing to fine processors which can not creat threads

**THEN** Threads is confirmed.

**And** Delete Processors which can not creat threads

### п.2.5 30 Rule Holes

**IF**

Requirement of holes is precisely equal to YES

**And** Use pathern mathing to fine processors which can not creat holes

**THEN** Holes is confirmed.

**And** Delete Processors which can not creat holes

#### ก.2.6 ข้อ Rule Inserts

**IF**

Requirement of inserts is precisely equal to YES

**And** Use pathern mathing to fine processors which can not creat inserts

**THEN** Inserts is confirmed.

**And** Delete Processors which can not creat inserts

#### ก.2.7 ข้อ Rule Undercuts

**IF**

Requirement of undercuts is precisely equal to YES

**And** Use pathern mathing to fine processors which can not creat undercuts

**THEN** Undercuts is confirmed.

**And** Delete Processors which can not creat undercuts

### ก.3 ข้อ Rule เกี่ยวกับความคลาดเคลื่อนอนุโลมของผลิตภัณฑ์ (Dimensional Tolerance)

#### ก.3.1 ข้อ Rule Fine Tolerance

**IF**



Requirement of Dimensional Tolerance is precisely equal to Fine

**And Use the Testmultivalue** execute to fine all plastic processor methods  
which Dimensional Tolerance is precisely equal to Normal and Coarse

**THEN** Dimensional Tolerance is confirmed.

**And** Delete Processors which Dimensional Tolerance is precisely equal to  
Normal and Coarse

**And** Check Tolerance is assigned to Check Tolerance

**ELSE**

Dimensional Tolerance is not confirmed.

**And Use AtomNameValue** to construct a multi-value containing the name of  
all the processor which corresponding Dimensional Tolerance requirement

### п.3.2 Rule Normal Tolerance

**IF**

Requirement of Dimensional Tolerance is precisely equal to Normal

**And Use the Testmultivalue** execute to fine all plastic processor methods  
which Dimensional Tolerance is precisely equal to Coarse

**THEN** Dimensional Tolerance is confirmed.

**And** Delete Processors which Dimensional Tolerance is precisely equal to

Coarse

**And** Check Tolerance is assigned to Check Tolerance

**ELSE**

Dimensional Tolerance is not confirmed.

**And** Use **AtomNameValue** to construct a multi-value containing the name of

all the processor which corresponding Dimensional Tolerance requirement

#### ก.4 Rule เกี่ยวกับความแข็งแรงของผลิตภัณฑ์ (Part Strength)

##### ก.4.1 ข้อ Rule Excellent Strength

**IF**

Requirement of Part Strength is precisely equal to Excellent

**And** Use the **Testmultivalue** execute to find all plastic processor methods

which Part Strength is precisely equal to Good, Fair and Poor

**THEN** Part Strength is confirmed.

**And** Delete Processors which Part Strength is precisely equal to Good, Fair

and Poor

**ELSE**

Part Strength is not confirmed.

**And Use AtomNameValue** to construct a multi-value containing the name of all the processor which corresponding Part Strength requirement

#### n.4.2 Rule Good Strength

**IF**

Requirement of Part Strength is precisely equal to Good

**And Use the Testmultivalue** execute to find all plastic processor methods which Part Strength is precisely equal to Fair and Poor

**THEN** Part Strength is confirmed.

**And Delete Processors** which Part Strength is precisely equal to Fair and Poor

**ELSE**

Part Strength is not confirmed.

**And Use AtomNameValue** to construct a multi-value containing the name of all the processor which corresponding Part Strength requirement

#### n.4.3 Rule Fair Strength

**IF**

Requirement of Part Strength is precisely equal to Fair

**And Use the Testmultivalue** execute to find all plastic processor methods

which Part Strength is precisely equal to Poor

**THEN** Part Strength is confirmed.

**And** Delete Processors which Part Strength is precisely equal to Poor

**ELSE**

Part Strength is not confirmed.

**And** Use **AtomNameValue** to construct a multi-value containing the name of

all the processor which corresponding Part Strength requirement

#### ก.5 Rule เกี่ยวกับขนาดของผลิตภัณฑ์พลาสติก (Product Size)

##### ก.5.1 ข้อ Rule Large Size

**IF**

Requirement of Product Size is precisely equal to Large

**And** Use the **Testmultivalue** execute to fine all plastic processor methods

which Product Size is precisely equal to Medium and Small

**And** Plastic processor methods requirement is a member of Processors

**THEN** ProductSize is confirmed.

**And** Delete Processors which Product Size is precisely equal to Medium

and Small

**And Use AtomNameValue** to construct a multi-value containing the name of all the processor which corresponding Part Size requirement

#### ก.5.2 ข้อ Rule Medium Size

**IF**

Requirement of Product Size is precisely equal to Medium

**And Use the Testmultivalue** execute to find all plastic processor methods which Product Size is precisely equal to Small

**And** Plastic processor methods requirement is a member of Processors

**THEN** ProductSize is confirmed.

**And** Delete Processors which Product Size is precisely equal to Small

**And Use AtomNameValue** to construct a multi-value containing the name of all the processor which corresponding Part Size requirement

#### ก.6 Rule เกี่ยวกับปริมาณการผลิตผลิตภัณฑ์พลาสติก (Product Volume)

##### ก.6.1 ข้อ Rule Very high Volume

**IF**

Requirement of Product Volume is precisely equal to Very high

**And Use the Testmultivalue** execute to find all plastic processor methods

which Product Volume is precisely equal to High, Medium, Low and Very low

**And** Plastic processor methods requirement is a member of Processors

**THEN**

Product Volume is confirmed.

**And** Delete Processors which Product Volume is precisely equal to High,

Medium, Low and Very low

**ELSE**

Product Volume is not confirmed.

**And** Use AtomNameValue to construct a multi-value containing the name of

all the processor which corresponding Product Volume requirement

#### 0.6.2 Rule Medium Volume

**IF**

Requirement of Product Volume is precisely equal to Medium

**And** Use the Testmultivalue execute to find all plastic processor methods

which Product Volume is precisely equal to Low and Very low

**And** Plastic processor methods requirement is a member of Processors

**THEN**

Product Volume is confirmed.

**And** Delete Processors which Product Volume is precisely equal to Low and

Very Low

**ELSE**

Product Volume is not confirmed.

**And** Use AtomNameValue to construct a multi-value containing the name of

all the processor which corresponding Product Volume requirement

### n.6.3 Rule Low Volume

**IF**

Requirement of Product Volume is precisely equal to Low

**And** Use the Testmultivalue execute to find all plastic processor methods

which Product Volume is precisely equal to Very Low

**And** Plastic processor methods requirement is a member of Processors

**THEN**

Product Volume is confirmed.

**And** Delete Processors which Product Volume is precisely equal to Very

Slow

**ELSE**

Product Volume is not confirmed.

**And Use AtomNameValue** to construct a multi-value containing the name of all the processor which corresponding Product Volume requirement

### ก.7 Rule เกี่ยวกับความเรียบของผลิตภัณฑ์ (Surface Finishing)

#### ก.7.1 ข้อ Rule Very smooth Surface Finishing

**IF**

Requirement of Surface Finishing is precisely equal to Very smooth

**And Use the Testmultivalue** execute to find all plastic processor methods which Surface Finishing is precisely equal to Smooth, Moderate smooth, Moderate Rough and Rough

**And** Plastic processor methods requirement is a member of Processors

**THEN** Surface Finishing is confirmed.

**And** Delete Processors which Surface Finishing is precisely equal to Smooth, Moderate smooth, Moderate Rough and Rough

**ELSE**

Surface Finishing is not confirmed.

**And Use AtomNameValue** to construct a multi-value containing the name of all the processor which corresponding Surface Finishing requirement



### п.7.2 Rule Smooth Surface Finishing

**IF**

Requirement of Surface Finishing is precisely equal to Very smooth

**And Use the Testmultivalue** execute to find all plastic processor methods

which Surface Finishing is precisely equal to Moderate smooth, Moderate

Rough and Rough

**And** Plastic processor methods requirement is a member of Processors

**THEN** Surface Finishing is confirmed.

**And** Delete Processors which Surface Finishing is precisely equal to

Moderate smooth, Moderate Rough and Rough

**ELSE**

Surface Finishing is not confirmed.

**And Use AtomNameValue** to construct a multi-value containing the name of

all the processor which corresponding Surface Finishing requirement

### п.7.3 Rule Moderate Rough Surface Finishing

**IF**

Requirement of Surface Finishing is precisely equal to Moderate rough

**And Use the Testmultivalue** execute to find all plastic processor methods

which Surface Finishing is precisely equal to Rough

**And** Plastic processor methods requirement is a member of Processors

**THEN** Surface Finishing is confirmed.

**And** Delete Processors which Surface Finishing is precisely equal to Rough

**ELSE**

Surface Finishing is not confirmed.

**And Use AtomNameValue** to construct a multi-value containing the name of

all the processor which corresponding Surface Finishing requirement

## ก.8 Rule เกี่ยวกับอัตราการการผลิต (Production Rate)

### ก.8.1 ข้อ Rule Rapid Rate

**IF**

Requirement of Production Rate is precisely equal to Rapid

**And Use the Testmultivalue** execute to find all plastic processor methods

which Production Rate is precisely equal to Medium and Slow

**THEN**

Production Rate is confirmed.

**And** Delete Processors which Production Rate is precisely equal to Medium  
and Slow

**ELSE**

Production Rate is not confirmed.

**And** Use **AtomNameValue** to construct a multi-value containing the name of  
all the processor which corresponding Production Rate requirement

#### п.8.2 Rule Medium Rate

**IF**

Requirement of Production Rate is precisely equal to Medium

**And** Use the **Testmultivalue** execute to find all plastic processor methods  
which Production Rate is precisely equal to Slow

**THEN**

Production Rate is confirmed.

**And** Delete Processors which Production Rate is precisely equal to Slow

**ELSE**

Production Rate is not confirmed.

**And** Use **AtomNameValue** to construct a multi-value containing the name of  
all the processor which corresponding Production Rate requirement

## ก.9 Rule เกี่ยวกับการตรวจสอบ แล้วกลับไปค้นหาในฐานความรู้

### ก.9.1 ข้อ Rule Relax Tolerance

**IF**

Check Weight Tolerance is assigned to Check Weight Tolerance

**And** Show Relaxing Constraints of Tolerance

**And** Reset Tolerance Dimensional of Tolerance

**And** Reset Requirement of Dimensional Tolerance

**And** Reset Tolerance Dimensional

**And** Reset Check Tolerance

**And** Reset Dimensional Tolerance

**And** Delete Processors which Dimensional Tolerance is precisely equal to previous tolerance

**And** Tolerance Weight is assigned to Tolerance Dimensional

**And** Dimensional Tolerance is assigned to Dimensional Tolerance

**THEN** Relax Tolerance is confirmed.

### ก.9.2 ข้อ Rule Relax Strength

**IF**

Check Weight Strength is assigned to Check Weight Strength

**And** Show Relaxing Constraints of Strength

**And** Reset Strength Part of Strength

**And** Reset Requirement of Part Strength

**And** Reset Strength Part

**And** Reset Check Strength

**And** Reset Part Strength

**And** Delete Processors which Part Strength is precisely equal to previous  
Strength

**And** Strength Weight is assigned to Strength Part

**And** Part Strength is assigned to Part Strength

**THEN** Relax Strength is confirmed.

ก.10 Rule เกี่ยวกับการถ่วงน้ำหนักความสำคัญ

ก.10.1 ข้อ Rule R\_CheckWeightTolerance\_\_3

**IF**

Dimensional Tolerance of Weight\_Rank is precisely equal to 4

**And Use GetListElem** retrieves name of processors from Class Weight Ranking  
which Weight\_Rank is precisely equal to 3 and attaches them to Class Weight

**THEN** Check Weight Tolerance is confirmed.

**And** Take the name of processors in multi-value of weight and link them to temporary Class Processors

**And** Delete all Processors in Class Weight

#### п.10.2 Rule R\_CheckWeightTolerance\_\_2

**IF**

Dimensional Tolerance of Weight\_Rank is precisely equal to 3

**And Use GetListElem** retrieves name of processors from Class Weight Ranking which Weight\_Rank is precisely equal to 2 and attaches them to Class Weight

**THEN** Check Weight Tolerance is confirmed.

**And** Take the name of processors in multi-value of weight and link them to temporary Class Processors

**And** Delete all Processors in Class Weight

#### п.10.3 Rule FirstOrder

**IF**

Use RankList ranks a list of Class Weight Ranking according to Weight Property

**And** Product Volume of Weight\_Rank is assigned to Check Volume of weight\_Rank

**And** Dimensional Tolerance of Weight\_Rank is assigned to Check Tolerance of

Weight\_Rank

**And** Production Rate of Weight\_Rank is assigned to Check Rate of

Weight\_Rank

**And** Surface Finishing of Weight\_Rank is assigned to Check Surface Finishing of

Weight\_Rank

**And** Part Strength of Weight\_Rank is assigned to Check Part Strength of

Weight\_Rank

**And** Sending Message FirstOrder to Class Weight Ranking

**THEN** FirstOrder is confirmed.

#### ก.11 Rule เกี่ยวกับการแสดงผล

##### ก.11.1 Rule Show Processors

**IF**

Plastic processor methods requirement is a member of Processors

**THEN**

Show Processors is confirmed.

**And** Show Processors and Resins

**And** Resin Product is assigned to Resin Product

## ก.12 กฎเกี่ยวกับเรซิน

### ก.12.1 ชื่อ Rule Resin Product

**IF**

Requirement of Resins is precisely equal to Acetal, ABS, Acrylic, Cellulose acetate,

Cellulose acetate butylate, Cellulose nitrate, Cellulose propionate, Ethyl cellulose,

Chlorinated polyether, CTFE, TFE, FEP, CTFE-VF2, Nylon, Phenoxy or Polyim

**And the Testmultivalue** execute to fine plastic processor methods which

produce product from resin requirement

**And** Plastic processor methods requirement is a member of Processors

**THEN** Resin Product is confirmed.

**And** Delete Processors which resin is not precisely equal to resin requirement

**And** Show Processors and Information

**ELSE**

Resin Product is not confirmed.

**And** Show Processors and Information



## ภาคผนวก ข

### การแสดงความรู้โดยใช้เฟรมของกรรมวิธีการผลิตผลิตภัณฑ์พลาสติก

#### CLASS BLOW MOLDING

META-SLOT = |BlowMolding|.Bosses  
INITVAL= "Yes"

META-SLOT = |BlowMolding|.ComplicatedShape  
INITVAL= "NO"

META-SLOT = |BlowMolding|.ControlThickness  
INITVAL= "NO"

META-SLOT = |BlowMolding|.CostEquipment  
INITVAL= 2.5

META-SLOT = |BlowMolding|.CostEquipmentMax  
INITVAL= "High"

META-SLOT = |BlowMolding|.CostEquipmentMin  
INITVAL= "Medium"

META-SLOT = |BlowMolding|.CostFactorAverageMax  
INITVAL= 2.0

META-SLOT = |BlowMolding|.CostFactorAverageMin  
INITVAL= 1.125

META-SLOT = |BlowMolding|.CostFactorOverallMax  
INITVAL= 4.0

META-SLOT = |BlowMolding|.CostFactorOverallMin  
INITVAL= 1.0625

META-SLOT = |BlowMolding|.CostLabor  
INITVAL= "Medium"

META-SLOT = |BlowMolding|.CostMold  
           INITVAL= "Low"  
 META-SLOT = |BlowMolding|.CostResin  
           INITVAL= "High"  
 META-SLOT = |BlowMolding|.CostTooling  
           INITVAL= 3.5  
 META-SLOT = |BlowMolding|.CostToolingMax  
           INITVAL= "Medium"  
 META-SLOT = |BlowMolding|.CostToolingMin  
           INITVAL= "low"  
 META-SLOT = |BlowMolding|.Description  
           INITVAL= "An Extruded tubeparison of heated thermoplastic is placed between  
 two halves of an open split mold and expanded against the sides of the closed mold by air  
 pressure The mold is opened, the part ejected "  
 META-SLOT = |BlowMolding|.DimensionalAccuracy  
           INITVAL= "Bad"  
 META-SLOT = |BlowMolding|.DimensionalTolerance  
           INITVAL= "Normal"  
 META-SLOT = |BlowMolding|.EnclosedHollow  
           INITVAL= "YES"  
 META-SLOT = |BlowMolding|.Holes  
           INITVAL= "YES"  
 META-SLOT = |BlowMolding|.HollowBodies  
           INITVAL= "ClosedHollowShape.OpenHollowShape"  
 META-SLOT = |BlowMolding|.Inserts  
           INITVAL= "YES"  
 META-SLOT = |BlowMolding|.Name  
           INITVAL= "BlowMolding"

META-SLOT = |BlowMolding|.OpenHollow  
           INITVAL= "YES"  
 META-SLOT = |BlowMolding|.PartArea  
           INITVAL= "Large"  
 META-SLOT = |BlowMolding|.PartComplexity  
           INITVAL= "Very high"  
 META-SLOT = |BlowMolding|.PressureMax  
           INITVAL= 100.0  
 META-SLOT = |BlowMolding|.PressureMin  
           INITVAL= 40.0  
 META-SLOT = |BlowMolding|.ProductionRate  
           INITVAL= "Rapid"  
 META-SLOT = |BlowMolding|.ProductMajor  
           INITVAL= "Bottles, Necked containers, Tanks, Drums, Large hollow shapes, Jars,  
 Jugs, Cans, Cosmetic, Medical, Pharmaceutical, Food containers"  
 META-SLOT = |BlowMolding|.ProductMinor  
           INITVAL= "Hoods, Housings, Autoparts"  
 META-SLOT = |BlowMolding|.ProductShape  
           INITVAL= "Open hollow bodies, Enclosed hollow bodies, Film, Molded products"  
 META-SLOT = |BlowMolding|.ProductSize  
           INITVAL= "Small, Medium"  
 META-SLOT = |BlowMolding|.ProductVolume  
           INITVAL= "Medium, High, Very high"  
 META-SLOT = |BlowMolding|.Resins  
           INITVAL= "ABS, Polycarbonate, Polyethylene, Polypropylene, Polystyrene, PVC,  
 Acetal, Acrylic, FEP, CTFE-VF2, Phenoxy, PPO, Polysulfone, SAN, Polyvinyl acetate,  
 Chlorinate polyether"  
 META-SLOT = |BlowMolding|.Ribs

INITVAL= "YES"  
 META-SLOT = |BlowMolding|.SizeFactor  
 INITVAL= "Mold"  
 META-SLOT = |BlowMolding|.StrengthPart  
 INITVAL= "Good"  
 META-SLOT = |BlowMolding|.SurfaceFinishing  
 INITVAL= "Very smooth,Smooth"  
 META-SLOT = |BlowMolding|.TemperatureMax  
 INITVAL= 500.0  
 META-SLOT = |BlowMolding|.TemperatureMin  
 INITVAL= 300.0  
 META-SLOT = |BlowMolding|.Thickness  
 INITVAL= "Yes"  
 META-SLOT = |BlowMolding|.ThicknessMax  
 INITVAL= 0.2  
 META-SLOT = |BlowMolding|.ThicknessMin  
 INITVAL= 0.003  
 META-SLOT = |BlowMolding|.Threads  
 INITVAL= "YES"  
 META-SLOT = |BlowMolding|.TypicalResins  
 INITVAL= "Thermoplastics"  
 META-SLOT = |BlowMolding|.Undercuts  
 INITVAL= "YES"

#### CLASS INJECTION MOLDING

META-SLOT = |Injection|.Bosses  
 INITVAL= "YES"  
 META-SLOT = |Injection|.ComplicatedShape

INITVAL=	"YES"
META-SLOT =	Injection .ControlThickness
INITVAL=	"YES"
META-SLOT =	Injection .CostEquipment
INITVAL=	2.0
META-SLOT =	Injection .CostEquipmentMax
INITVAL=	"VeryHigh"
META-SLOT =	Injection .CostEquipmentMin
INITVAL=	"Medium"
META-SLOT =	Injection .CostFactorAverageMax
INITVAL=	2.0
META-SLOT =	Injection .CostFactorAverageMin
INITVAL=	1.1875
META-SLOT =	Injection .CostFactorOverallMax
INITVAL=	3.0
META-SLOT =	Injection .CostFactorOverallMin
INITVAL=	1.125
META-SLOT =	Injection .CostInvesment
INITVAL=	"High"
META-SLOT =	Injection .CostMold
INITVAL=	"High"
META-SLOT =	Injection .CostPart
INITVAL=	"Low"
META-SLOT =	Injection .CostResin
INITVAL=	"High"
META-SLOT =	Injection .CostTooling
INITVAL=	2.5
META-SLOT =	Injection .CostToolingMax

INITVAL= "High"  
 META-SLOT = |Injection|.CostToolingMin  
 INITVAL= "Medium"  
 META-SLOT = |Injection|.Description  
 INITVAL= "Thermoplastic or thermoset molding compound is heated to plasticity in cylinder at controlled temperature, then forced under pressure through a nozzle into sprues, runners, gates and cavities of mold."  
 META-SLOT = |Injection|.DimensionalAccuracy  
 INITVAL= "Good"  
 META-SLOT = |Injection|.DimensionalTolerance  
 INITVAL= "Fine"  
 META-SLOT = |Injection|.EnclosedHollow  
 INITVAL= "NO"  
 META-SLOT = |Injection|.Holes  
 INITVAL= "YES"  
 META-SLOT = |Injection|.HollowBodies  
 INITVAL= "OpenHollowShape"  
 META-SLOT = |Injection|.Inserts  
 INITVAL= "YES"  
 META-SLOT = |Injection|.OpenHollow  
 INITVAL= "YES"  
 META-SLOT = |Injection|.PartComplexity  
 INITVAL= "Very high"  
 META-SLOT = |Injection|.PartLength  
 INITVAL= "Short sections"  
 META-SLOT = |Injection|.PressureMax  
 INITVAL= 40000.0  
 META-SLOT = |Injection|.PressureMin

INITVAL= 5000.0  
 META-SLOT = |Injection|.ProductionRate  
 INITVAL= "Very rapid"  
 META-SLOT = |Injection|.ProductMajor  
 INITVAL= "Cups, Trays, Open containers, Caps, Covers, Closures, Hoods,  
 Housings, Autoparts, Complex shapes, Thickness changes"  
 META-SLOT = |Injection|.ProductMinor  
 INITVAL= "Bottles, Necked containers. Linear shapes, Pipe. Profiles"  
 META-SLOT = |Injection|.ProductShape  
 INITVAL= "Open hollow bodies, Molded products. Rod. Pipe. Profile"  
 META-SLOT = |Injection|.ProductSize  
 INITVAL= "Small,Medium"  
 META-SLOT = |Injection|.ProductVolume  
 INITVAL= "Low, Medium, High, Very high"  
 META-SLOT = |Injection|.Resins  
 INITVAL= "ABS, Polycarbonate, Polyethylene, Polypropylene, Polystyrene, PVC,  
 Acetal, Acrylic, Cellulose acetate, Cellulose acetate butylate, Cellulose nitrate, Cellulose,  
 propionate, Ethyl cellulose, Chlorinate polyether, CTFE, TFE, FEP, CTFE-VF2 "  
 META-SLOT = |Injection|.Ribs  
 INITVAL= "YES"  
 META-SLOT = |Injection|.SizeFactor  
 INITVAL= "Equipment"  
 META-SLOT = |Injection|.StrengthPart  
 INITVAL= "Good"  
 META-SLOT = |Injection|.SurfaceFinishing  
 INITVAL= "Very smooth"  
 META-SLOT = |Injection|.TemperatureMax  
 INITVAL= 300.0

META-SLOT = |Injection|.TemperatureMin  
           INITVAL= 200.0  
 META-SLOT = |Injection|.Thickness  
           INITVAL= "No"  
 META-SLOT = |Injection|.ThicknessMax  
           INITVAL= 0.5  
 META-SLOT = |Injection|.ThicknessMin  
           INITVAL= 0.02  
 META-SLOT = |Injection|.Threads  
           INITVAL= "YES"  
 META-SLOT = |Injection|.TypicalResins  
           INITVAL= "Thermoplastics, Thermosets"  
 META-SLOT = |Injection|.Undercuts  
           INITVAL= "Yes"

#### RESIN TRANSFER MOLDING

META-SLOT = ResinTransferMolding.Bosses  
           INITVAL= "No"  
 META-SLOT = ResinTransferMolding.ControlThickness  
           INITVAL= "No"  
 META-SLOT = ResinTransferMolding.CostEquipmentMax  
           INITVAL= "Medium"  
 META-SLOT = ResinTransferMolding.CostInvesment  
           INITVAL= "Medium"  
 META-SLOT = ResinTransferMolding.CostLabor  
           INITVAL= "High"  
 META-SLOT = ResinTransferMolding.CostMold



INITVAL=	"Medium"	
META-SLOT =	ResinTransferMolding.CostResin	
INITVAL=	"Low"	
META-SLOT =	ResinTransferMolding.CostToolingMax	
INITVAL=	"Medium"	
META-SLOT =	ResinTransferMolding.DimensionalAccuracy	
INITVAL=	"Good"	
META-SLOT =	ResinTransferMolding.DimensionalTolerance	
INITVAL=	"Normal"	
META-SLOT =	ResinTransferMolding.EnclosedHollow	
INITVAL=	"No"	
META-SLOT =	ResinTransferMolding.Holes	
INITVAL=	"No"	
META-SLOT =	ResinTransferMolding.Inserts	
INITVAL=	"Yes"	
META-SLOT =	ResinTransferMolding.Name	
INITVAL=	"Resin Transfer Molding"	
META-SLOT =	ResinTransferMolding.OpenHollow	
INITVAL=	"Yes"	
META-SLOT =	ResinTransferMolding.PartComplexity	
INITVAL=	"High"	
META-SLOT =	ResinTransferMolding.PressureMax	
INITVAL=	25.0	
META-SLOT =	ResinTransferMolding.PressureMin	INITVAL= 0.0
META-SLOT =	ResinTransferMolding.ProductionRate	
INITVAL=	"Rapid"	
META-SLOT =	ResinTransferMolding.ProductMajor	
INITVAL=	"Boats hulls, Hatches, Computer housings, Fan shrouds containers"	

META-SLOT =	ResinTransferMolding.ProductShape
INITVAL=	"Molded products. Open hollow bodies"
META-SLOT =	ResinTransferMolding.ProductSize
INITVAL=	"Large"
META-SLOT =	ResinTransferMolding.ProductVolume
INITVAL=	"Low, Medium, High"
META-SLOT =	ResinTransferMolding.Resins
INITVAL=	"Polyester, Epoxy. Phenolic"
META-SLOT =	ResinTransferMolding.Ribs
INITVAL=	"Yes"
META-SLOT =	ResinTransferMolding.SizeFactor
INITVAL=	"Mold"
META-SLOT =	ResinTransferMolding.StrengthPart
INITVAL=	"Good"
META-SLOT =	ResinTransferMolding.SurfaceFinishing
INITVAL=	"Moderate smooth"
META-SLOT =	ResinTransferMolding.TemperatureMax
INITVAL=	100.0
META-SLOT =	ResinTransferMolding.TemperatureMin
INITVAL=	85.0
META-SLOT =	ResinTransferMolding.Thickness
INITVAL=	"No"
META-SLOT =	ResinTransferMolding.ThicknessMin
INITVAL=	0.125
META-SLOT =	ResinTransferMolding.Threads
INITVAL=	"NotRecommend"
META-SLOT =	ResinTransferMolding.Undercuts
INITVAL=	"No"

**ROTATIONAL MOLDING**

META-SLOT =	Rotational.Bosses
INITVAL=	"YES"
META-SLOT =	Rotational.ComplicatedShape
INITVAL=	"NO"
META-SLOT =	Rotational.ControlThickness
INITVAL=	"NO"
META-SLOT =	Rotational.CostEquipment
INITVAL=	2.5
META-SLOT =	Rotational.CostEquipmentMax
INITVAL=	"High"
META-SLOT =	Rotational.CostEquipmentMin
INITVAL=	"Medium"
META-SLOT =	Rotational.CostFactorAverageMax
INITVAL=	3.0
META-SLOT =	Rotational.CostFactorAverageMin
INITVAL=	1.5
META-SLOT =	Rotational.CostFactorOverallMax
INITVAL=	5.0
META-SLOT =	Rotational.CostFactorOverallMin
INITVAL=	1.25
META-SLOT =	Rotational.CostInvesment
INITVAL=	"Low"
META-SLOT =	Rotational.CostLabor
INITVAL=	"Medium"
META-SLOT =	Rotational.CostMold
INITVAL=	"Low"

META-SLOT = Rotational.CostResin  
     INITVAL= "High"  
 META-SLOT = Rotational.CostTooling  
     INITVAL= 4.0  
 META-SLOT = Rotational.CostToolingMax  
     INITVAL= "Low"  
 META-SLOT = Rotational.CostUnit  
     INITVAL= "Low"  
 META-SLOT = Rotational.Description  
     INITVAL= "A predetermined amount of powdered or liquid thermoplastic or the  
 rmset material is poured into mold. Mold is closed, heated, and rotated in the axis of two planes  
 until contents have fused to inner walls of mold. The mold is opened and the part removed"  
 META-SLOT = Rotational.DimensionAccuracy  
     INITVAL= "Fair"  
 META-SLOT = Rotational.DimensionTolerance  
     INITVAL= "Normal"  
 META-SLOT = Rotational.EnclosedHollow  
     INITVAL= "YES"  
 META-SLOT = Rotational.Holes  
     INITVAL= "YES"  
 META-SLOT = Rotational.HollowBodies  
     INITVAL= "OpenHollowShape,ClosedHollowShape"  
 META-SLOT = Rotational.Inserts  
     INITVAL= "YES"  
 META-SLOT = Rotational.Name  
     PRIVINITVAL= "Rotational"  
 META-SLOT = Rotational.OpenHollow  
     INITVAL= "YES"

META-SLOT = Rotational.PartComplexity  
     INITVAL= "Low"  
 META-SLOT = Rotational.ProductionRate  
     INITVAL= "Slow"  
 META-SLOT = Rotational.ProductMajor  
     INITVAL= "Agricultural sprayers, Tanks, Drums, Large hollow shapes,  
 Automative dashboards, Door liners, Gearshift covers, Containers "  
 META-SLOT = Rotational.ProductMinor  
     INITVAL= "Bottles, Necked containers, Balls, Housings, Dolls"  
 META-SLOT = Rotational.ProductShape  
     INITVAL= "Open hollow bodies, Molded products "  
 META-SLOT = Rotational.ProductSize  
     INITVAL= "Small,Medium,Large"  
 META-SLOT = Rotational.ProductVolume  
     INITVAL= "Very low, Medium, High"  
 META-SLOT = Rotational.Resins  
     INITVAL= "ABS, Polyethylene, Polypropylene, Polystyrene, PVC"  
 META-SLOT = Rotational.Ribs  
     INITVAL= "YES"  
 META-SLOT = Rotational.SizeFactor  
     INITVAL= "Equipment"  
 META-SLOT = Rotational.StrengthPart  
     INITVAL= "Poor"  
 META-SLOT = Rotational.SurfaceFinishing  
     INITVAL= "Moderate rough,Moderate smooth"  
 META-SLOT = Rotational.Thickness  
     INITVAL= "No"  
 META-SLOT = Rotational.Threads

INITVAL= "YES"  
 META-SLOT = Rotational.Undercuts  
 INITVAL= "YES"  
 META-SLOT = TransferMolding.Bosses  
 INITVAL= "Yes"  
 META-SLOT = TransferMolding.ComplicatedShape  
 INITVAL= "YES"  
 META-SLOT = TransferMolding.ControlThickness  
 INITVAL= "YES"  
 META-SLOT = TransferMolding.CostEquipment  
 INITVAL= 2.5  
 META-SLOT = TransferMolding.CostEquipmentMax  
 INITVAL= "High"  
 META-SLOT = TransferMolding.CostEquipmentMin  
 INITVAL= "Medium"  
 META-SLOT = TransferMolding.CostFactorAverageMax  
 INITVAL= 3.0  
 META-SLOT = TransferMolding.CostFactorAverageMin  
 INITVAL= 1.75  
 META-SLOT = TransferMolding.CostFactorOverallMax  
 INITVAL= 5.0  
 META-SLOT = TransferMolding.CostFactorOverallMin  
 INITVAL= 1.5  
 META-SLOT = TransferMolding.CostMold  
 INITVAL= "High"  
 META-SLOT = TransferMolding.CostTooling  
 INITVAL= 2.5  
 META-SLOT = TransferMolding.CostToolingMax

INITVAL= "High"  
 META-SLOT = TransferMolding.CostToolingMin  
 INITVAL= "Medium"  
 META-SLOT = TransferMolding.Description  
 INITVAL= "Thermoset molding compound is fed from hopper in to a transfer chamber, where it is heated to plasticity. It is then fed by means of plunger through sprues, runners and gates of closed mold into mold cavity. The mold is opened and the part ejected."  
 META-SLOT = TransferMolding.DimensionalAccuracy  
 INITVAL= "Good"  
 META-SLOT = TransferMolding.DimensionalTolerance  
 INITVAL= "Fine"  
 META-SLOT = TransferMolding.EnclosedHollow  
 INITVAL= "NO"  
 META-SLOT = TransferMolding.Holes  
 INITVAL= "YES"  
 META-SLOT = TransferMolding.HollowBodies  
 INITVAL= "OpenHollowShape"  
 META-SLOT = TransferMolding.Inserts  
 INITVAL= "YES"  
 META-SLOT = TransferMolding.Name  
 INITVAL= "Transfer Molding"  
 META-SLOT = TransferMolding.OpenHollow  
 INITVAL= "YES"  
 META-SLOT = TransferMolding.PartComplexity  
 INITVAL= "High"  
 META-SLOT = TransferMolding.PartLength  
 INITVAL= "Short sections"  
 META-SLOT = TransferMolding.PressureMax

INITVAL= 12000.0  
 META-SLOT = TransferMolding.PressureMin  
 INITVAL= 6000.0  
 META-SLOT = TransferMolding.ProductionRate  
 INITVAL= "Rapid"  
 META-SLOT = TransferMolding.ProductMajor  
 INITVAL= "Cups, Trays, OpenContainers,Caps, Covers, Closures, Hoods,  
 Housings, Autoparts, ComplexShapes, ThicknessChanges"  
 META-SLOT = TransferMolding.ProductMinor  
 INITVAL= "Linear shapes, Pipe, Profiles,Sheets, Panels, Laminates, Electronic  
 devices, Cookware, DelicateInserts"  
 META-SLOT = TransferMolding.ProductShape  
 INITVAL= "Open hollow bodies, Molded products, Sheet, Pipe, Profile, Rod"  
 META-SLOT = TransferMolding.ProductSize  
 INITVAL= "Small"  
 META-SLOT = TransferMolding.ProductVolume  
 INITVAL= "Low, Medium, High"  
 META-SLOT = TransferMolding.Resins  
 INITVAL= "PVC"  
 META-SLOT = TransferMolding.Ribs  
 INITVAL= "YES"  
 META-SLOT = TransferMolding.SizeFactor  
 INITVAL= "Equipment"  
 META-SLOT = TransferMolding.StrengthPart  
 INITVAL= "Fair"  
 META-SLOT = TransferMolding.SurfaceFinishing  
 INITVAL= "Very smooth, Smooth"  
 META-SLOT = TransferMolding.TemperatureMax



INITVAL= 380.0  
META-SLOT = TransferMolding.TemperatureMin  
INITVAL= 280.0  
META-SLOT = TransferMolding.Thickness  
INITVAL= "No"  
META-SLOT = TransferMolding.ThicknessMax  
INITVAL= 6.0  
META-SLOT = TransferMolding.ThicknessMin  
INITVAL= 0.01  
META-SLOT = TransferMolding.Threads  
INITVAL= "YES"  
META-SLOT = TransferMolding.TypicalResins  
INITVAL= "Thermosets"  
META-SLOT = TransferMolding.Undercuts  
INITVAL= "Yes"

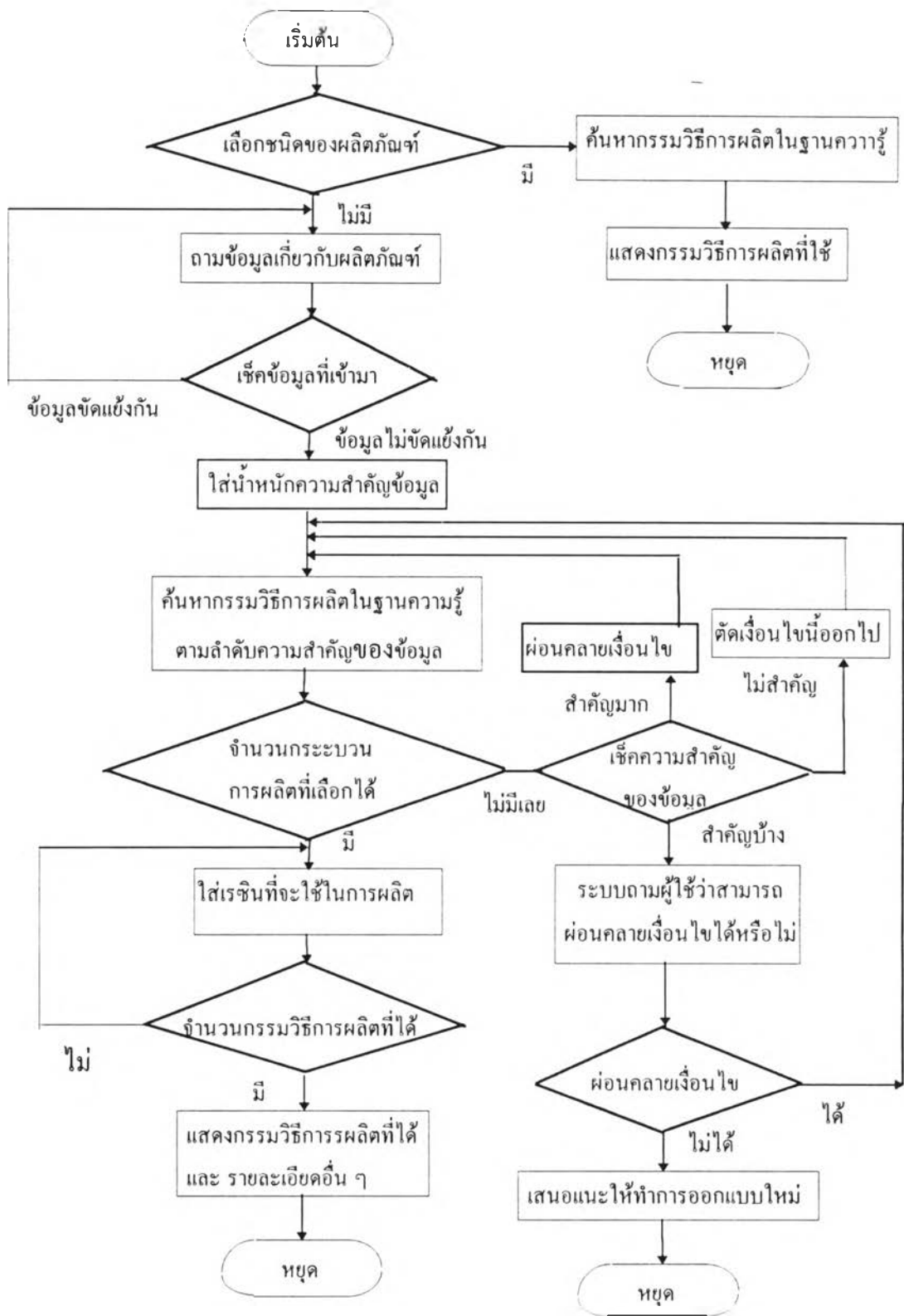
## ภาคผนวก ค

### ขั้นตอนในการเลือกกรรมวิธีการผลิตผลิตภัณฑ์พลาสติก

จากรูปที่ ค.1 มีลำดับขั้นการเลือกกรรมวิธีการผลิตผลิตภัณฑ์พลาสติกดังต่อไปนี้

- (1) ป้อนข้อมูลเกี่ยวกับผลิตภัณฑ์พลาสติกที่จะผลิต เช่น รูปร่างของผลิตภัณฑ์ ขนาดและปริมาณการผลิต ความเรียบของพื้นผิวชิ้นงาน ความแกร่งของชิ้นงาน ความซับซ้อนของชิ้นงาน รวมถึงค่าความเที่ยงตรงของผลิตภัณฑ์
- (2) ระบบจะทำการตรวจสอบข้อมูลที่ผู้ใช้ป้อน ถ้าข้อมูลไม่แมตช์กัน (match) กันระบบจะแจ้งให้ทราบ แล้วถามคำถามเกี่ยวกับข้อมูลผลิตภัณฑ์นั้นใหม่อีกครั้ง
- (3) ให้ลำดับความสำคัญของข้อมูล
- (4) ระบบจะทำการตรวจสอบข้อมูลในฐานความรู้โดยใช้การแมตช์แพทเทิร์น (Pattern matching) เพื่อหากรรมวิธีการผลิตที่สามารถผลิตได้ตามความต้องการของผู้ใช้ โดยเรียงลำดับตามความสำคัญที่ผู้ใช้ต้องการ
- (5) เมื่อระบบไม่สามารถหากรรมวิธีการผลิตที่ตรง กับความต้องการของผู้ใช้ได้ ในกรณีที่ข้อมูลมีความสำคัญมาก ระบบจะถามผู้ใช้ว่าคุณสมบัตินั้นสามารถผ่อนคลายได้หรือไม่ ถ้าได้ระบบจะถามคำถามนั้นใหม่ แล้วไปค้นในฐานความรู้ใหม่อีกครั้ง แต่ถ้าไม่ได้ระบบจะให้ ออกแบบผลิตภัณฑ์นั้นใหม่อีกครั้งกรณีที่ข้อมูลมีความสำคัญบ้าง หรือสำคัญน้อยระบบจะผ่อนคลายให้ แต่ในกรณีที่ข้อมูลนั้นไม่มีความสำคัญ ระบบไม่พิจารณาคุณสมบัติใหม่อีก

- (6) พิจารณาถึง ชนิดของเรซินที่ใช้ว่าแมทช์ (match) กับ กรรมวิธีการผลิตที่เลือกได้หรือไม่ และ เงื่อนไขในการผลิตเช่น อุณหภูมิ ความดัน โดยพิจารณาว่ามีความเหมาะสมกับ ชนิดของเรซินที่ใช้หรือไม่ เพราะเรซิน แต่ละชนิดจะมีขีดจำกัดในการรักษาคุณสมบัติที่ สภาวะอุณหภูมิ และความดันต่างกัน
- (7) แสดงรายละเอียดเกี่ยวกับราคาของ เรซิน, แม่แบบ, และราคาของกรรมวิธีการผลิตที่ใช้

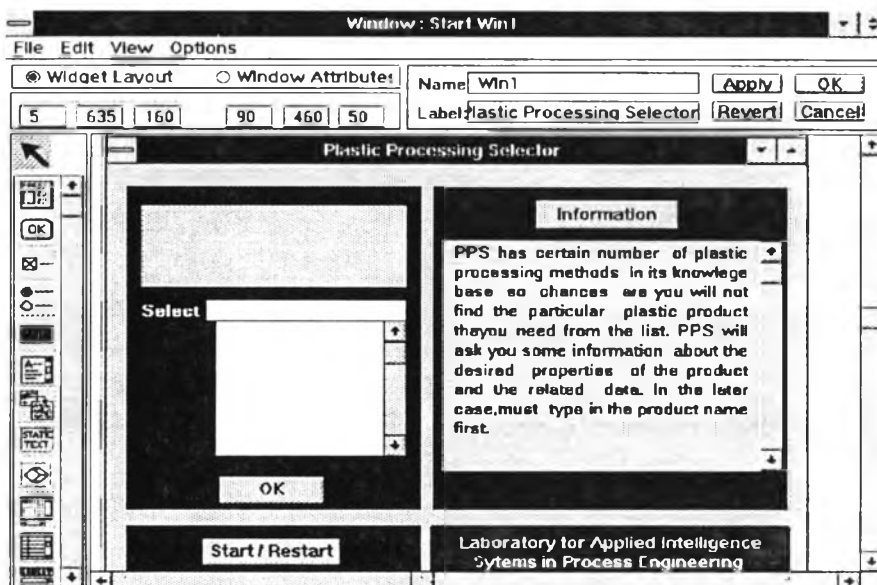


รูปที่ ค.1 แสดงลำดับการเลือกกรรมวิธีการผลิตผลิตภัณฑ์พลาสติก

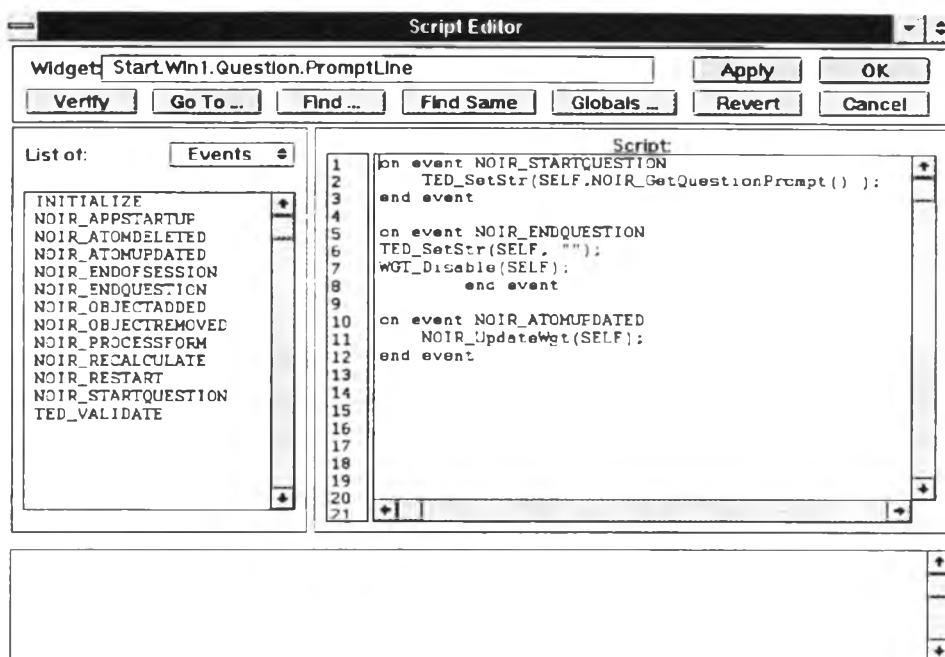
## ภาคผนวก ง

### การติดต่อผู้ใช้ผ่านทางกราฟฟิค (Graphical User Interface)

เป็นส่วนที่ใช้ติดต่อกับผู้ใช้โปรแกรม โดยบรรจุกราฟฟิคเข้าไปเพื่อช่วยอำนวยความสะดวกในการใช้ประโยชน์จากฐานความรู้ ทำหน้าที่รับข้อมูลจากผู้ใช้ระบบ และส่งผลลัพธ์มาให้ผู้ใช้ระบบผ่านทางกราฟฟิค เช็ทของกราฟฟิคที่สามารถสร้างเป็นระบบการติดต่อกับผู้ใช้ผ่านทางกราฟฟิค ประกอบด้วย Text and Iconic lables, Push buttons, Check boxes, Radio buttons, Selectio Menus, Input fields, Menus, Selection table and Input table ใน Smart Elements มีภาษา Script ซึ่งเป็นภาษาที่ใช้ควบคุมการทำงานของ GUI ยกตัวอย่างเช่น โหลดโปรแกรมรับข้อมูลจากผู้ใช้ หรือส่งข้อมูลผลลัพธ์ไปยังผู้ใช้ เป็นต้น

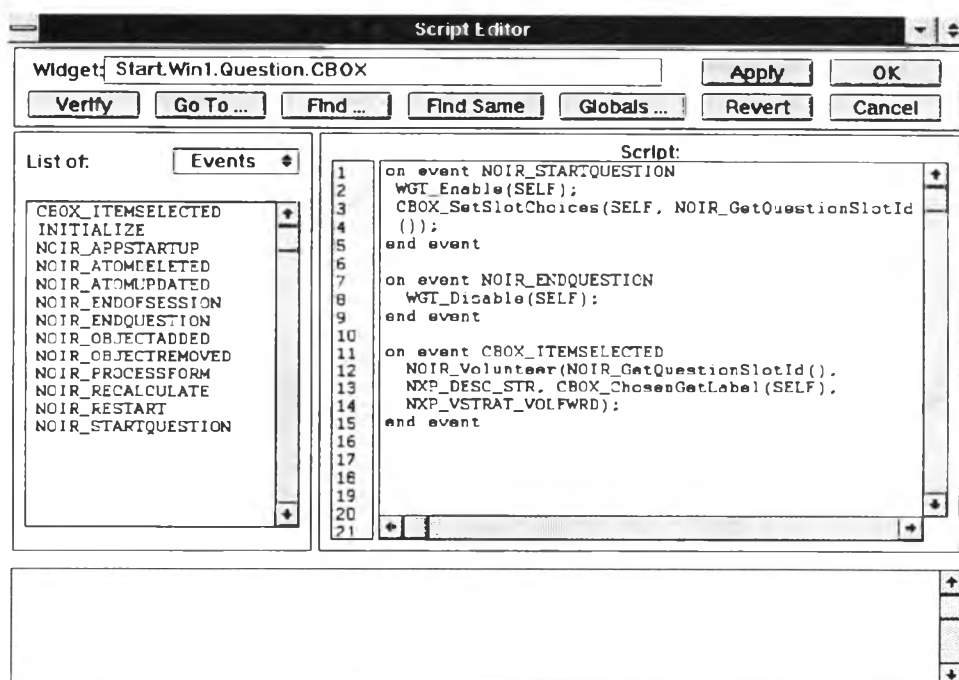


รูปที่ ง.1 แสดงการสร้างหน้าต่างที่ใช้รับข้อมูลจากผู้ใช้ระบบ

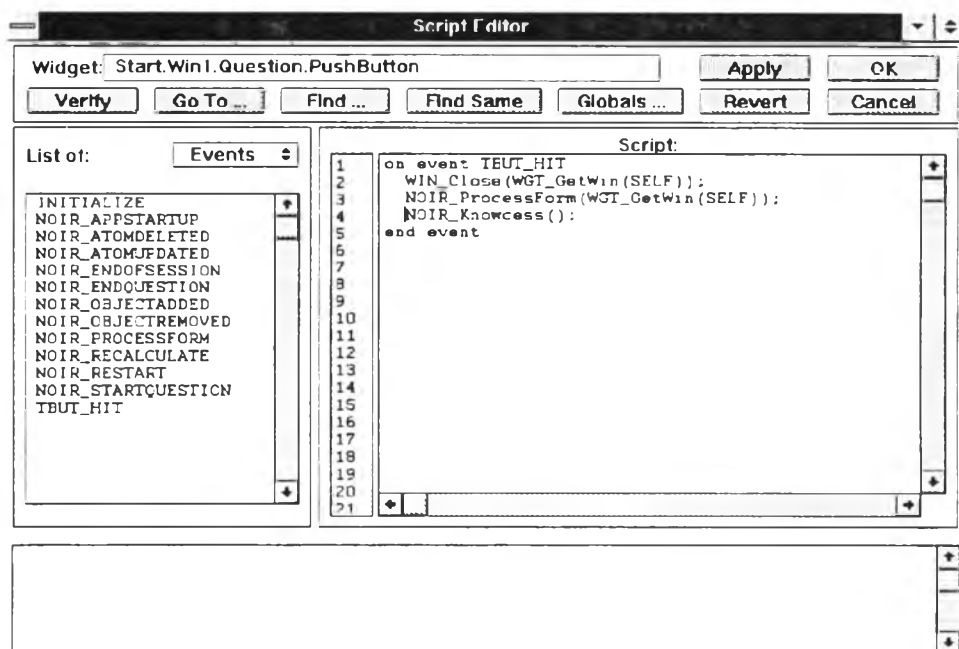


รูปที่ ง.2 แสดงภาษา Script ในส่วนของคำถามของรูปที่ ง.1

จากรูปที่ ง.1 สามารถสร้างหน้าต่างที่ใช้ติดต่อกับผู้ใช้ได้โดยใช้ ไอคอนทางด้านซ้ายมือ และในแต่ละบล็อกมี ภาษา Script ที่ใช้ในการรับข้อมูล หรือดึงข้อมูล มาแสดง ในรูปที่ ง.2 เป็นหน้าต่าง Script Editor ที่ใช้เขียนภาษา Script ซึ่งมีรูปแบบของภาษาเฉพาะ โดยในรูปที่ ง.2 เป็นส่วนของคำถาม ทำหน้าที่ในการดึงคำถามจากส่วนของ Prompt line ในสล็อต มาแสดง

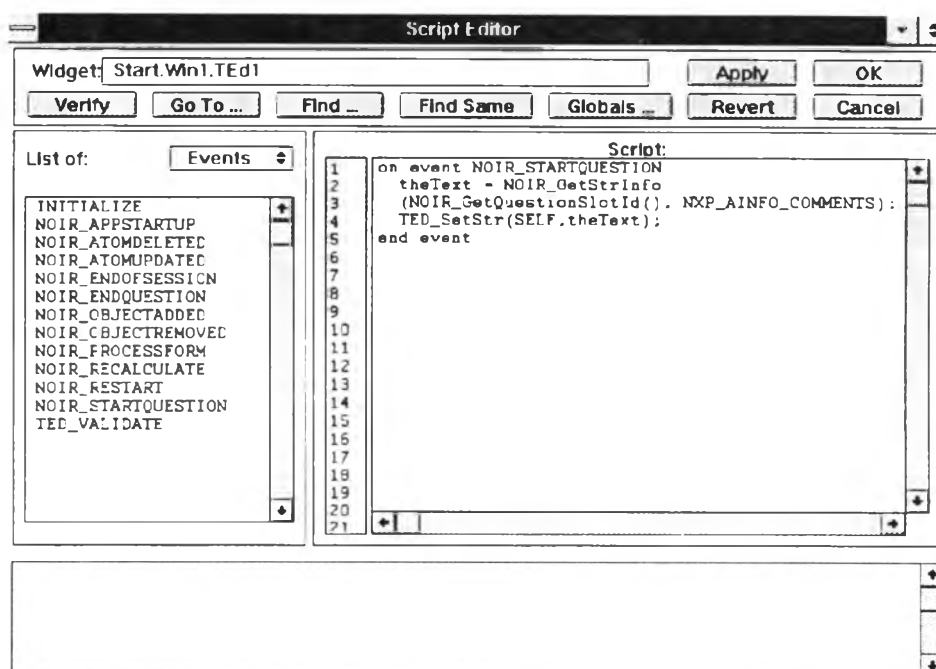


รูปที่ ง.3 แสดงภาษา Script ในส่วนของตัวเลือกที่ให้ผู้ใช้เลือกตอบคำถามของรูปที่ ง.1



รูปที่ ง.4 แสดงภาษา Script ในส่วนของการรับข้อมูล

รูปที่ ๓.3 เป็นภาษา Script ที่ดึงตัวเลือกจาก กฎ (Rule) มาแสดงซึ่งจะสัมพันธ์กับส่วน  
ของคำถาม ที่ตำแหน่ง OK ในรูปที่ ๓.1 มีภาษา Script ที่แสดงในรูปที่ ๓.4 เพื่อรับข้อมูลไปเก็บ  
ไว้ในฐานความรู้ และแสดงคำถามต่อไป

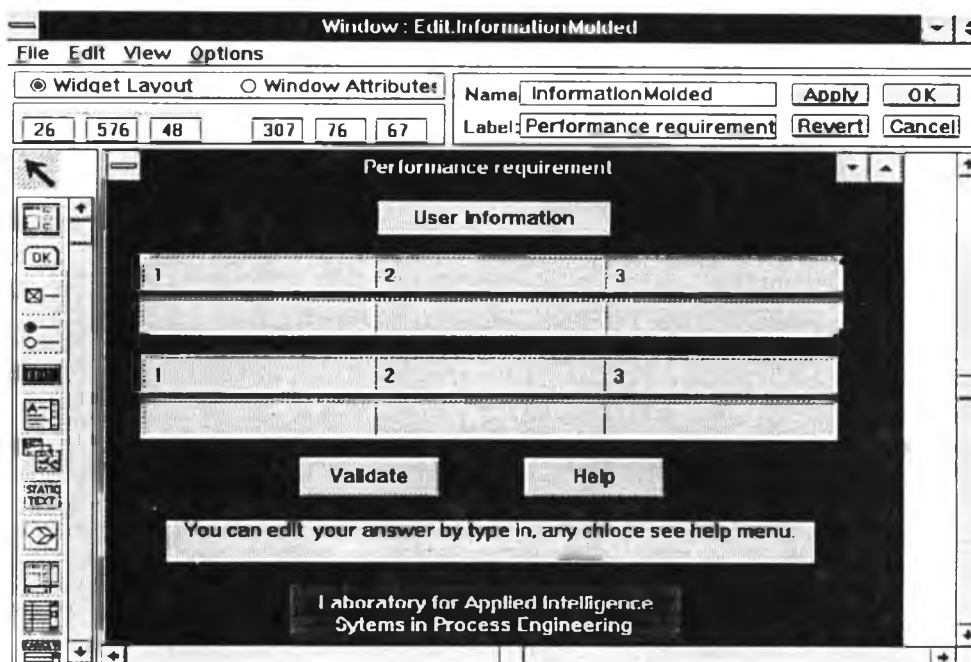


รูปที่ ๓.5 แสดงภาษา Script ในส่วนของคำอธิบายคำถาม

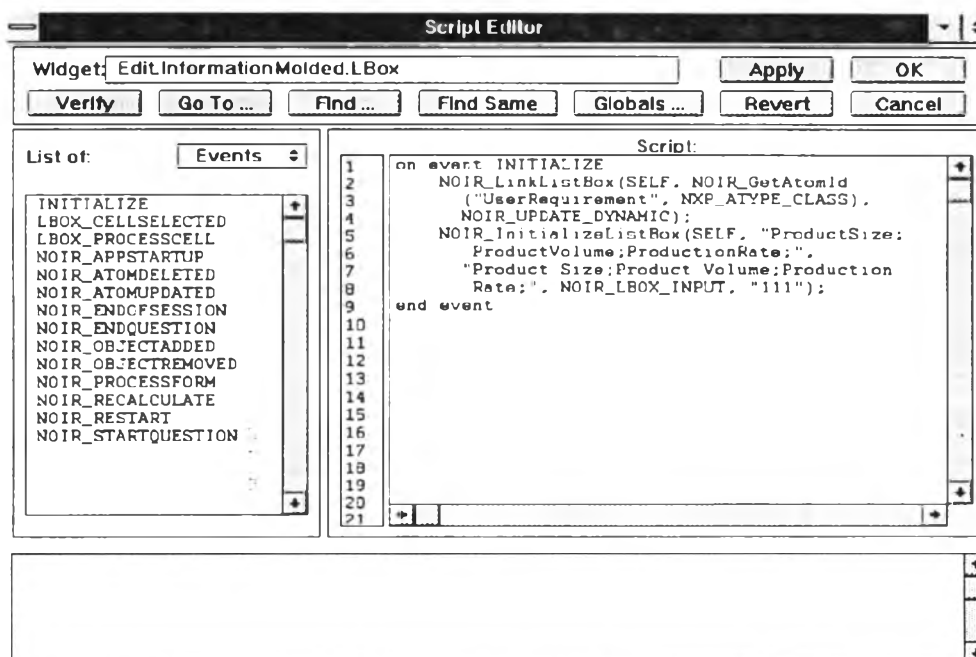
รูปที่ ๓.5 เป็นภาษา Script ที่ใช้แสดงคำอธิบายคำถามที่อยู่ทางขวามือของรูปที่ ๓.1 คำ  
อธิบายคำถามจะดึงมาจากส่วนของ Comment ในแต่ละ สล๊อต จึงทำให้คำอธิบายคำถาม  
สัมพันธ์กับส่วนของคำถาม

รูปที่ ๓.6 เป็นการสร้างหน้าต่างที่ใช้แสดงข้อมูลที่ผู้ใช้ป้อนเข้าไป เพื่อให้ผู้ใช้ทำการ  
ตรวจสอบ หรือทำการแก้ไข ก่อนที่จะไปอนุมานเพื่อหาคำตอบที่ต้องการ



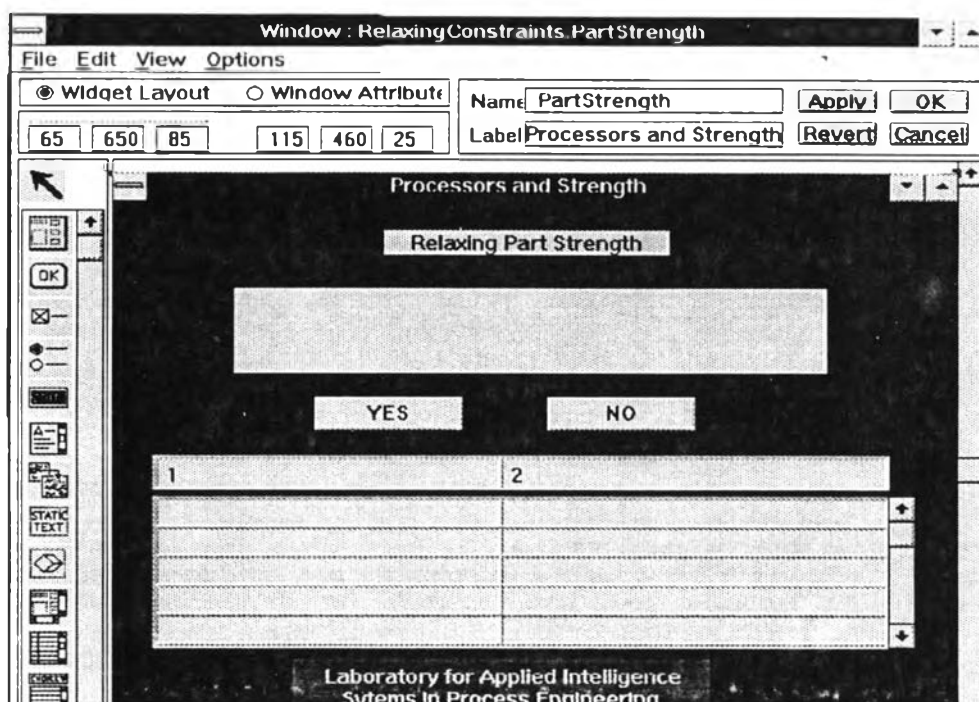


รูปที่ ง.6 แสดงการสร้างหน้าต่างที่ใช้แสดงข้อมูลที่ใช้ป้อนเข้าไป



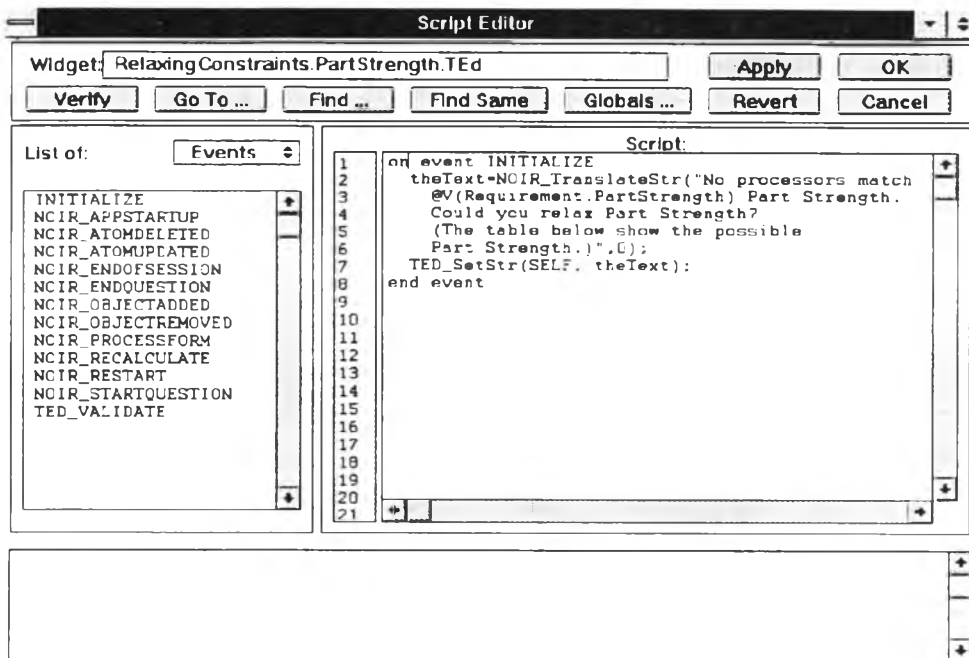
รูปที่ ง.7 แสดงภาษา Script ที่ใช้ดึงข้อมูลที่รับจากผู้ใช้มาแสดง

รูปที่ ง.7 เป็นภาษา Script ที่ใช้ดึงข้อมูลที่เก็บไว้ในสล็อต ซึ่งเป็นข้อมูลที่รับจากผู้ใช้ เพื่อนำมาแสดงในรูปที่ ง.6 เพื่อให้ผู้ใช้ทำการตรวจสอบ หรือทำการแก้ไข

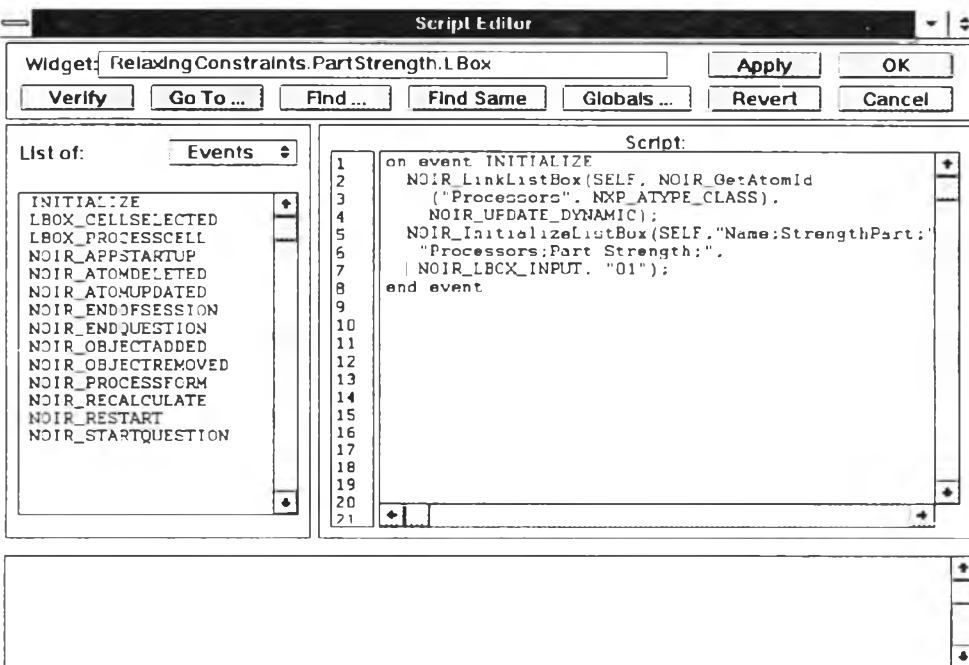


รูปที่ ง.8 แสดงการสร้างหน้าต่างที่ใช้แสดงการผ่อนคลายเงื่อนไข

รูปที่ ง.8 แสดงการสร้างหน้าต่างที่ใช้แสดงการผ่อนคลายเงื่อนไขในกรณีที่ไม่พบกรรมวิธีการผลิตผลิตภัณฑ์พลาสติกในฐานความรู้ และในรูปที่ ง.9 เป็นภาษา Script ที่ใช้แสดงคำถามเพื่อให้ผู้ใช้โปรแกรมตัดสินใจว่าจะทำการผ่อนคลายเงื่อนไขหรือไม่ โดยมีกรรมวิธีการผลิตผลิตภัณฑ์ และเงื่อนไขที่เป็นไปได้แสดงในตารางข้างล่างของรูปที่ ง.8 โดยมีภาษา Script แสดงในรูปที่ ง.10 ที่ใช้ดึงเอากรรมวิธีการผลิต และเงื่อนไขที่เป็นไปได้ในฐานความรู้ออกมาแสดง



รูปที่ 9.9 แสดงภาษา Script ที่แสดงคำถามเกี่ยวกับการผ่อนคลายเงื่อนไข



รูปที่ 9.10 แสดงภาษา Script ที่ใช้แสดงกรรมวิธีการผลิต และเงื่อนไข

## ประวัติผู้เขียน

นาย สมเดช แซ่ซื่อ เกิดวันที่ 25 ตุลาคม พ.ศ. 2509 สำเร็จการศึกษาในระดับชั้นมัธยมศึกษาปีที่ 6 จากโรงเรียนพะเยาพิทยาคม เมื่อ ปี พ.ศ. 2528 สำเร็จการศึกษาปริญญาวิทยาศาสตรบัณฑิต สาขา เคมี จากมหาวิทยาลัยเชียงใหม่ เมื่อปี พ.ศ. 2532 เคยทำงานที่บริษัท ไทยอคริลิกไฟเบอร์ จำกัด เมื่อปี พ.ศ. 2532 ทำงานบริษัทไทยเยอรมัน เซรามิกส์ เมื่อ ปี พ.ศ. 2533-2534

