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الكلمات المفتاحية: أوامر التغيير – عوامل التغيير – كلفة مشروع التشييد - المنطق الضبابي - نموذج استدلال ضبابي.

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: [1]

✓ (Ting-ya Hsieh, Shih-tong Lu, Chao-hui Wu-2004)

✓

✓ Chao hui Wu, Ting ya)
(Hsieh, and Wen lon Cheng-2005)

✓

✓

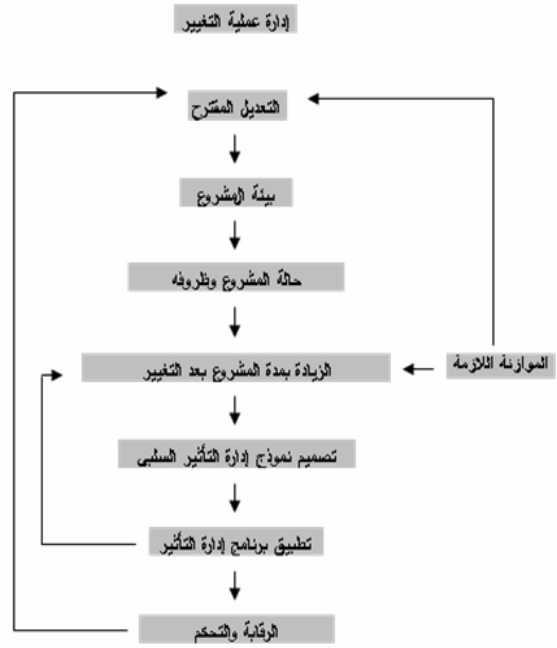
Naif T. Ibn-Homaid, Adel I. Eldosouky,)
(Mohammed A. Al-Ghamdi -2011)

(Safuan, A. - 2005)

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(1

1965



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(1)

(FHWA- 1999)

✓

✓

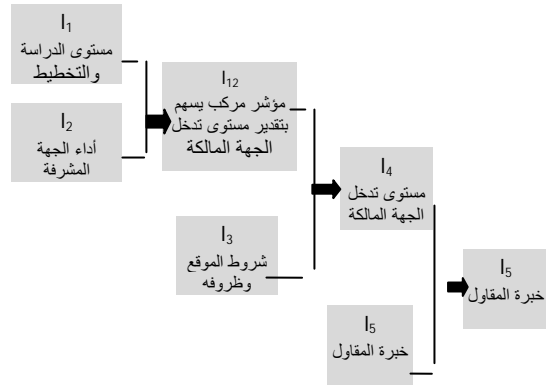
(5):

(5)

درجات تقييم المؤشر وفق المنطق التقليدي			المؤشر
G3 الثالثة	G2 الثانية	G1 الأولى	
عالية (12-16%)	متوسطة (4-12%)	قليلة (0-4%)	I ₁ : مستوى الدراسة والتخطيط
عالي (3-4%)	متوسطة (1-3%)	قليل (0-1%)	I ₂ : أداء الجهة المشرفة
جيدة (3-4%)	متوسطة (1-3%)	سيئة (0-1%)	I ₃ : شروط الموقع وظروفه
كبير (30-40%)	متوسطة (10-30%)	قليل (0-10%)	I ₄ : تدخل الجهة المالكة
جيدة (3-4%)	متوسطة (1-3%)	قليلة (0-1%)	I ₅ : خبرة المقاول
كبير (37-50%)	متوسط (12-37%)	قليل (0-12%)	CI: معيار التغيير

(3)

(2):

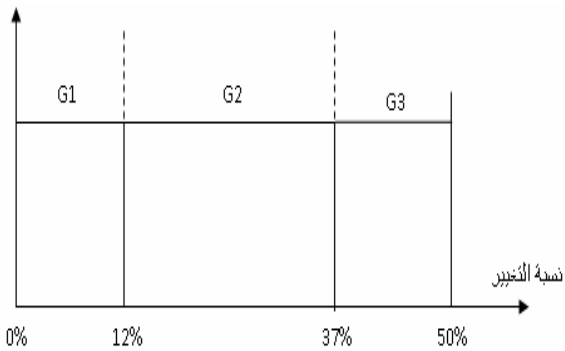


(2)

3-3

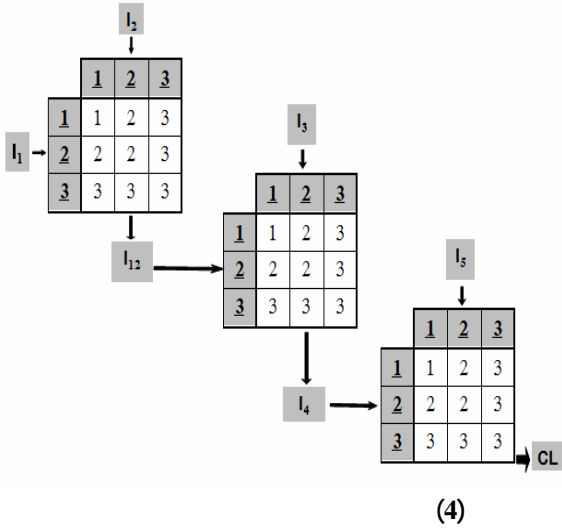
(6)

0% < CI < 12%	G ₁
12% < CI < 37%	G ₂
37% < CI < 50%	G ₃



(3)

C₁



(I_{1,2})

(I₁ × I₂)

: (I₁ × I₂)

(I₁)

(I₂)

(I_{1,2})

1-4

2-4 مؤشر التغيير الضبابي:

(5)

.max

(I₃)

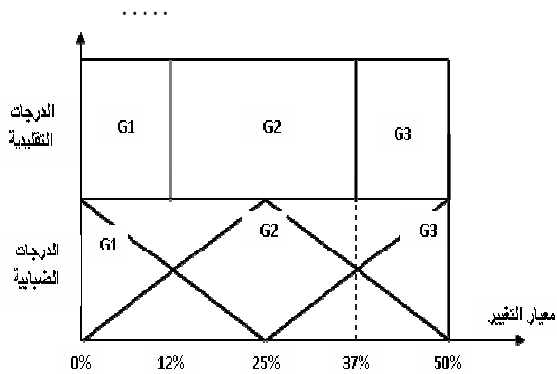
(I₁₂)

%12

(I₅)

(I₄)

%25



(5)

%37 %12

(3)

1. _____ :
)
 I_{12}
 $(I_1 \times I_2)$

I_{12} (7)
 I_2 I_1

() .() I_{12}	1
) I_{12} ()	2
	3
	4
	5
	6
	7
	8
	9

1. _____ :

_____ :
 _____ :

(3)

3-4 :

$(I_2 - I_1)$

I_{12}

$(I_1 \times I_2)$

I_{12}

(2) (Fuzzy inference systems)

:

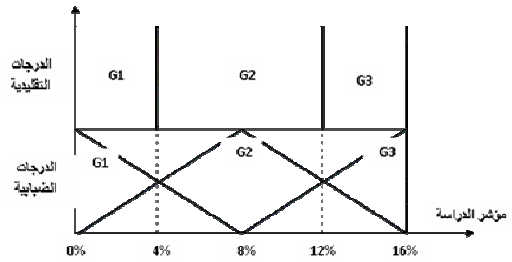
_____ :

$(I_4 I_5 I_3 I_2 I_1)$

(4)

(I_1)

:



(6)

(8)

$$\mu_{I1_i I2_j I3_k} = \mu_{I1_i I2_j} \wedge_2 \mu_{I3_k}$$

$$= \left(\mu_{I1_i} \wedge_1 \mu_{I2_j} \right) \wedge_2 \mu_{I3_k}$$

$i = 1, \dots, 3$
 $j, k = 1, \dots, 3$

1

$$\mu_{I1_3 I2_2 I3_2} = \mu_{I1_3 I2_2} \wedge_2 \mu_{I3_2}$$

$$= \left(\mu_{I1_3} \wedge_1 \mu_{I2_2} \right) \wedge_2 \mu_{I3_2}$$

$$= (0.25 * 0.75) * 1 = 0.1875$$

2

$$\mu_{I1_2 I2_1 I3_2} = \mu_{I1_2 I2_1} \wedge_2 \mu_{I3_2}$$

$$= \left(\mu_{I1_2} \wedge_1 \mu_{I2_1} \right) \wedge_2 \mu_{I3_2}$$

$$= (0.75 * 0.25) * 1 = 0.1875$$

<u>:1</u>
() () .() () $\mu_{I1_3} = 0 \mu_{I1_2} = 0.75 \mu_{I1_1} = 0.25$
<u>:2</u>
$\mu_{I2_3} = 0 \mu_{I2_2} = 0.75 \mu_{I2_1} = 0.25$
<u>:1</u>
() () .() I_{12} $\mu_{I3_3} = 0 \mu_{I3_2} = 1 \mu_{I3_1} = 0$
<u>:2</u>
() () .() I_{12} $\mu_{I3_3} = 0 \mu_{I3_2} = 1 \mu_{I3_1} = 0$

_____ •

_____ •

or ()

\perp = sum :

-and

\wedge_1 = product

$$\mu_{I3_k} = \perp_{i=1, \dots, 3, j=1, \dots, 3} \mu_{I1_i I2_j I3_k} \text{ with } k=1, \dots, 3$$

$$\mu_{I1_i I2_j} = \mu_{I1_i} \wedge_1 \mu_{I2_j} \text{ with } i=1, \dots, 3 \text{ et } j=1, \dots, 3$$

القاعدة ١ $\mu_{I1_1 I2_2} = \mu_{I1_1} \wedge_1 \mu_{I2_2} = 0.25 * 0.75 = 0.1875$

القاعدة ٢ $\mu_{I2_2 I2_2} = \mu_{I2_2} \wedge_1 \mu_{I2_2} = 0.75 * 0.75 = 0.5625$

_____ •

$$\mu_{I3_2} = \min \left(1; \mu_{I1_1 I2_2 I3_2} + \mu_{I1_2 I2_1 I3_2} \right)$$

$$= \min \left(1; 0.1875 + 0.1875 \right) = 0.375$$

()

\wedge_2 = product

(9)

(9)

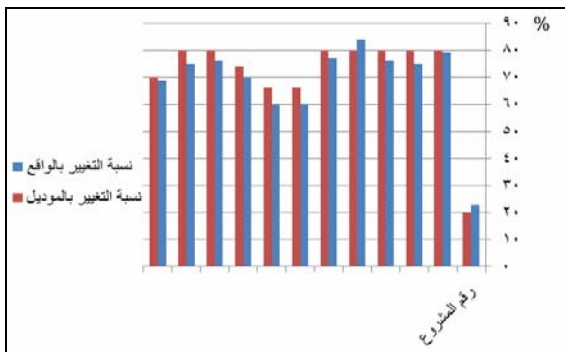
(I₃)

(I ₂ & I ₁)	I ₁	I ₂
1 & 1	$\mu_{111} = 0.25$	$\mu_{121} = 0.25$
1 & 2	$\mu_{111} = 0.25$	$\mu_{122} = 0.75$
1 & 3	$\mu_{111} = 0.25$	$\mu_{123} = 0$
2 & 1	$\mu_{112} = 0.75$	$\mu_{121} = 0.25$
2 & 2	$\mu_{112} = 0.75$	$\mu_{122} = 0.75$
2 & 3	$\mu_{112} = 0.75$	$\mu_{123} = 0$
3 & 1	$\mu_{113} = 0$	$\mu_{121} = 0.25$
3 & 2	$\mu_{113} = 0$	$\mu_{122} = 0.75$
3 & 3	$\mu_{113} = 0$	$\mu_{123} = 0$

.%0

.% 50

(4



(7)

مؤثرات		
درجة 1	درجة 2	درجة 3
$0.25 * 0.25 * 1 = 0.0625$	-	-
-	$0.25 * 0.75 * 1 = 0.1875$	-
-	-	$0.25 * 0 * 1 = 0$
-	$(0.75 * 0.25) * 1 = 0.1875$	-
-	$0.75 * 0.75 * 1 = 0.5625$	-
-	-	$0.75 * 0 = 0$
-	-	$0 * 0.25 * 1 = 0$
-	-	$0 * 0.75 = 0$
-	-	$0 * 0 * 1 = 0$
0.0625	0.9375	0

(I₃ I₁₂)

(I₄ I₅) (I₄ I₁₂₃)

%2

-3

.(%10) (%90)

(%75)

I_4 .(%25)

(%97.5)

.(%2.5)

%25) (%75)

..(

.(5) %25

(%70)

(%30)

.(5) %41

:

(10)

:						
μ_3	μ_2	μ_1	μ_3	μ_2	μ_1	
0	0.75	0.25	0	1	0	I_1
0	0.75	0.25	0	1	0	I_2
0	0.9	0.1	0	1	0	I_{12}
0	0.75	0.25	0	1	0	I_3
0	0.975	0.025	0	1	0	I_{123}
0	0.75	0.25	0	1	0	I_4
0	1	0	0	1	0	_____

:(10)

:						
μ_3	μ_2	μ_1	μ_3	μ_2	μ_1	
0.25	0.75	0	0	1	0	I_1
0.25	0.75	0	0	1	0	I_2
0.45	0.55	0	0	1	0	I_{12}
0.25	0.75	0	0	1	0	I_3
0.6	0.4	0	0	1	0	I_{123}
0.25	0.75	0	0	1	0	I_4
0.7	0.3	0	0	1	0	_____

:

%25) (%75)

.(

(%75)

I_{12} .(%25)

_____ :

)

.(

:

-4

_____ :

:

-5

:(1)

x :

x

A

A

X

[0, 1]

A

.(Zadeh LA- 2005)

:

:

%50

.%50

x

A - B

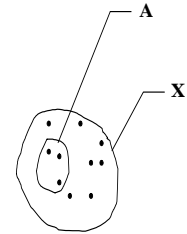
$\mu_B(x) - \mu_A(x)$

$$[0, 1] \in (x)_A \cdot \mu$$

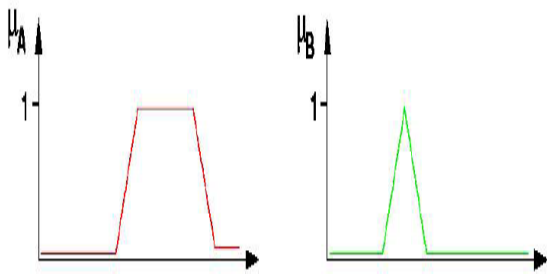
$\forall x \in X$

$\mu_A(x) = 0$ if $x \notin A$

$\mu_A(x) = 1$ if $x \in A$

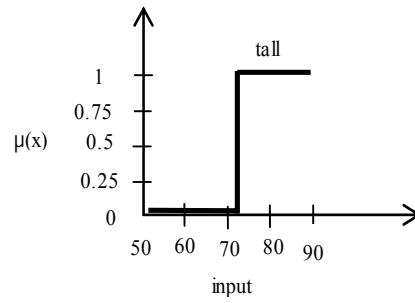


(8)

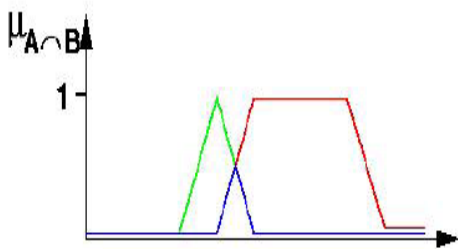


(11)

A, B



(9)

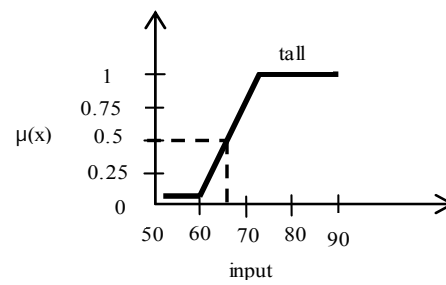


(12)

A, B

72

72



(10)



(13)

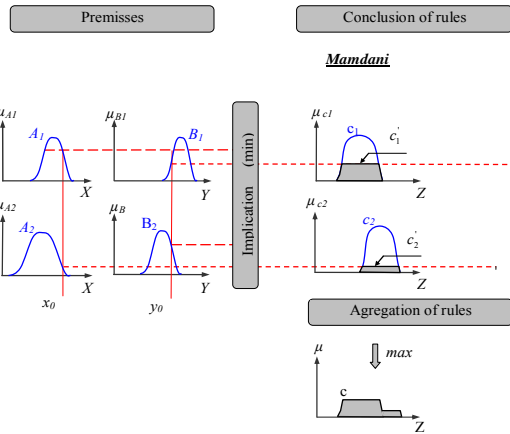
A, B

60

72 60

66

Fuzzy inference (Zadeh LA- 2005)



(14)

(Premises)

$$\mu_{A_i B_j} = \mu_{A_i} \wedge \mu_{B_j} \text{ with } i=1,2 \dots \text{ et } j=1,2 \dots$$

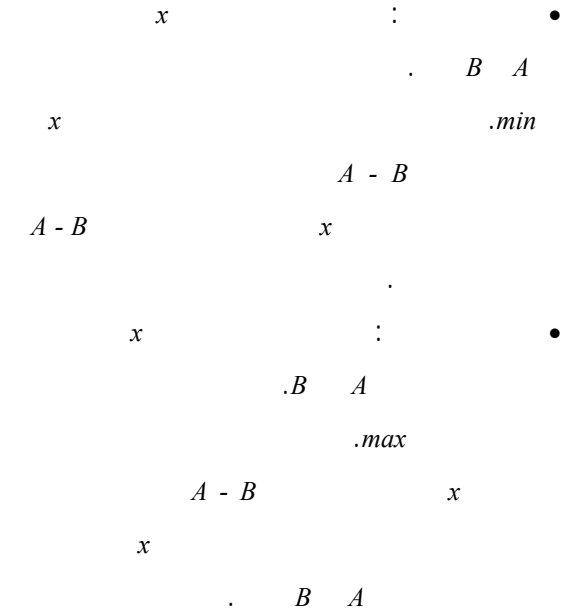
(Implication)

$$\mu_{A_i B_j C_k} = \mu_{A_i B_j} \wedge \mu_{C_k} = \left(\mu_{A_i} \wedge \mu_{B_j} \right) \wedge \mu_{C_k}$$

$i=1,2 \dots ; j,k=1,2 \dots$

(Agregation of rules)

$$\mu_{C_k} = \max_{i=1,2 \dots ; j=1,2 \dots} \mu_{A_i B_j C_k} \text{ with } k=1,2 \dots$$



$$\mu_{A \cap B}(x) = \min [\mu_A(x), \mu_B(x)]$$

$$\mu_{A \cup B}(x) = \max [\mu_A(x), \mu_B(x)]$$

:(2)

:(B-A)

A : $\mu_A(x)$

B : $\mu_B(y)$

(C)

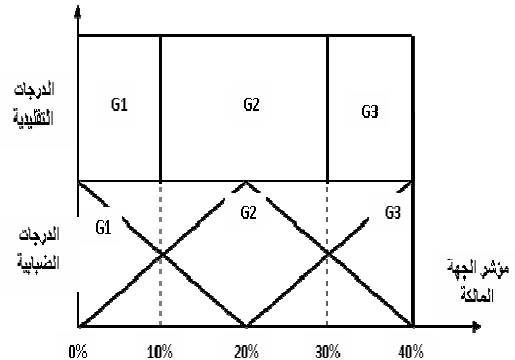
:(AxB)

if (x is A) and (y is B) then (z is C)

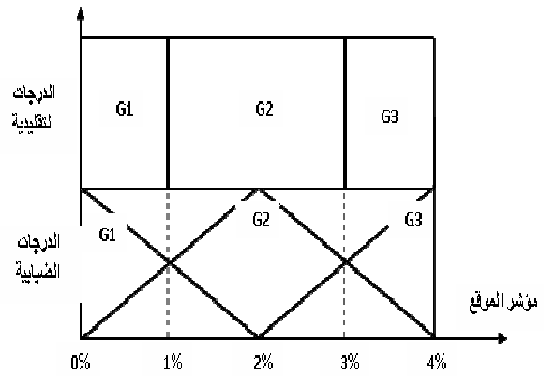
(4)

(1)	
14155175	
48.91%- 6922770	
12.23%- 1730692	
0%- 0	
3.15%- 446100	
33.53%- 4745978	
0- 0%	
(4)	
53729524	
18.84%- 10124702	
3.20%- 1721199	
0- 0%	
0.57%- 303742	
15.08%- 8099762	
0- 0%	
(7)	
18029177	
48.44%- 8733846	
15.02%- 2707495	
0- 0%	
3.39%- 611368	

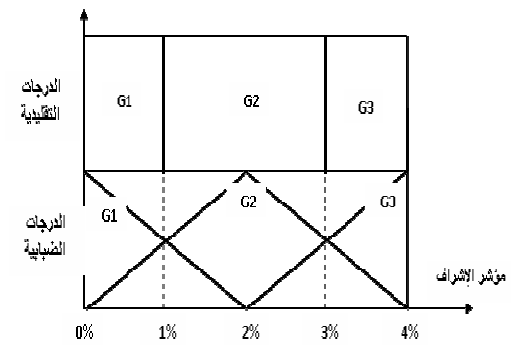
(3)



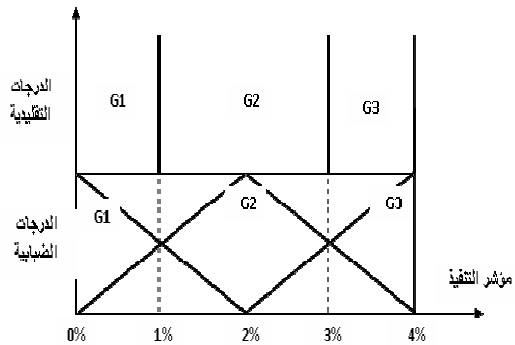
(15)



(16)



(17)



(18)

(3)	
36084394	
38.02%- 13720461	
8.37%- 3018503	
0	
3.4%- 1234841	
26.24%- 9467117	
0- 0%	
(6)	
90035028	
34.25%- 30837998	
6.51%- 5859218	
0- 0%	
2.74%- 2467038	
25.00%- 22511742	
0- 0%	
(9)	
18799305	
12.54%- 2357755	
3.39%- 636593	
0- 0%	
0- 0%	

(2)	
58487375	
49.05%- 28688225	
14.83%- 8676566	
1.96%- 1147529	
9.59%- 5607008	
22.67%- 13257122	
0%- 0	
(5)	
151128985	
39.93%- 60345416	
13.98%- 21120893	
0- 0%	
0.5%- 713820	
25.78%- 39098587	
0- 0%	
(8)	
12943836	
14.44%- 1869585	
3.84%- 497586	
0- 0%	
0.55%- 70982	

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