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Increasing the Applicability of Strategy Map

Emin Gündoğar
Industrial Engineering, Sakarya University, Turkey

Ayşegül Aydın
Industrial Engineering, Sakarya University, Turkey

Mümtaz İpek
Industrial Engineering, Sakarya University, Turkey

Nilüfer Yurtay
Computer Engineering, Sakarya University, Turkey

ABSTRACT

This study proposes a scoring-based structure to make the strategy map feasible. The subjectivity of cause-and-effect relationships is reduced by scoring the map. By map-based reports the strategy map is included to the performance evaluation process. Weighted total method is used in scoring. Causal relations are added in scoring process by strategic path definition. In reporting phase, traffic lamp method is used with the Pareto principle. The scoring-based structure is designed as a synchronization-driven, system-initiating frame. The proposed structure is coded and a software application that generates strategic map and strategic plan reports is developed.

Keywords: Scoring strategy map, performance reporting and evaluation, balanced scorecard, causal relationships, strategic plan, traffic lamp method.

INTRODUCTION

Balanced Scorecard (BSC) method is a measurement-based strategic performance management tool in which financial indicators are reported as well as non-financial indicators [1]. As it measures non-financial perspectives like learning and growth with certain indicators, it is called "balanced". It is a dynamic performance measurement system or management technique that provides strategic feedback, aims to reach the strategy from the data and make the strategy applied.

There is a considerable amount of work in this field, primarily by the founders of the method, and other authors. The results of the searches with the keyword "balanced scorecard" in the sample databases as shown in Figure 1, reach to total amount 50.186.

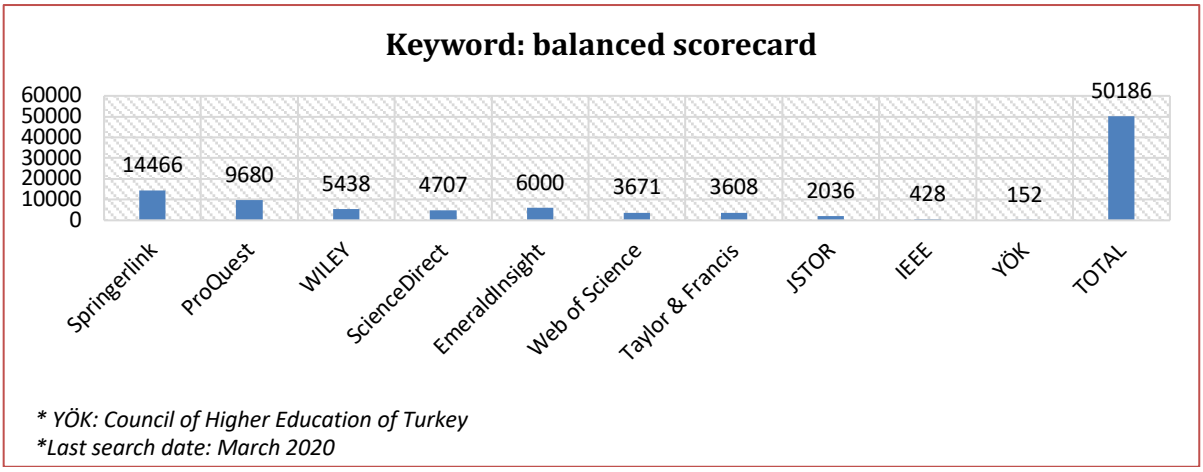


Figure 1. Numbers of BSC studies in selected databases

The score card report is the measurement part of the method. The method, along with all its phases, is a strategic management methodology that encompasses the design and implementation processes of the strategy, whose steps are shown in as Figure 2. Design process is about the effectiveness of strategies, implementation process is about efficiency of strategies. The link is applied from the beginning by creating the strategy map and distributing it to the score cards.

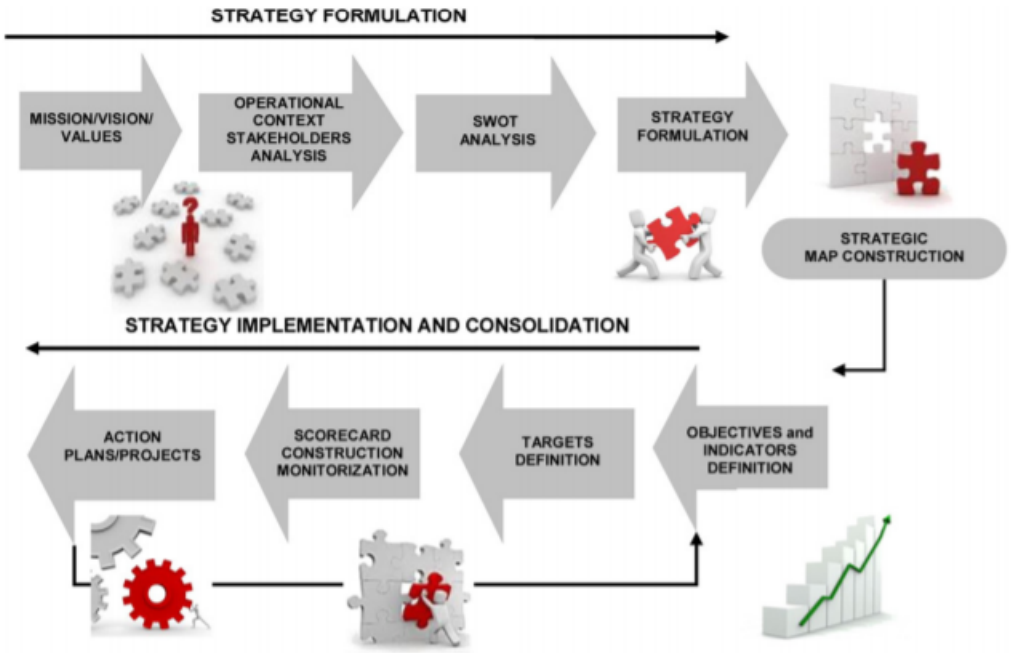


Figure 2. BSC strategy formulation and implementation [2]

BSC is applied at various levels. Speckbacker et. al. [3] also notice these levels, stating that BSC is implemented with one of three levels/types, and they define the functions that each level contains as follows:

- Type I BSC: a specific multidimensional framework for strategic performance measurement that combines financial and non-financial strategic measures.

- Type II BSC: a Type I BSC that additionally describes strategy by using cause-and-effect relationships.
- Type III BSC: a Type II BSC that also implements strategy by defining objectives, action plans, results and connecting incentives with BSC.

STRATEGY MAP ISSUE IN BALANCED SCORECARD CONCEPT

Strategy maps are explanations of the vision via strategic objectives. Strategies need to be well understood to be implemented and well explained to be understood [4]. There are three features of strategy map identified by Kaplan and Norton [4, 5]:

- Cause-and-effect relationships
- Hierarchical structure
- Corporate or individual design

The first feature is that the map elements are connected to each other in a cause-effect relationships (Figure 3).

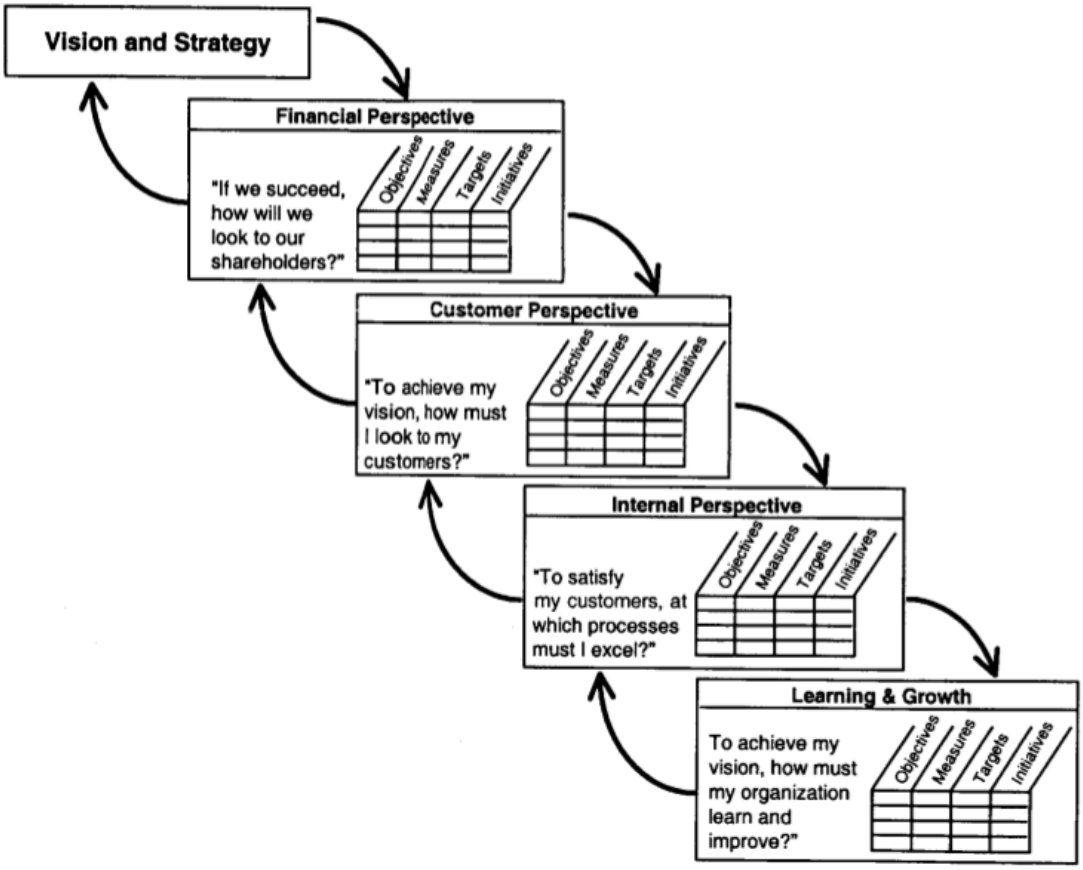


Figure 3. Cause-and-effect relationships in strategy map [4]

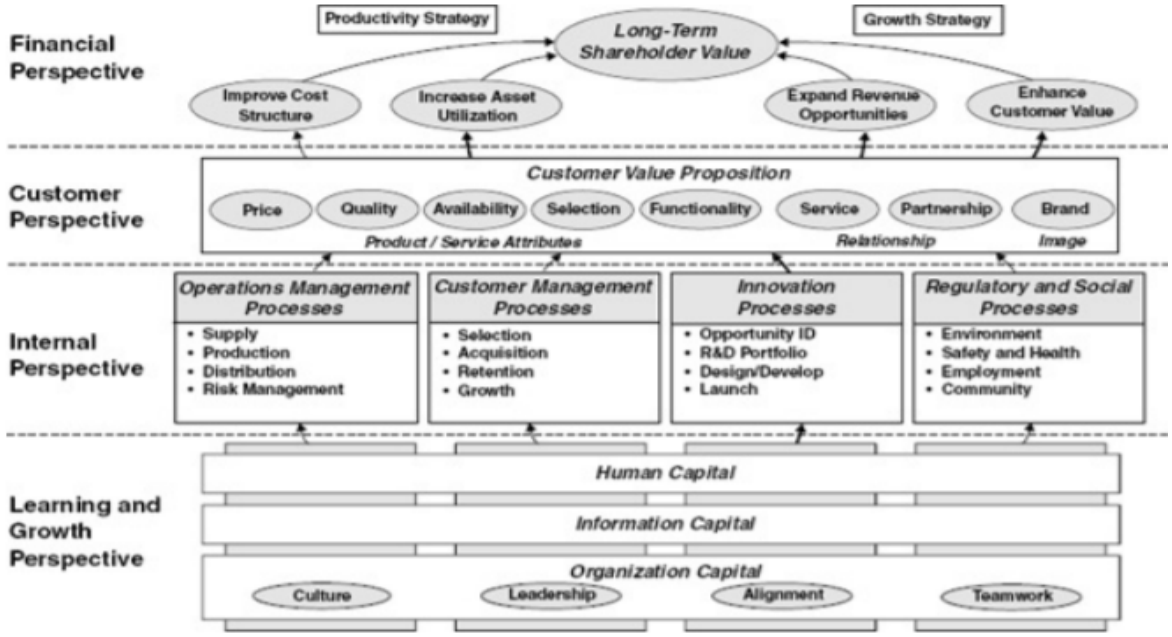


Figure 4. A corporate strategy map in the hierarchical structure [5]

The second feature is that it has a hierarchical structure in which the predecessor perspectives are supported by successive perspectives. (Figure 4).

The third feature is that the strategy map may serve as the newspaper of the enterprise that publishes the corporate strategy, as well as each individual score card can be designed with the help of its own strategy map (Figure 5).

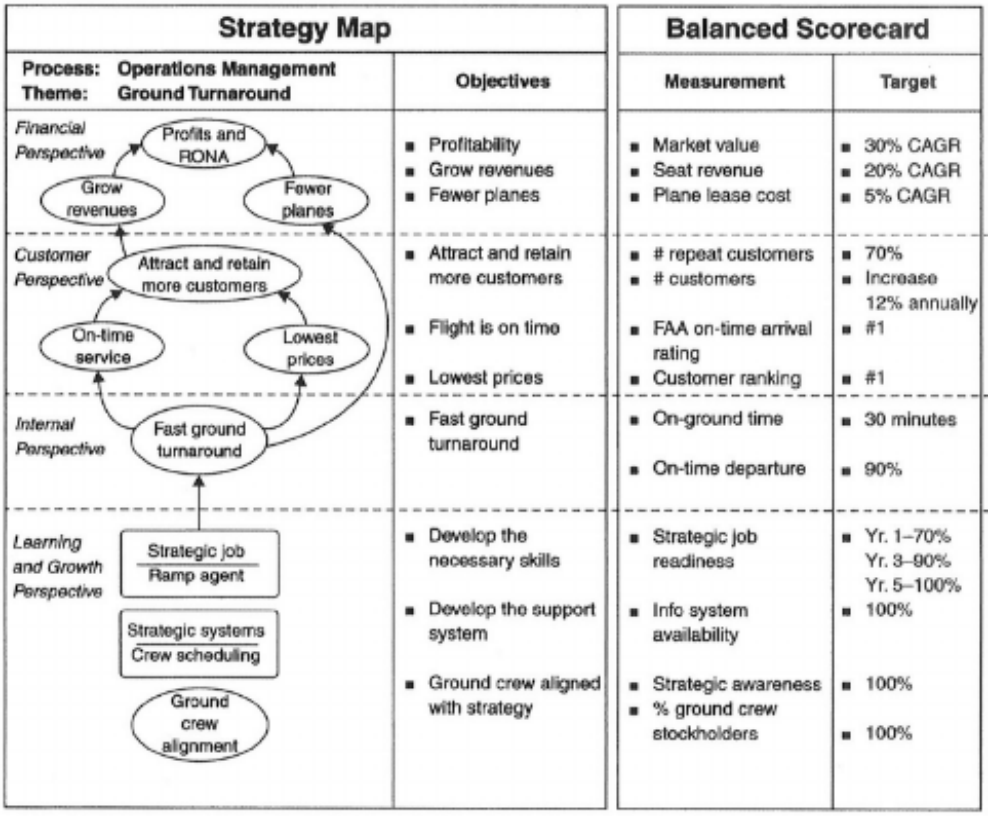


Figure 5. A scorecard designed by its individual strategy map [6]

Without a proposed certain scoring method Kaplan and Norton [5] offers strategy map in terms of subjective causal links based framework. And in proposed case studies strategy map has no computation as a whole, however map elements has value time plots.

There are three topics discussed in the BSC concept regarding strategy maps. These are the scope/framework of the map design, the objectivity/accountability of cause and effect relations, and connection with the scorecards. When these issues do not form integrity, strategy maps cannot be included in the system except as a visual tool.

PROPOSED METHOD

In order to make the strategy map feasible, a system has been developed regarding the design of the map, the accountability of cause-and-effect relationships and its connection with balanced scorecards.

There are two different design approaches related to strategy map scope/framework. The first is the manager-forwarded and map-to-cards (from the start) approach, based on the view that the map is a strategic structure that should be created by the management team (top and bottom managers) with effective strategies [7]. The other approach is employee-forwarded and cards-to-map (from the end) approach in which employees are also involved in creating the strategy map [8-9]. In proposed system, the strategy map is designed as a structure that initiates the system, with executive team-forwarded.

Cause-and-effect relations between strategic objectives are a subjective decision-making process. Decision makers' decisions may change and the decision made at first time may not always be the best one [10]. Experimental studies show that the clearly stated rate of cause-and-effect relationships is 30 % [11, 12]. The nature of cause-and-effect relationships permits motivated reasoning. So managers are able to convince themselves that the strategic objectives they are connected to are relevant [12]. The quality of cause-and-effect relationships is directly proportional to the fact that they can be tested and explained. Two methods have been encountered in the literature about the improvements in this field. The first describes the degree of correlation of the strategic objectives drawn from the scorecards to the map platform [9]. In the second, Glykas [13] adapted fuzzy cognitive maps to strategy maps. Quezada et. al. [14] and Acuña-Carvajal et. al. [15], explain cause-effect relationships with fuzzy methods. In proposed system, the strategy map is designed with weighted sum and strategic path feature to reduce the subjectivity of cause-and-effect relationships (Table 1).

When the scorecards are created independently from the map, the strategy map is formed by placing the selected strategic objectives from scorecards to the map template. When the scorecards are created dependent to the map, the strategic objectives in the strategy map are distributed to the scorecards [8]. In proposed system, the strategy map spreads to the balanced scorecards (Strategic plan).

The characteristics of the current approaches and the structure of the proposed strategy map are shown in Table 2.

Table 1. Cause-and-effect relationships encountered in literature and in proposed system

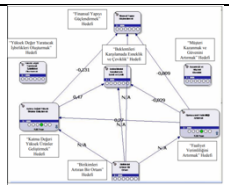
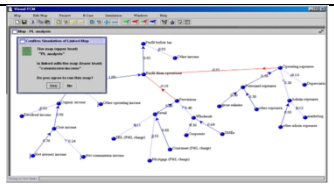
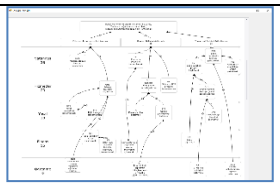
Reference	**Utkutuğ, 2007 [9]**	**Glykas, 2013 [13]; Quezada et. al., 2018 [14]; Acuña-Carvajal et. al., 2019[15]**	**Proposed system**
Cause-and-effect relationships	Correlation	Fuzzy scoring	Weighted sum Strategic path
Graphic			

Table 2. Characteristics of current approaches and proposed strategy map structure

	From the start	From the end	Proposed system
Design frame	Manager-forwarded	Employee forwarded	Manager-forwarded
Cause-and-effect relationships	Subjective	Subjective	Objective
Horizontal synchronization	Not mandatory	Not mandatory	Strategic priorities
Vertical synchronization	Strategic unit level	Multi-level	Strategic unit level
Connection with scorecards	Distribution to scorecards	Pulling from scorecards	Distribution to scorecards
Advantages	Strategy map is included to system	Adaptation to system Assuming work responsibility	o Accountability in causal relations o Synchronization-driven design that starts the system o Performance evaluation tool that produces scored feedback report
Disadvantages	Strategy map mostly visual only, quantitatively unrelated with scorecards	Management difficulty of too many scorecards	
Reference	[2], [7]	[8], [9]	Experimental studies on BSC efficiency and strategy map [16-21] (Appendix A and Appendix B)

SYNCHRONIZATION ORIENTED DESIGN

The synchronization-driven design of the strategy map is the type of diagram it is organized. Diagram types refer to what is the ultimate priority in vision and in what way the vision will be realized. The same strategic objectives mean different when arranged with different types of diagrams. There are two different strategy map designs with the same strategic objectives in Figure 6 for instance; Silo type strategy map and pyramid type strategy map. In the Silo-type diagram the scores are transferred through storage to a base and the ultimate goal (vision) is for value. In the Pyramid-type diagram the scores are transferred individually and the ultimate goal (vision) is for finance.

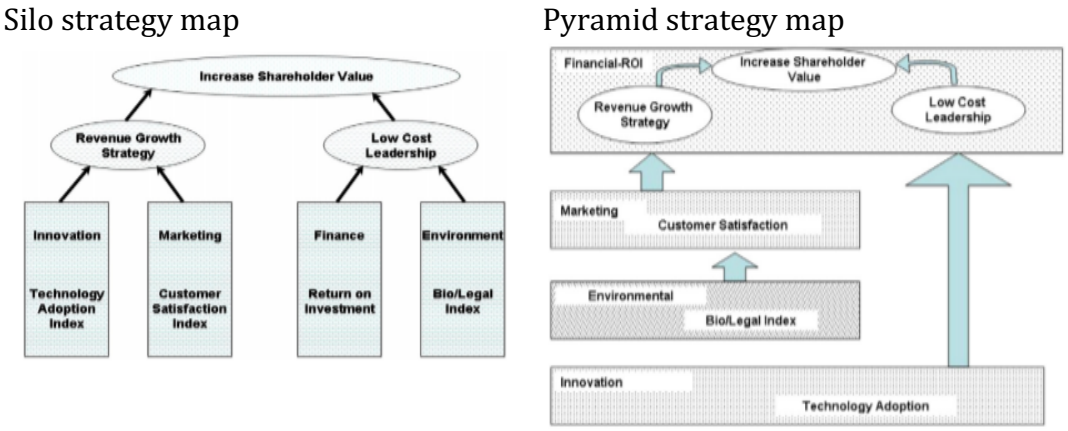


Figure 6. Different types of diagrams [22]

Horizontal synchronization (Consensus)

Horizontal synchronization in the strategy map means decision makers' consensus about the vision. Consensus is represented by strategic priorities which are the distribution of the vision. In another words, horizontal synchronization is the "what will be done?" part of the strategy map. Experimental studies indicate that the horizontal synchronization level or too much strategic priorities is not appropriate for functioning [23].

Vertical synchronization (Alignment)

There are two meanings of vertical synchronization in the strategy map. One is supporting strategic priorities by strategic objectives those in BSC perspectives via cause-and-effect relationships [12, 24 and 25]. As well as, the number of units/departments whose scorecards will be created - Several strategic objectives can also be assigned to a scorecard or separate scorecards can also be created for each [11]. In another words, vertical synchronization is the "How will be done?" part of the strategy map. Kaplan and Norton advise strategic unit level vertical synchronization, and define that applying to whole institution can cause problems [26].

Assignment to scorecards (Expand to strategic plan)

In proposed system, the whole of the balanced scorecards that the strategy map is distributed into is called as strategic plan. The number of balanced scorecards spilled from the strategy map is at the strategic unit level. Does not cover all units/departments of the institution. Although the traditional BSC bears the pretense of transforming vision into action/day-to-day work, not all day jobs are strategic. Not all units of the institution have to be strategic either.

Scoring

BSC is initially found to solve a performance measurement problem, it is later found that it could also be used as a performance evaluation tool [27-29]. Experimental studies also highlight the importance of feedback reports on strategy [26, 30]. The strategy map is scored to assess where failures have been made/what needs to be improved on the way to the vision [31].

Weighted Sum

In strategy map scoring, weighted sum method is used together with traffic lamp method. If a strategic goal on the strategy map is independent, that is, if there is no other goal attached to it,

it is scored according to the scoring method defined in the system (Percentage or limit). If a strategic goal in the strategy map is dependent, that is, if there is another goal or goals attached to it, then the score is obtained by taking the weighted sums of those goals according to the weights defined in the system when creating the strategy map. And in the traffic lamp method, the coloring condition is the Pareto rule

Strategic Path

The strategic path is the path that independent strategic objectives follow when transferring to dependent objectives. While the strategy map is poured into the balanced scorecards, the scores of the dependent strategic objectives are calculated by averaging the scores from the strategic path, not included in the scoring method that the balanced scorecards are subject to (Percentage or limit).Table 3 refers to the scoring methods in the strategy map and balanced scorecards, designed for strategic goals (independent or dependent).

Table 3. Summary of scoring methods designed in proposed system.

<table>
<tr><th></th><th colspan="2">SCORE METHOD</th><th colspan="2">TRAFFIC LAMP METHOD</th></tr>
<tr><th></th><th>Strategy Map</th><th>Balanced Scorecards</th><th>Rule (Pareto)</th><th>Color</th></tr>
<tr><td rowspan="2">Independent strategic goal</td><td rowspan="2">- Percentage
- Limit</td><td rowspan="2">- Percentage
- Limit</td><td>0 ≤ Score < 80</td><td>Red</td></tr>
<tr><td rowspan="2">80 ≤ Score <100</td><td rowspan="2">Yellow</td></tr>
<tr><td>Dependent strategic goal</td><td>Weighted sum</td><td>Strategic path average</td><td>Score= 100</td><td>Green</td></tr>
</table>

ILLUSTRATIVE SCENARIO

The proposed strategy map is exemplified by a scenario inspired by the 2015-2019 Strategic Plan of a municipality (Sakarya Metropolitan Municipality) in Turkey. In the strategic map shown in Figure 7, the vision of the municipality is determined as “To be an exclusive city that has comfortable transportation systems, that is planned in a clean and natural environment and that is integrated with the society”. This vision has been distributed to three strategic priorities: “Building integrated transportation systems“,” Enhancing urban development“, and “Improving social development".

The perspectives are sorted as in Figure 7, according to the hierarchy based on their weights (Citizen-Services-Legal-Finance-Learning & Growth). In the next phase, the strategic objectives of the lower dimensions that will support the strategic priorities will be determined. For instance, by renewing the modern bus fleet in the citizen perspective, by launching the Adaray project (Sakarya rail system) in the services perspective, integrated transportation systems will be established. Renewing the bus fleet is an objective related to citizen satisfaction, hence citizen perspective. Launching the Adaray project is a service process, hence an objective related to the services perspective. This first strategic priority will be achieved by being supported by two objectives from two perspectives. Legal, finance, learning and growth perspectives do not contribute directly to this strategic priority, they contribute indirectly. These perspectives support the second objective (launching the Adaray project). In order to launch the project, an acceptable budget should be created in finance perspective, legal procedure should be completed in legal perspective, resource and time management trainings should be organized for the relevant personnel in learning and development perspective. There

may be other objectives for launching the project, but these objectives are strategic; they are essential according to the game plan.

If the Strategy Map is considered as a chessboard, the three chessman / three strategies that is proposed for Enhancing urban development priority are to complete the City Park project, to complete the Sakarya HPP (Hydroelectric power plant) project and to realize the Urban Transformation. To provide the City Park Project, costing the areas that need to be expropriated by financial perspective is strategic. For Urban transformation decreasing illegal buildings and preventing irregular structures by legal perspective are strategic.Improving social development strategic priority is planned to realize by developing awareness of unity and solidarity. This strategic objective will be supported by two different objectives of the same perspective (Renewing the pavements for the disabled citizens and completing the Donation market project). And other sub-objectives have been established by cause-effect relationships as in Figure 7.All strategic objectives connected by cause-effect relationships should also be connected to one another by a measure. Because, for instance, Enhancing Urban Development will be achieved through the City Park project, but rather than Urban Transformation. Sakarya HPP is more important than City Park project but it is not prior than Urban Transformation. Therefore, City Park, Sakarya HPP, Urban Transformation strategic objectives are connected with 10%, 20%, 70% weights respectively, to the Enhancing Urban Development strategic priority. This mentioned process which is before scoring phase is called creating the strategy map.

Next stage is the strategic plan stage. Expanding the strategy map into the strategic plan means which strategic unit is responsible from which strategic objective. The strategic units of the municipality are its selected departments. Responsibility for the achievement of the objectives in the strategy map is assigned to the heads of strategic departments as indicated in Figure 8. The list of whole assigned objectives form each department's balanced scorecard. Strategic plan is a set of balanced scorecards.

At the end of the planning period, strategic objectives are scored according to the realization of those objectives. According to Figure 9, the vision on the Strategic Map received 90 points. Although largely realized, the municipality has not fully achieved its vision. From unsuccessful red strategic objectives, it can be judged at a glance that where the deficiency is. The reason why the vision is not fully achieved is that the strategic objective "Developing awareness of unity and solidarity in the society" is not realized sufficiently because there is a lack in determining who are in need disadvantageous and there is not enough donations for these individuals. It is also concluded from the yellow strategic objectives that more illegal structures should be reduced and skewed structures should be prevented by further training in order to complete the urban transformation. When we look at the strategic plan, the unsuccessful strategic objectives belongs to the responsibility of the Social Services Department and strategic objectives to be improved belongs to the responsibility of the Reconstruction and Urbanism Department.

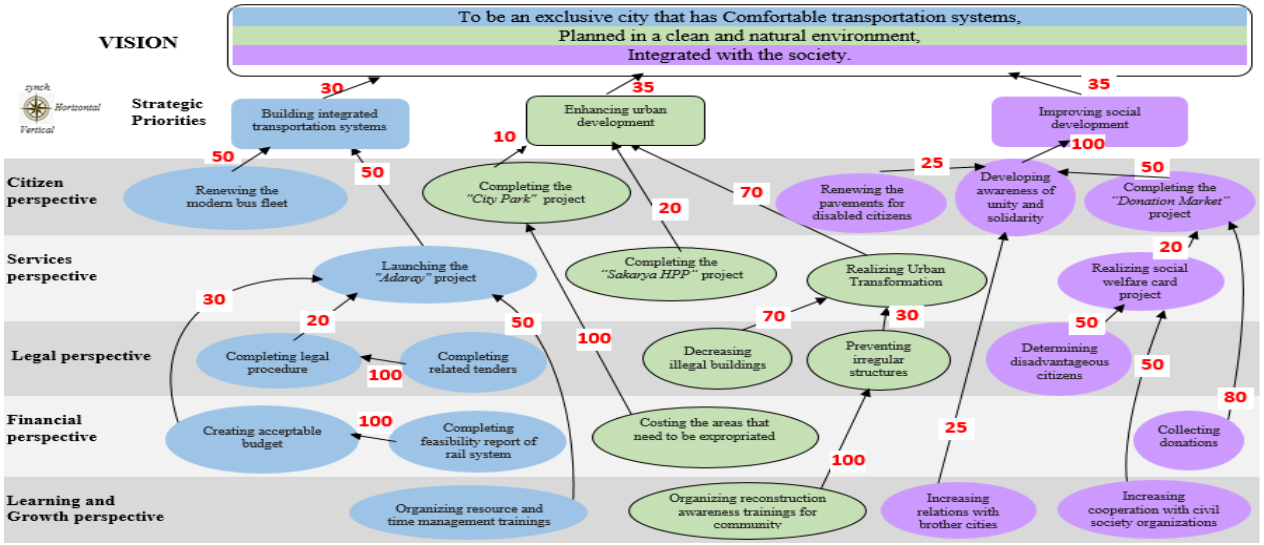


Figure 7. Synchronization oriented design of the illustrative Strategy Map

STRATEGIC PLAN (BALANCED SCORECARDS)

MAYOR

Strategic Objectives	Indicator Definition	Indicator Unit	Target Value
CITIZEN PERSPECTIVE			
MC1. Developing awareness of unity and solidarity	İV2, SV1, BO1		
SERVICES PERSPECTIVE			
MS1. Completing the"Sakarya HPP" project	Percentage of completion	PERCENTAGE	100
LEGAL PERSPECTIVE			
ML1. Completing related tenders	Completion time	MONTH	5
FINANCIAL PERSPECTIVE			
MF1. Creating acceptable budget	UF1		
LEARNING & GROWTH PERSPECTIVE			
MG1. Increasing relations with brother cities	Number of organizations	NUMBER	5

TRANSPORTATION DEPARTMENT

Strategic Objectives	Indicator Definition	Indicator Unit	Target Value
CITIZEN PERSPECTIVE			
TC1. Renewing the modern bus fleet	Number of new buses	NUMBER	23
SERVICES PERSPECTIVE			
TS1. Launching the "Adaray" project	BF1, UY1, UO1		
LEGAL PERSPECTIVE			
TL1. Completing legal procedure	BY1		
FINANCIAL PERSPECTIVE			
TF1. Completing feasibility report of rail system	Acceptance status of the report	TEXT	Accept
LEARNING & GROWTH PERSPECTIVE			
TG1. Organizing resource and time management trainings	Number of trainings	NUMBER	10

RECONSTRUCTION AND URBANISM DEPARTMENT

Strategic Objectives	Indicator Definition	Indicator Unit	Target Value
CITIZEN PERSPECTIVE			
RC1. Completing the "City Park" project	İF1		
RC2. Renewing the pavements for disabled citizens	Pavement length	KM	100
SERVICES PERSPECTIVE			
RS1. Realizing Urban Transformation	İY1, İY2		
LEGAL PERSPECTIVE			
RL1. Decreasing illegal buildings	Land size	HECTARE	300
RL2. Preventing irregular structures	İO1		
FINANCIAL PERSPECTIVE			
RF1. Costing the areas that need to be expropriated	Completion time	MONTH	4
LEARNING & GROWTH PERSPECTIVE			
RG1. Organizing reconstruction awareness trainings for community	Number of people trained	NUMBER	500

SOCIAL SERVICES DEPARTMENT

Strategic Objectives	Indicator Definition	Indicator Unit	Target Value
CITIZEN PERSPECTIVE			
SC1. Completing the "Donation Market" project	SF1, SH1		
SERVICES PERSPECTIVE			
SS1. Realizing social welfare card project	SY1, SO1		
LEGAL PERSPECTIVE			
SL1. Determining disadvantageous citizens	Completion time	MONTH	2
FINANCIAL PERSPECTIVE			
SF1. Collecting donations	Donation amount	TL (Turkish Lira)	100.000
LEARNING & GROWTH PERSPECTIVE			
SG1. Increasing cooperation with civil society organizations	Number of activities	NUMBER	15

Figure 8. Expanding the Strategy Map to Strategic Plan

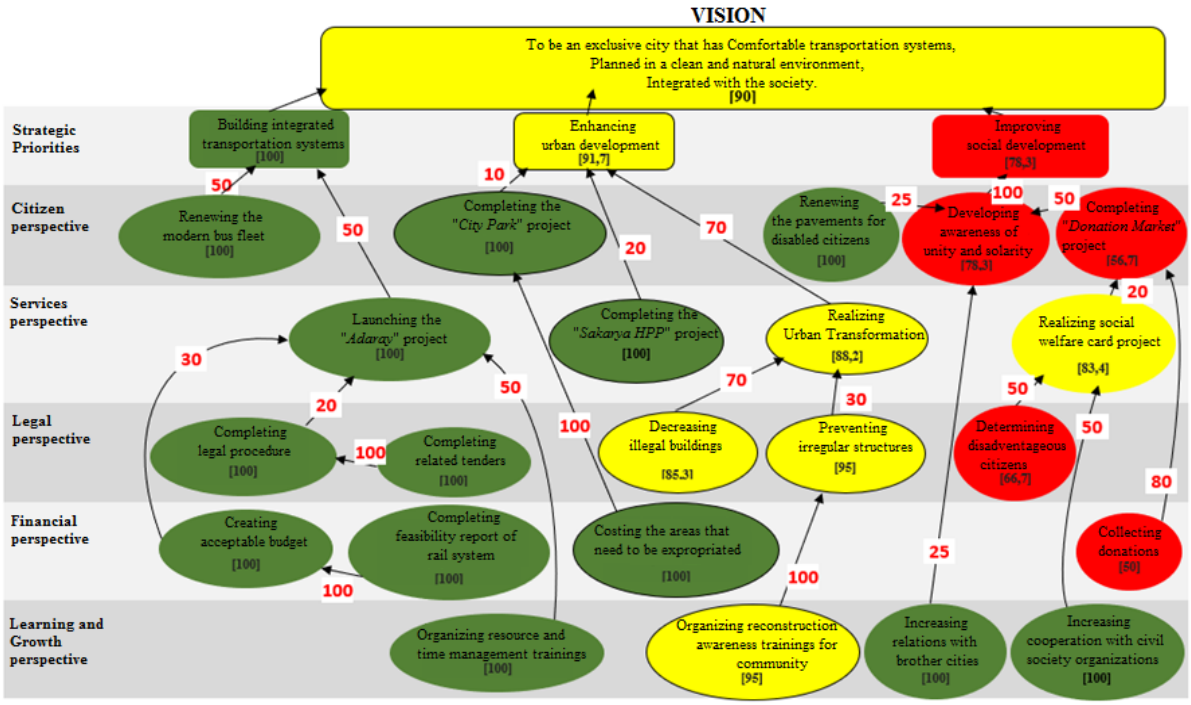


Figure 9. Scored Strategy Map

PROGRAMMING ILLUSTRATIVE SCENARIO

The proposed method is performed via a software programme. Firstly an excel prototype is prepared then coded in a development environment. The Sakarya municipality illustrative scenario values are used for testing the programme.

The software we call BestBSC (Municipal Strategic Balanced Scorecard System) is developed in C # programming language and all the menus of the software are as shown in Figure 10. All the technologies used in the software are as follows:

- Development environment: Visual Studio 2015
- Data base: MsSQL
- Programming language: C#

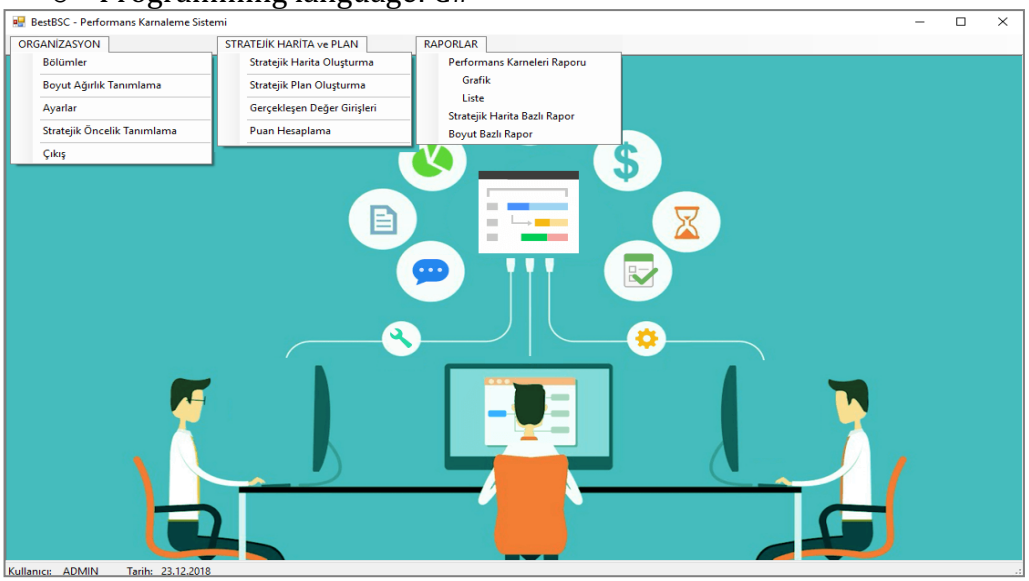


Figure 10. Developed software (BestBSC) and menus

BSC software consists of three main menus whose process flow diagram is shown in Figure 11, and the processes are performed according that indicated order. These main menus are; Organization menu where definitions are made, Strategic Map and Plan menu where data entry and calculations are made and the Reports menu that contains performance results.

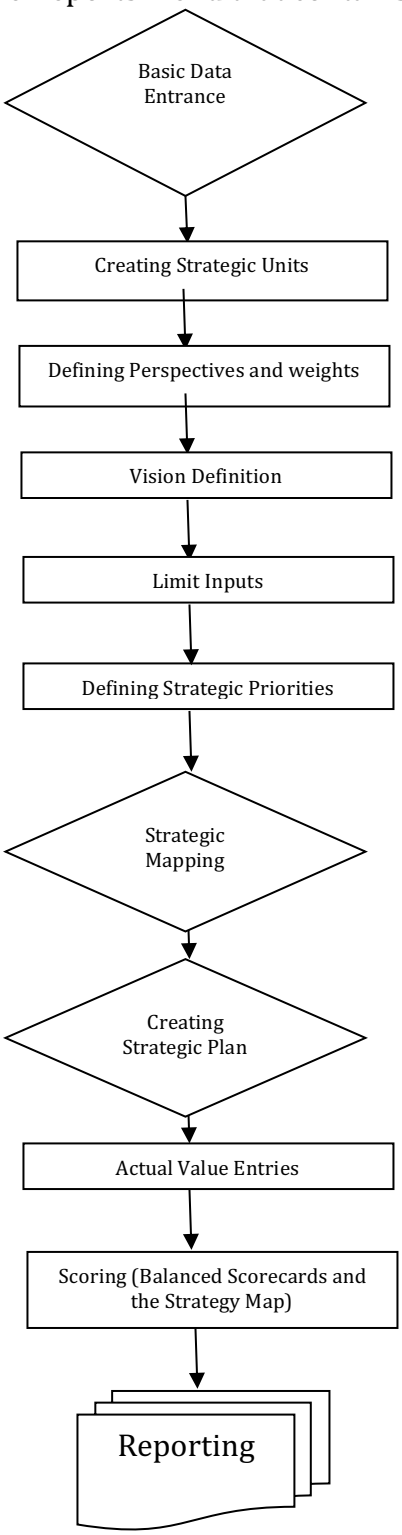


Figure 11. Process flow chart of the software

The strategy map screen is opened with pre-defined vision and strategic priorities. Strategic priorities are supported by distribution to perspectives in cause-and-effect relationships. During the distribution, for independent strategic objectives the indicators and units, for dependent strategic objectives the weights, and for all strategic objectives responsible strategic units should be defined. The generated strategy map is shown in Figure 12.

The strategy map is automatically converted to the strategic plan and target values are entered for independent strategic objectives. The strategy map and the strategic plan are published to the whole organization at the beginning of the planning period (Figure 12 and Figure 13). Until the end of the planning period, the organization work to achieve the strategic objectives.

Actual values are entered into the system at the end of the planning period. Manual entry is not possible for the scores of the dependent strategic objectives since they come from the strategic path.

Scoring can be started after all mentioned stage. From the Strategic Map and Plan menu > Score Calculation section, the algorithm calculates both the strategy map's and the balanced scorecards' scores with two scoring methods (percentage and limit).

Reports menu consists of three basic reports. Balanced scorecards report, strategic map report, and perspective based report.

From balanced scorecards report menu, each strategic goal can be analysed one by one and the scorecard score of all strategic objectives can be examined.

Figure 14 shows the strategic map report. Once the strategy map is scored, the strategic objectives are scored and coloured according to the method in Table 3. In our illustrative example, the vision is realized at 90.12% level according to the percentage method and 81.38% is realized according to the limit method (Figure 15).

All reports are designed printable. For the sample scenario of the strategic plan, a printout (Figure 16 and Figure 17) can be printed according to two scoring methods for the end of the period which can be accessed from the balanced scorecards report menu.

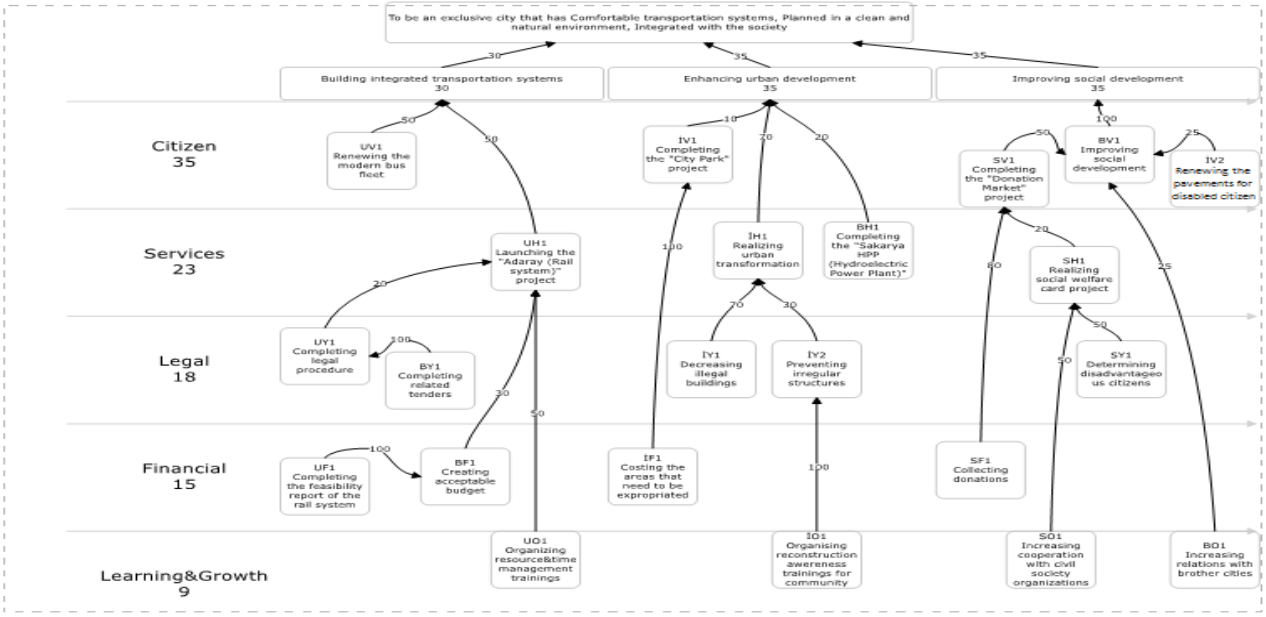


Figure 12. Creating strategy map in the software

Stratejik Amaç	Boyut	Gösterge	Birim	Ağırlık	Hedef Değer
Bölüm: Mayor					
BV1 Improving social developme	[35] Citizen	BO1,SV1,İV2		35	Stratejik Yol
BH1 Completing the "Sakarya HP	[23] Services	Tamamlanma yüzde	yüzde	23	100
BY1 Completing related tenders	[18] Legal	İhale sayısı	adet	18	5
BF1 Creating acceptable budget	[15] Financial	UF1		15	Stratejik Yol
BO1 Increasing relations with br	[09] Learning	Düzenlenen organiz	adet	9	5
Bölüm: Reconstruction and Urbanism Department					
İV2 Renewing the pavements	[35] Citizen	Yenilenen kaldırım u	km	15	100
İV1 Completing the "City Park" p	[35] Citizen	İF1		20	Stratejik Yol
İH1 Realizing urban transformati	[23] Services	İY1,İY2		23	Stratejik Yol
İY1 Decreasing illegal buildings	[18] Legal	18.madde uygulama	hektar	10	300
İY2 Preventing irregular structur	[18] Legal	İO1		8	Stratejik Yol
İF1 Costing the areas that need t	[15] Financial	Tamamlanan rapor	adet	15	4
İO1 Organising reconstruction a	[09] Learning	Eğitim alan kişi sayıs	adet	9	500
Bölüm: Social Services Department					
SV1 Completing the "Donation M	[35] Citizen	SF1,SH1		35	Stratejik Yol
SH1 Realizing social welfare card	[23] Services	SY1,SO1		23	Stratejik Yol
SY1 Determining disadvantageou	[18] Legal	Belirlenen birey sayı	adet	18	3
SF1 Collecting donations	[15] Financial	Bağış miktarı	TL	15	100000
SO1 Increasing cooperation with	[09] Learning	Faaliyet sayısı	adet	9	15
Bölüm: Transportation Department					
UV1 Renewing the modern bus fl	[35] Citizen	Yeni otobüs sayısı	adet	35	23
UH1 Launching the "Adaray (Rail	[23] Services	BF1,UY1,UO1		23	Stratejik Yol
UY1 Completing legal procedure	[18] Legal	BY1		18	Stratejik Yol
UF1 Completing the feasibility re	[15] Financial	Raporun kabul yüzd	yüzde	15	100
UO1 Organizing resource&time	[09] Learning	Eğitim sayısı	adet	9	10

Figure 13. Strategic plan at the beginning of the period (Non-scored)



Figure 14. Strategic map based performance report (According to percentage method)

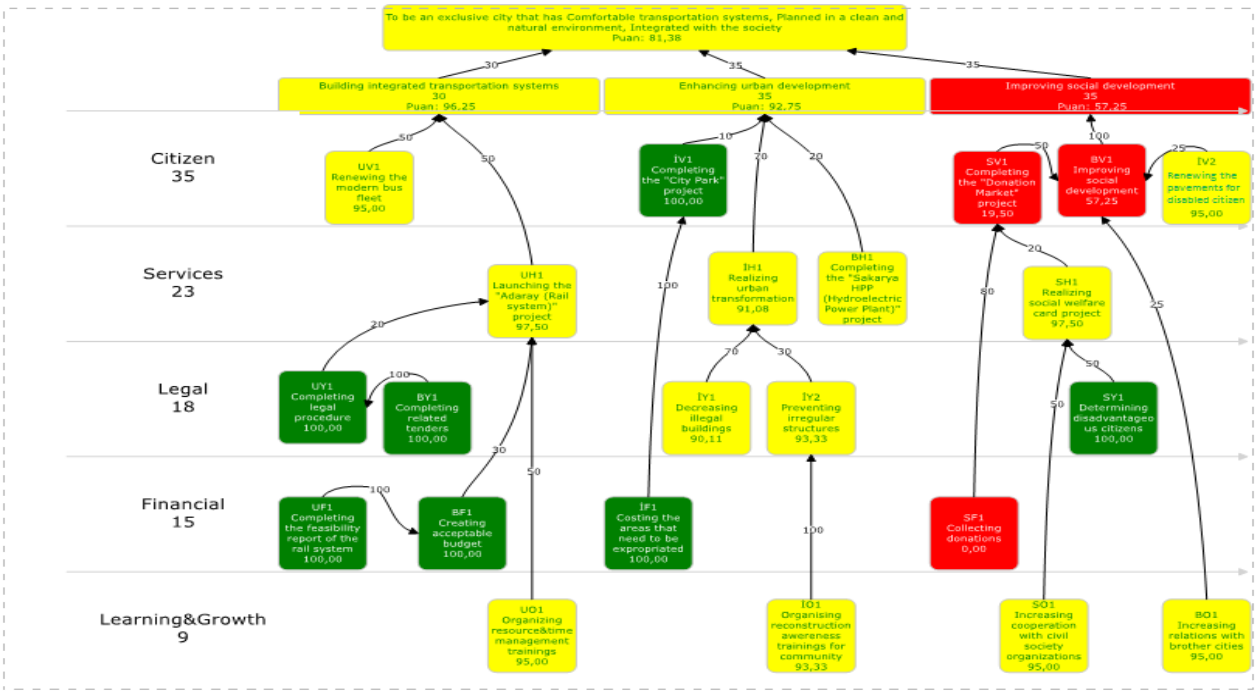


Figure 15. Strategic map based performance report (According to limit method)

Stratejik Amaç	Boyut	Gösterge	Birim	Ağırlık	Hedef Değer	Gerçekleşen Değer	Sonuç	Ağr. Puan.
Bölüm: Mayor								
BV1 Improving social developme	[35] Citizen	BO1,SV1,İV2		35	Stratejik Yol	Stratejik Yol	91,67	32,08
BH1 Completing the "Sakarya HP	[23] Services	Tamamlanma yüzde	yüzde	23	100	100	100	23
BY1 Completing related tenders	[18] Legal	İhale sayısı	adet	18	5	6	100	18
BF1 Creating acceptable budget	[15] Financial	UF1		15	Stratejik Yol	Stratejik Yol	100	15
BO1 Increasing relations with br	[09] Learning	Düzenlenen organiz	adet	9	5	5	100	9
Bölüm: Reconstruction and Urbanism Department								
İV2 Renewing the pavements for	[35] Citizen	Yenilenen kaldırım u	km	15	100	100	100	15
İV1 Completing the "City Park" p	[35] Citizen	İF1		20	Stratejik Yol	Stratejik Yol	100	20
İH1 Realizing urban transformati	[23] Services	İY1,İY2		23	Stratejik Yol	Stratejik Yol	90,17	20,74
İY1 Decreasing illegal buildings	[18] Legal	18.madde uygulama	hektar	10	300	256	85,33	8,53
İY2 Preventing irregular structur	[18] Legal	İO1		8	Stratejik Yol	Stratejik Yol	95	7,6
İF1 Costing the areas that need t	[15] Financial	Tamamlanan rapor	adet	15	4	5	100	15
İO1 Organising reconstruction a	[09] Learning	Eğitim alan kişi sayıs	adet	9	500	475	95	8,55
Bölüm: Social Services Department								
SV1 Completing the "Donation M	[35] Citizen	SF1,SH1		35	Stratejik Yol	Stratejik Yol	75	26,25
SH1 Realizing social welfare card	[23] Services	SY1,SO1		23	Stratejik Yol	Stratejik Yol	100	23
SY1 Determining disadvantageou	[18] Legal	Belirlenen birey sayı	adet	18	3	4	100	18
SF1 Collecting donations	[15] Financial	Bağış miktarı	TL	15	100000	50000	50	7,5
SO1 Increasing cooperation with	[09] Learning	Faaliyet sayısı	adet	9	15	15	100	9
Bölüm: Transportation Department								
UV1 Renewing the modern bus fl	[35] Citizen	Yeni otobüs sayısı	adet	35	23	23	100	35
UH1 Launching the "Adaray (Rail	[23] Services	BF1,UY1,UO1		23	Stratejik Yol	Stratejik Yol	100	23
UY1 Completing legal procedure	[18] Legal	BY1		18	Stratejik Yol	Stratejik Yol	100	18
UF1 Completing the feasibility re	[15] Financial	Raporun kabul yüzd	yüzde	15	100	150	100	15
UO1 Organizing resource&time	[09] Learning	Eğitim sayısı	adet	9	10	10	100	9

Figure 16. Strategic plan at the end of the period (By percentage method)

Stratejik Amaç	Boyut	Gösterge	Birim	Ağırlık	Hedef Değer	Alt Limit	Üst Limit	Gerçekleşen Değe	Sonuç	Ağr. Puan.
Bölüm: Mayor										
BV1 Improving social develo	[35] Citizen	BO1,SV1,İV2		35	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	79,58	27,85
BH1 Completing the "Sakary	[23] Service	Tamamlanma yüz	yüzde	23	100	85	115	100	95	21,85
BY1 Completing related tend	[18] Legal	İhale sayısı	adet	18	5	4,25	5,75	6	100	18
BF1 Creating acceptable bud	[15] Financi	UF1		15	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	100	15
BO1 Increasing relations wit	[09] Learnin	Düzenlenen organ	adet	9	5	4,25	5,75	5	95	8,55
Bölüm: Reconstruction and Urbanism Department										
İV2 Renewing the pavements	[35] Citizen	Yenilenen kaldırım	km	15	100	85	115	100	95	14,25
İV1 Completing the "City Par	[35] Citizen	İF1		20	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	100	20
İH1 Realizing urban transfor	[23] Service	İY1,İY2		23	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	91,72	21,1
İY1 Decreasing illegal buildin	[18] Legal	18.madde uygula	hektar	10	300	255	345	256	90,11	9,01
İY2 Preventing irregular stru	[18] Legal	İO1		8	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	93,33	7,47
İF1 Costing the areas that n	[15] Financi	Tamamlanan rapo	adet	15	4	3,4	4,6	5	100	15
İO1 Organising reconstructio	[09] Learnin	Eğitim alan kişi sa	adet	9	500	425	575	475	93,33	8,4
Bölüm: Social Services Department										
SV1 Completing the "Donati	[35] Citizen	SF1,SH1		35	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	48,75	17,06
SH1 Realizing social welfare	[23] Service	SY1,SO1		23	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	97,5	22,42
SY1 Determining disadvanta	[18] Legal	Belirlenen birey s	adet	18	3	2,55	3,45	4	100	18
SF1 Collecting donations	[15] Financi	Bağış miktarı	TL	15	100000	85000	115000	50000	0	0
SO1 Increasing cooperation	[09] Learnin	Faaliyet sayısı	adet	9	15	12,75	17,25	15	95	8,55
Bölüm: Transportation Department										
UV1 Renewing the modern b	[35] Citizen	Yeni otobüs sayısı	adet	35	23	19,55	26,45	23	95	33,25
UH1 Launching the "Adaray	[23] Service	BF1,UY1,UO1		23	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	98,33	22,62
UY1 Completing legal proce	[18] Legal	BY1		18	Stratejik Yol	Stratejik	Stratejik	Stratejik Yol	100	18
UF1 Completing the feasibilit	[15] Financi	Raporun kabul yü	yüzde	15	100	85	115	150	100	15
UO1 Organizing resource&ti	[09] Learnin	Eğitim sayısı	adet	9	10	8,5	11,5	10	95	8,55

Figure 17. Strategic plan at the end of the period (By limit method)

TESTS AND CONCLUSIONS

According to the illustrative scenario results, the municipality realized its vision at 90.12% level and the average of the balanced scorecards is 94.1 points by percentage method while the results decrease to 81.38% level at the vision realization and 87.5 points at the balanced scorecards average according to the limit method (Figure 18).

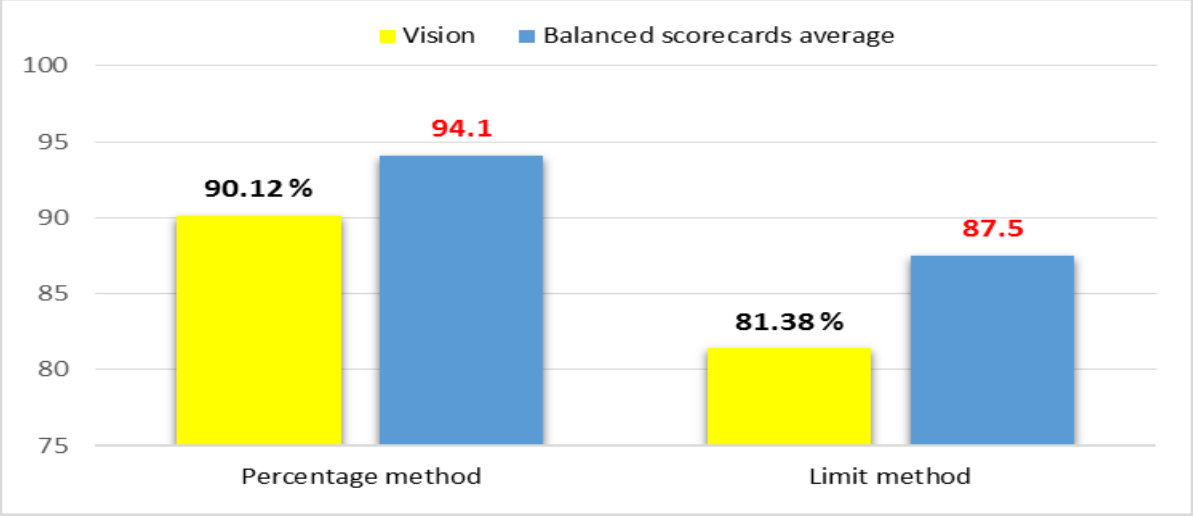


Figure 18. Illustrative scenario results

In order to test the sensitivity of the software, 26 more scenarios are also generated. IF-THEN scenario values are tested on Microsoft excel first, and then are compared with software results (Figure 19). Consistent test results are shown as in Figure20.

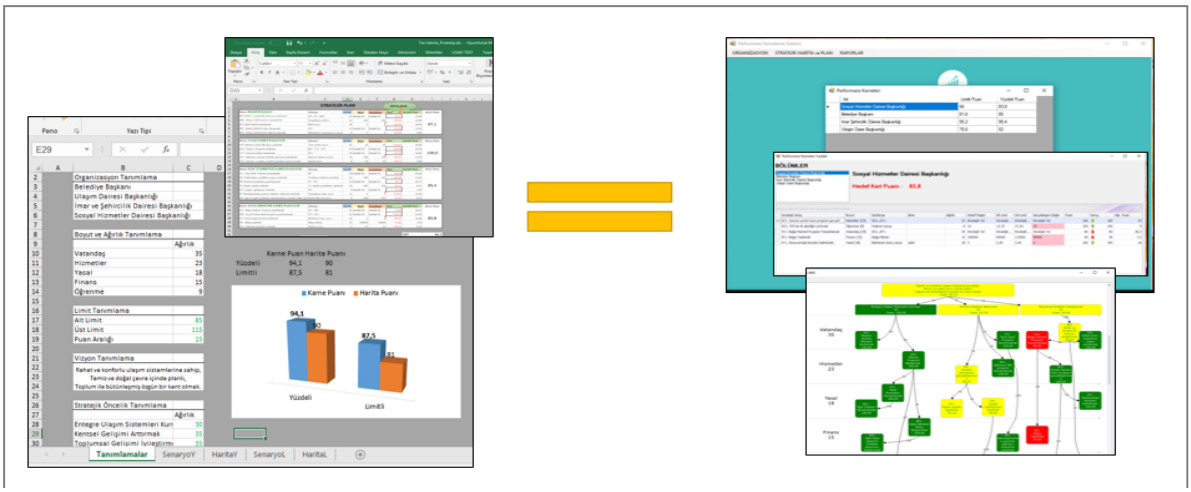


Figure 19. Excel prototype – Software comparison

Illustrative scenario = S1 and S11

	Percentage metho	Limit method
Cards Average=	94.1	87.5
Map score =	90.12%	81.38%

STRATEGY MAP SENSITIVITY

			Weights of Strategic Priorities 30-35-35		50-20-30	
			S1			S2
		S1	Cards Average	94.1	Cards Average	94.1
			Map score	90.12	Map score	92.35
			S3			S4
		S1, when all targets are achieved	Cards Average	100	Cards Average	100
			Map score	100	Map score	100
			S5			S6
	Percentage Method	S1, when only 1 target is not achieved (From independent objectives)	Cards Average	97.1	Cards Average	97.1
			Map score	96.5	Map score	98
			S7			S8
		S1, when only 1 target is not achieved (From dependent objectives)	Cards Average	96.7	Cards Average	96.7
			Map score	95.63	Map score	96.25
			S9			S10
		S1, when 1 target is text and 1 target has negative effect	Cards Average	82.9	Cards Average	82.9
			Map score	84.92	Map score	84.45
			S11			S12
		Limit method settings: [85/115, SR:5]	Cards Average	87.5	Cards Average	87.5
			Map score	81.38	Map score	83.85
			S13			S14
		S1, Limit method settings: [77/120, SR:17]	Cards Average	80.9	Cards Average	80.9
BALANCED SCORECARDS SENSITIVITY			Map score	71.42	Map score	74.54
			S15			S16
		S1, when all targets are achieved	Cards Average	95	Cards Average	95
			Map score	95	Map score	95
			S17			S18
		S1, when all actual targets above the upper limit	Cards Average	100	Cards Average	100
			Map score	100	Map score	100
			S19			S20
	Limit Method	S1, when only 1 target is not achieved (From independent objectives)	Cards Average	89.5	Cards Average	89.5
			Map score	88.35	Map score	91.2
			S21			S22
		S1, when only 1 target is not achieved (From dependent objectives)	Cards Average	88.7	Cards Average	88.7
			Map score	86.69	Map score	87.88
			S23			S24
		S1, when 1 target is text and 1 target has negative effect	Cards Average	69.3	Cards Average	69.3
			Map score	73.38	Map score	74.35
			S25			S26
		S1, when 1 actual target is between Lower limit - Planned target	Cards Average	86.7	Cards Average	86.7
			Map score	80.44	Map score	83.32
			S27			S28
		S1, when 1 actual target is between Planned target - Upper limit	Cards Average	87.7	Cards Average	87.7
			Map score	81.61	Map score	83.98

Figure 20. Sensitivity tests of the software

As a conclusion, the subjectivity of the Strategy map is reduced by using the weighted sum method and the strategic path feature in cause-and-effect relationships, the map is expanded into scorecards and became a viable structure that starts the system, and it is scored according to the traffic lamp method and included in the performance evaluation process. Attention should be paid to the number of strategic objectives to be used in the strategy map. Also, while working to achieve strategic goals, the BSC turns the vision to action / strategies into daily works, but not every daily works are strategic. The objectives included in the strategy map are strategic moves, they are indispensable (chess piece).

The benefit of BestBSC (Municipal Strategic Balanced Scorecard System) is that it is an information system that provides fast and reliable data flow that is easy to use. It is a reporting system that ensures the traceability of the targets. It is a performance evaluation system that shows the perspectives that need to be improved and shows strategic goals that cannot be achieved.

Illustrative scenario results propose higher performance in balanced scorecards average according to strategic maps (94.1 - 90.12 / 87.5 - 81.38) and propose better results in percentage method according to limit method. Different methods may be used and be compared in scoring and different application areas besides municipal environment may be cased in future. Furthermore cause-and-effect relationships computing literature consists from correlation, fuzzy scoring, weighted sum and strategic path methods for now. Other methods may contribute the area.

ACKNOWLEDGEMENT

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APPENDIX A

Keywords: Balanced Scorecard AND empirical, Balanced Scorecard AND effectiveness

Factors that influence the BSC efficiency		Support	Partial Support	Reject	Insufficient Evidence
BSC Types		– De Geuser, Mooraj ve Oyon (2009)_H_1		– Yongvanich, Guthrie (2009)_H_1	
Type I	Perspective extension	– Ittner, Larcker, Randall (2003)_H_1 – Tung, Baird and Schoch (2011)_H_1 – Baird, Schoch, Chen (2012)_H_1 – Upadhaya, Munir, Blount (2014)_H_2			
	Perspective weights	– Upadhaya, Munir and Blount (2014)_H_{2a}		– Upadhaya, Munir and Blount (2014)_H_{2a}, H_{2b}	
Type II	Horizontal synchronization (Consensus)	– Ittner, Larcker, Randall (2003)_H_2, H_3 – Deem, Barnes, Segal and Preziosi (2010)_$H_{1.2}$		– De Geuser, Mooraj and Oyon (2009)_H_{2a}	
	Vertical synchronization (Alignment)	– Iselin, Mia and Sands (2008)_H_1 – De Geuser, Mooraj and Oyon (2009)_H_{2a} – Deem, Barnes, Segal and Preziosi (2010)_$H_{1.2}$			
	Cause-and-effect relationships	– Ittner, Larcker, Randall (2003)_H_1 – De Geuser, Mooraj and Oyon (2009)_H_{2a} – William B. Tayler (2010)_H_{2a}		– Yongvanich and Guthrie (2009)_H_1 – William B. Tayler (2010)_H_{2a}	
	Strategy Map	– Carmona, Iyer, Reckers (2011)_H_1 – Cheng and Humphreys (2012)_H_1, H_2, H_{2a}, H_{2b}			
Type III	Measurement	– De Geuser, Mooraj and Oyon (2009)_H_{2a} – Molina, Florencio ve Gonzalez (2014)_H_1, H_{2a}, H_{2b}, H_3, H_4			
	Scoring	– Ittner, Larcker, Randall (2003)_H_1 – Upadhaya, Munir and Blount (2014)_H_2, H_3			
	Software interface features		– Emad M. Kamhawi (2011)_H_2		
	Software reporting ability	– Iselin, Mia and Sands (2008)_H_2 – Upadhaya, Munir and Blount (2014)_H_1		– Yongvanich and Guthrie (2009)_H_1	
	Performance-based reward system	– Carmona, Iyer, Reckers (2011)_H_2 – Baird, Schoch, Chen (2012)_H_2			– Tung, Baird and Schoch (2011)_H_2

Figure 21. Affecting factors of BSC efficiency according to BSC Types (Hypothesis)

APPENDIX B

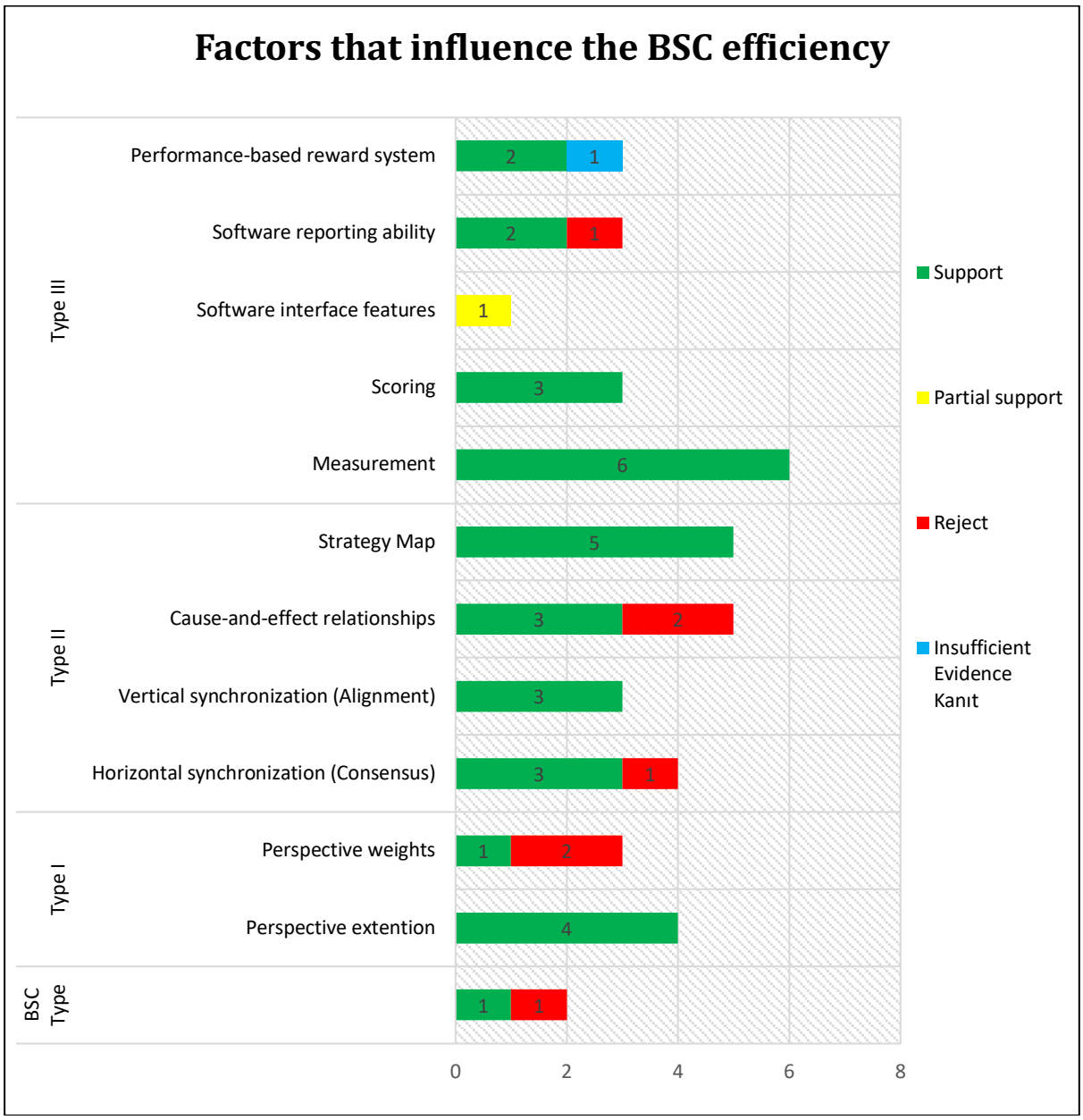


Figure 22. Affecting factors of BSC efficiency according to BSC Types (Numbers)