PRIORITIZING THE ANTECEDENTS OF JOB SATISFACTION: A DATA MINING APPROACH

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ABSTRACT

Job satisfaction (JS) is important because it is related to the success of the organization. It has been found to bring about such outcomes as job performance, organizational citizenship behavior (OCB), absence, turnover, and so forth for the employees and organizations. The factors causing JS are composed of thoughts, feelings, and actions of a group of employees in a certain organizational culture. This study aims to identify and prioritize the contributory factors to job satisfaction in Turkish employees with the purpose of helping develop organizational policies that could increase JS. Being the first study using data mining approach (decision tree, association rules, Bayesian network, and attribute selection) with a sample of 44,820 employees in all sectors in Turkey, the study has found that a great majority of the employees are satisfied with their jobs. The most significant variable in job satisfaction is 'problem with working conditions,' followed by 'problem with administrative issues,' and 'sector.'

Keywords: job satisfaction, working conditions, data mining, decision tree, classification methods

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İŞ DOYUMUNA SEBEP OLAN FAKTÖRLERİN ÖNCELİK SIRALAMASI: BİR VERİ MADENCİLİĞİ YAKLAŞIMI

ÖZ

İş doyumu, örgüt başarısı ile ilgili olduğu için önemlidir. İş doyumunun çalışanlar ve örgütler için çalışma performansı, örgütsel vatandaşlık davranışı, işe gelmeme, iş değiştirme gibi sonuçlarının olduğu çeşitli çalışmalarla ortaya konmuştur. İş doyumuna sebep olan faktörler belirli bir örgütsel kültürde çalışan bir grup iş görenin düşüncelerinden, duygularından ve eylemlerinden oluşmaktadır. Türkiye'deki iş doyumu ile ilgili çalışmalar, sınırlı sayıda örnekle ve klasik istatistiki yöntemlerin kullanılmasıyla yapılmıştır ve iş doyumu açısından hangi faktörün öncelik arz ettiği bilinmemektedir. Bu çalışma, iş doyumunu artırabilecek örgütsel politikaların geliştirilmesine katkı sağlamak amacıyla Türkiye'deki çalışanların iş doyumuna etki eden faktörleri tespit etmeyi ve bu faktörleri öncelik sırasına koymayı hedeflemiştir. Türkiye'deki tüm sektörlerden 44,820 çalışanı kapsayan ve ilk defa veri madenciliği yönteminin kullanıldığı bu çalışmada karar ağacı, ilişkilendirme kuralları, Bayes ağları ve analiz ve sınıflandırmalar için nitelik seçimi tekniklerinden yararlanılmıştır. Araştırma sonucunda çalışanların büyük çoğunluğunun işlerinden memnun oldukları bulunmuştur. Ayrıca, iş doyumunu etkileyen en önemli faktör "çalışma koşullarıyla ilgili sorunlar" olarak tespit edilmiş ve bunu sırasıyla "yönetsel konularla ilgili sorunlar" ve "sektör" izlemiştir.

Anahtar Kelimeler: iş doyumu, çalışma koşulları, veri madenciliği, karar ağacı, sınıflama yöntemleri

I) INTRODUCTION

Job satisfaction (JS) has been defined as "an affective or emotional response toward various facets of one's job" (Kreitner & Kinici, 2013, p. 168). In other words, it refers to "how people feel about their jobs and different aspects of their jobs" (Spector, 1997, p.2) and thus containing "evaluative judgement" (Weiss, 2002, p. 175) indicating the subjective nature of the construct. In this respect, it is a matter of *attitude* toward work and therefore having cognitive, affective, and behavioral components (Robbins & Judge, 2013, p.105; Hellriegel et al., 1995). Consequently, JS represents a dynamic and situational sum of such antecedents as job characteristics, pay, workload etc. (Figure 1).

JS is important because it is closely related to the success of the organization. JS has been found to bring about such outcomes as job performance, organizational citizenship behavior (OCB), absence, turnover, and so forth for the employees and organizations (Figure 1). For example, high levels of JS are found to be protective against stress, positively influence self-esteem, and may be the motivator for self-development (d'Archardvan Enschut, 2012 cited in Warmelink et al., 2015). Therefore, from a managerial point of view, it is necessary to know the broad context around JS (Figure 2) and be able to influence the predictors of JS so that the effects of JS could be affected in the intended direction. The management of an organization is expected to increase the quantity and quality of products while spending enough effort to enhance employee JS. In such a case then emerges the balance of the two, which is the clear indication of 'success' (Basaran, 2000). Consequently, the success of an organization is also measured by the level of the employees' JS.

(Insert Figure 1 about here.)

A perusal of the literature on JS shows that JS is regarded both as an antecedent of organizational outcomes and as an outcome of organizational conditions (Staw et al., 1986; Musal et al., 1995; Spector, 1997; Warr, 2007; Yang, 2010; Klassen and Chiu, 2010; Kreitner & Kinici, 2013; Warmelink et al., 2015; Figure 1-2). Considering the antecedents of JS, studies have found a number of factors, among which are problems with working conditions, job characteristics, job security, inadequate wage at workplace, and problems with administration (Adamson et al., 1995; Spector, 1997; Fogarty et al., 1999; Kankaanranta et al., 2007; Miller et al.,2009; Poggi, 2010).

(Insert Figure 2 about here.)

The factors causing JS are composed of thoughts, feelings, and actions of a group of employees in a certain organizational culture where their organizations exist in a broader context of a sociological environment. The antecedents of JS listed in Figure 1-2 may show variation in terms of priority and degree of effectiveness from culture to culture and organization to organization, even from person to person. Moreover, it is noted that "there are differences in job satisfaction and in patterns of facet satisfaction across countries" (Spector, 1997, p.27); thus, the studies investigating JS with samples large enough to give a general picture of a given country are needed.

What makes up JS in a specific culture? Among the constituents, which one or ones are more influential and need further development? Which factor should be improved most to enhance JS? The answers to these questions change from culture to culture in general and organization to organization in particular. Hence, it is necessary to find out the most critical elements of the JS in a given sociological work setting, so that leaders of organizations and those who can influence the structure and functioning of the organization could introduce the

required changes accordingly. Consequently, the present study aims to identify the contributory factors to JS in Turkish employees with the purpose of helping develop organizational policies that could increase JS and to fill the gap in the existing literature because

- there is no study representing the whole country (all sectors in the country) in JS;

- the existing evidence concerning JS in Turkey stems from classical statistical techniques with limited number of participants;

- which factor is more pressing in Turkish context is unknown.

Being the first study using data mining approach with a sample large enough to represent the whole country in JS, the study follows the following threefold procedure:

1. A selection of variables affecting JS data is made, considering their relevance in our study. The variable JS serves as response.

2. Using powerful attribute evaluators and data mining tools provided by Weka software version 3-7-13 (Waikato Environmental for Knowledge Analysis developed at the University of Waikato in New Zealand incorporating a large variety of machine learning algorithms, called classifiers. Bishop, 2006; Witten et al., 2011; Bouckaert et al., 2013), a ranking of the most important predictors for the response JS is formed.

3. Association rules from decision trees for the predictor variables are obtained. These association rules allow the most relevant factors to be selected to allow for the response to be evaluated.

This study uses such techniques of data mining as *Variable Selection*, *Decision Trees*, *Bayesian Networks*, *and Association Rules*. Using data mining techniques, we identify the contributory factors to JS.

II) MATERIAL AND METHODOLOGY

A) Study population

The study population consists of 45,982 employees working on salary, wage or daily wage in Turkey in 2013. Those employees with missing values were excluded from the analyses, with a resulting 44,820 employees. Thus, this number was used throughout the study. Data was obtained from the database on Life Satisfaction (2013) of the Turkish Statistical Institute.

B) Variables

The study uses seventeen variables. One variable was considered as response and the remaining sixteen variables as predictors. The variables are given in the following categories:

The 16 predictor variables and the related classes are explained as:

Age (A): Age of the worker. Six classes are considered: [18, 24], [25, 34], [35, 44],[45, 54], [55, 64], [65+]

Gender (G): Two classes are 1= male, 2 = female.

Marital Status (MS): 1= Never married, 2= married, 3= divorced, 4= widow(er)

Education (E): 1= no schooling, 2= primary school, 3= two or three years' college, 4= university, 5= graduate, 6= general secondary school, 7= vocational or technical secondary school, 8= primary education, 9= general high school, 10= vocational or technical high school

Sector (S): 1= private, 2= public

Problem 1 (P1): problem with administrative issues at workplace. 1= Yes, 2= No

Problem 2 (P2): wage inequality at workplace. 1= Yes, 2= No

Problem 3 (P3): inadequate wage at workplace. 1= Yes, 2= No

Problem 4 (P4): problem with working conditions. 1= Yes, 2= No

Problem 5 (P5): problem with timing of the payment. 1= Yes, 2= No

Problem 6 (P6): problem with the wage amount (paid full or partial). 1= Yes, 2= No

Promotion (P): promotion received to a higher position. 1= Yes, 2= No

Esteem (E): 1= good family life, 2= wealth, 3= social circle, 4= moral life, 5= education, 6= occupation

Perceived worth of work (PWW): 1= important, 2= undecided, 3= not important

Pressure because of work (PBW): 1= never, 2= sometimes, 3= often, 4= always

Pressure because of the amount of income (PBAI): 1= never, 2= sometimes, 3= often, 4= always

The response (output) variable was JS.

Job satisfaction (JS): 1= satisfied, 2= undecided, 3=unsatisfied

C) Statistical procedures

In order to select the most important predictors, various classification methods are applied by using Select Attributes (function of Weka), which are shown in Table 1. The classifiers in Weka are designed to be trained to predict a single class attribute, which is the target for prediction. The attribute evaluators *ChiSquaredAttributeEval*, *CfsSubsetEval* and *InfoGainAttributeEval* combined with *Ranker*, *GreedyStepwise*, *ExhaustiveSearch* and *BestFirst* are the search methods used for the response variable JS. To select attributes, a statistical technique called cross-validation has been chosen, where a number of folds ($n = 3$, $n = 5$, $n = 10$ in our case) are specified. Another test mode applied at this point has been full training set. In this case, the worth of the attribute subset is determined using the full set of training data.

<div align="center">(Insert Table 1 about here.)</div>

The variables of *age*, *gender*, *marital status*, *education*, and *perceived worth of work* were considered to be insignificant (Table 1). The remaining 11 predictive variables were used to produce the decision tree and association rules.

The C4.5 algorithm, deriving from a divide-and-conquer technique for producing decision trees, is employed (Figure 3). Therefore, the J48 decision tree learner has been considered and a training set test option for the response variable has been applied. The confusion matrix illustrates the number of the instances correctly or incorrectly assigned to each class. In our study, 81.43 %

of the cases have been found to be properly assigned, which can be considered significant.

<div align="center">(Insert Figure 3 about here.)</div>

The association rules are obtained by working with Association-Rules Learners, namely with Predictive Apriori algorithm. The reason why Predictive Apriori association-rule learner has been used is that it combines confidence and coverage into a single measure of predictive accuracy and produces the best rules in order (Scheffer, 2001). The ten best rules for JS are given in Table 2.

<div align="center">(Insert Table 2 about here.)</div>

The rules were obtained using Association Rules regarding JS by the class of the predictive variables and selected the best 10 of the rules (Table 2). The *confidence* or *predictive accuracy* (at the end of each row) indicates the number of instances for which all the conditions are true (the coverage), divided by the number of instances for which the conditions in the antecedent are true. Thus, for instance, the first row in Table 2 has to be interpreted as: $P1 = 2$, $P3 = 2$, $P4 = 2$, $P5 = 2$, $PBW = 1$, and $PBAI = 1 \Rightarrow JS = 1$, with a confidence level of 0.94.

III) RESULTS

A) Decision tree

81.0 % of the 44,820 employees are satisfied with their jobs (JS=1). The determinant variable in JS is 'problem with working conditions' (P4). While 79.3 % of the employees do not experience any problems with working conditions, 20.7 % do (Node 0 in Figure 3).

The number of the employees satisfied with their job goes down (56.8%) if they experience problems with working conditions; however, their number increases (87.4%) if they do not have any problems with working conditions. For those having problems with working conditions, the most important factor in JS is 'problem with administrative issues' (P1). The percentage of those having problems with both working conditions and administrative issues is 8.6. Their level of JS is lower (45.7%). 12.2% of those have problems with working conditions but do not have any problems with administrative issues. 64.6 % of the employees in this group are satisfied with their jobs. The second determining factor in JS for those with problems with working conditions is 'sector.' JS shows a significant variation by sector. 58.0% of the employees in the public sector having problems with both working conditions and administrative issues are satisfied with their jobs, but the percentage of this group of employees satisfied with their jobs in the private sector is only 38.7. While 74.6 % of those having problems with working conditions but not having any problems with administrative issues in the public sector are satisfied with their jobs, the percentage of this group of employees satisfied with their jobs in the private sector is 59.5. If problems with administrative issues could be eliminated for those having problems with working conditions in the public sector, their JS increases (from 58.0 % to 74.6 %) a positive response to P4 in the public sector, the level of JS increases. The increase in JS for the same group in the private sector is from 38.7% to 59.5% (Node 2 and its sub-nodes in Figure 3).

For those not having any problems with working conditions, the most important factor in JS is 'inadequate wage at workplace' (P3). 65.5% of the employees do not experience any problems with working conditions and inadequate wage at workplace. 89.1 % of the employees in this group are satisfied with their jobs. 13.8% of the employees receive inadequate wage at workplace but do not have any problems with working conditions. 79.2 % of the employees in this group

are satisfied with their jobs. For those not having any problems with working conditions and not receiving inadequate wage at workplace, the most important factor in JS is 'pressure because of work' (PBW). JS shows a significant variation by PBW. If the employees do not feel any pressure because of work, JS increases significantly (from 89.1% to 89.5%); otherwise, JS decreases (from 89.1% to 73.4%). For those not having any problems with working conditions but receiving inadequate wage at workplace, the most important factor in JS is 'problem with administrative issues' (P1). If the employees in this group have problems with administrative issues, 65.8% are satisfied with their jobs. If they do not have any problems, this figure goes up to 81.9% (Node 1 and its sub-nodes in Figure 3).

B) Association rules

The most frequent response for JS is 1= satisfied, which appears in all of all the rules. Among the variables listed above, the determining factors in JS are P3 (inadequate wage at workplace) and P4 (problem with working conditions) because P3 and P4 appear in all of the rules. JS=1 occurs in P3=2 and P4=2. That is, those who do not face any problems with "inadequate wage at workplace" and "problem with working conditions" are satisfied with their jobs. On the other hand, because P1 (problem with administrative issues at workplace) appears in seven of the ten rules, it has a partial effect on JS. P5 (problem with timing of the payment) comes next in the list.

IV) DISCUSSION

The present study shows that the majority (81.0 %) of the employees working in Turkey are satisfied with their jobs, which supports other studies carried out with samples in different professions such as university lecturers (Dagdeviren et al., 2011), hospital staff (Tengilimoglu & Yigit, 2005), and police officers (Sanli, 2006). One of the reasons for this could be job security. Job security is thought to be closely related to JS as an antecedent (Onder & Wasti, 2003; Poyraz & Kama, 2008). The recent economic crises and political uncertainties have had consequences for the operation of world economies, decreasing levels of job security, especially in the private sector enterprises. As a result, being employed has become more satisfying than being employed in a decent job.

It has also been found that the determinant variable in JS is 'problem with working conditions.' Working conditions cover a large area of physical, social and psychological aspects. It contains the physical characteristics of the work environment (cold / hot, dangerous, requiring a lot of attention etc.), poor physical conditions (like noise and unwanted temperature), the nature of the hierarchal relationships, organizational justice and fairness, communication, being recognized and appreciated by the managers, opportunities for promotion, common ways to cope with conflicts, management style, organizational culture, socialization processes, economic compensations, working time, working styles and workload, duration of affiliation, their working system, night shifts, working at weekends, weekly working time (Akinci, 2002; Akman, Kelecioglu & Bilge, 2006; Eginli, 2009; Oflezer et al., 2011). Among these, "psychosocial factors are much more effective than economic factors on the job satisfaction of employees" (Akinci, 2002). Moreover, the nature of the job and the task(s) given in the job are variable in terms of JS. All these combined form the JS perception of the employees, with varying degrees of influence. As a result, to identify the most effective factors in JS with respect to working conditions is very important to enhance JS.

The study has shown that for those having problems with working conditions, the most important factor in JS is 'problem with administrative issues.' This

brings up a number of issues, leadership being at the top of the list. In case of a problem with administrative issues, it is better to think of poor leadership culture in the organization, considering leadership as a function rather than as individual traits. This function is distributed among the members of the organization (Schein, 2015). Thus, the responsibilities and duties may not be taken up and fulfilled by the members appropriately in those organizations where the employees experience administrative problems. Secondly, managerial policies and behaviors are among the most significant factors involved in JS along with the type of leadership, level of autonomy, and interpersonal relationships (Sahin & Batigun, 1997). Thirdly, professional traits of the managers are another factor in the relationship between employees and the management. A good manager is expected to be a good leader, which is an indication of the developed administrative skills (Tengilimoglu & Yigit, 2005). However, most administrative positions are not occupied by specially trained personnel in Turkey because the politics of bureaucracy is different from the politics of bureaucracy in the western tradition. In addition to the performative administrative skills, some other social and personal traits play an important role, which needs an extensive sociological exploration. A final point is organizational justice, an invisible tunnel through which relationships within an organization flow, which may influence the frequency and nature of problems with administrative issues. Administration of an organization is also a position to represent organizational justice. Research suggests that if the expectations of the employees as to procedural, distributional and interactional justice within an organization are met, their JS is enhanced, bringing about a higher level of identification with the organization (Tutar, 2007).

The second determining factor in JS for those with problems with working conditions is *sector*. JS shows a significant variation by sector (against private sector: only 38.7% of the employees in the private sector having problems with both working conditions and administrative issues are satisfied with their jobs). This could be explained by the situational and structural differences between the private sector and the public sector in Turkey in several aspects. Firstly, public sector is for public service. It is like a non-profit organization, with minimum concern about efficiency. Thus, it has no practical goals like maximum profit or quality, which has consequences for the organizational culture, working conditions, and other organizational variables. Secondly, there is no room or need for risk-taking in the public sector because the organizational context by its very nature is away from risk culture. It is rather an environment of role culture. However, private sector is based on competition, profit, and success. Thirdly, employees are civil servants in the public sector, which means their job description is clearly defined, so it is not very changeable, but private sector has changing roles for the employees and more difficult working conditions (Ozdevecioglu, 2002). Forthly, organizations in the public sector has stronger cultures, which means they have predetermined strategies for conflicts and challenges, but because the organizations are younger in the private sector, most are still developing, with cultural instability. The private sector organizations are more open to growth, more professional, while the public sector organizations are more bureaucratic (Kaya, 2008). Fifthly, the authority is the law in the public sector, while it is the administrators, supervisors or the owners of the organization in the private sector (Ozdevecioglu, 2002). Sixthly, the employees feel the public sector offers more job security and the employees in the public sector are more traditional and have a tendency to maintain the status quo (Sigri, 2007; Poyraz & Kama, 2008). Finally, trust in administrators on part of the employees is a more significant variable for JS in the private sector (Koc & Yazicioglu, 2011).

CONCLUSIONS

All the points mentioned up to here have a role to play in influencing the JS perception of the employees. Still, further studies are badly needed to investigate the antecedents of JS (job characteristics, organizational constraints, role variables, work-family conflict, pay, job stress, workload, control, work schedules, personality, supportive co-operation and teamwork, person-job fit, job performance demographic variables) with samples from different branches of the private sector in Turkey. Secondly, working conditions could be improved through identifying and analyzing the factors which may have an effect on employee psychology. Thirdly, to minimize problems with administrative issues, effective leadership practices could be introduced in two ways: leaders could be trained and organizational culture could be changed. For example, the primary roles of the past managers as order giver, privileged elite, and manipulator could be changed into facilitator, team member, teacher, advocate, sponsor and coach (Kreitner & Kinici, 2013). Considering leadership as a function, elements of the organizational culture could be changed so that effective leadership could operate at all levels in the organization. Finally, job descriptions and roles in the private sector could be clarified by contingency approach.

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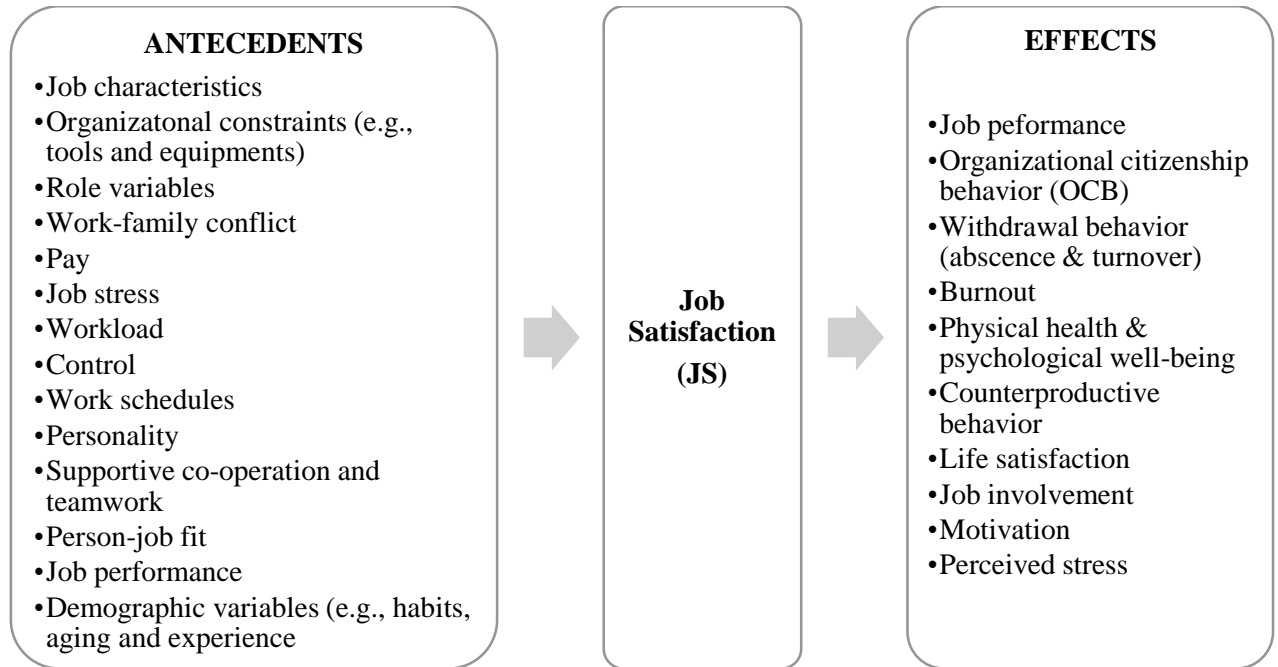
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Acknowledgements

ANTECEDENTS	Job Satisfaction (JS)	EFFECTS
•Job characteristics •Organizatonal constraints (e.g., tools and equipments) •Role variables •Work-family conflict •Pay •Job stress •Workload •Control •Work schedules •Personality •Supportive co-operation and teamwork •Person-job fit •Job performance •Demographic variables (e.g., habits, aging and experience		•Job peformance •Organizational citizenship behavior (OCB) •Withdrawal behavior (abscence & turnover) •Burnout •Physical health & psychological well-being •Counterproductive behavior •Life satisfaction •Job involvement •Motivation •Perceived stress

Figure 1. Antecedents and effects of Job Satisfaction

Source: Summarized from Staw et al., 1986; Musal et al., 1995; Spector, 1997; Warr, 2007; Klassen and Chiu, 2010; Kreitner & Kinici, 2013; Warmelink et al., 2015
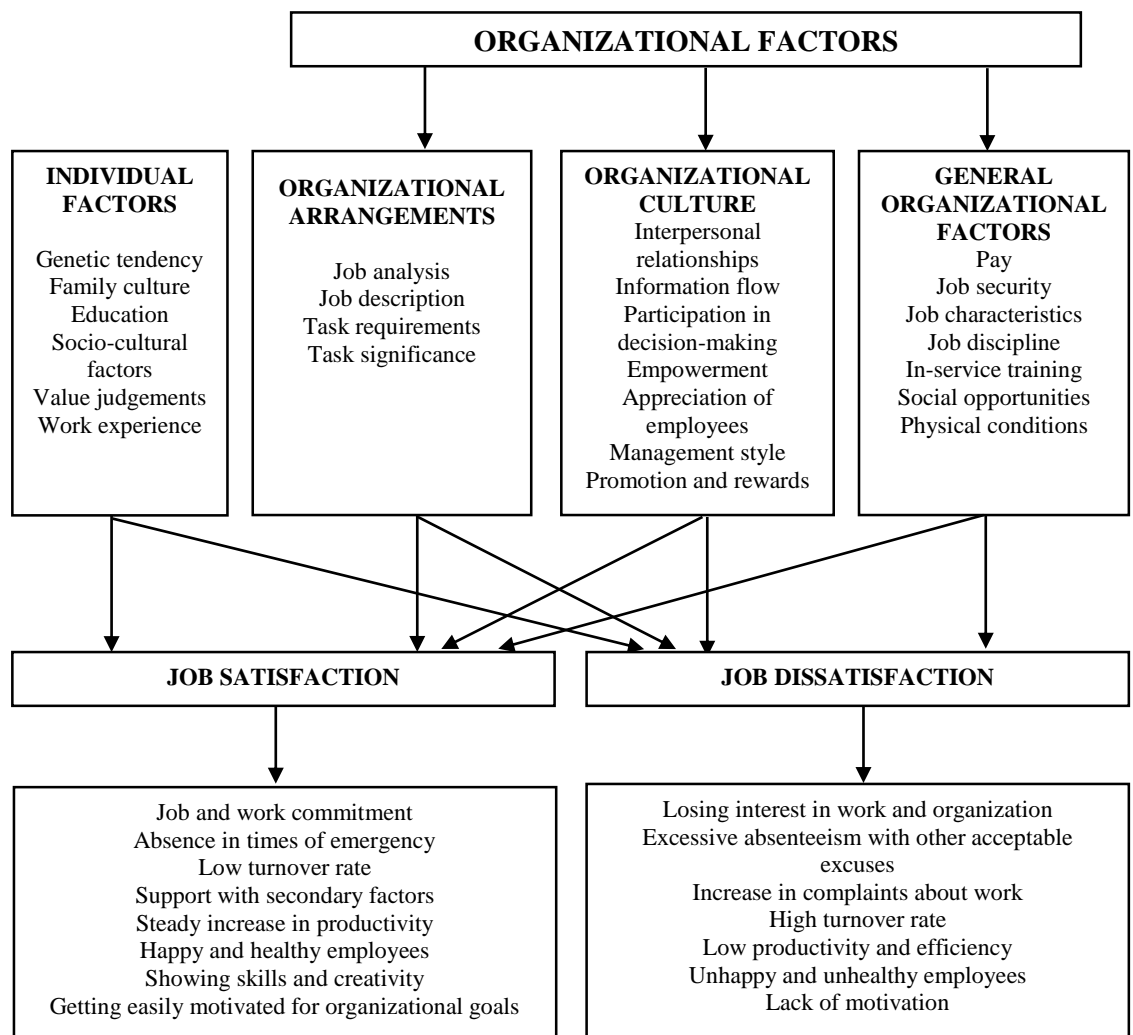
Figure 2. Job satisfaction cause-effect relationships

Source: Akinci, Z. (2002). Factors which affect job satisfaction in the tourism sector: A survey in five star hospitality organizations, *Akdeniz İ.İ.B.F. Dergisi (4)*, 1-25
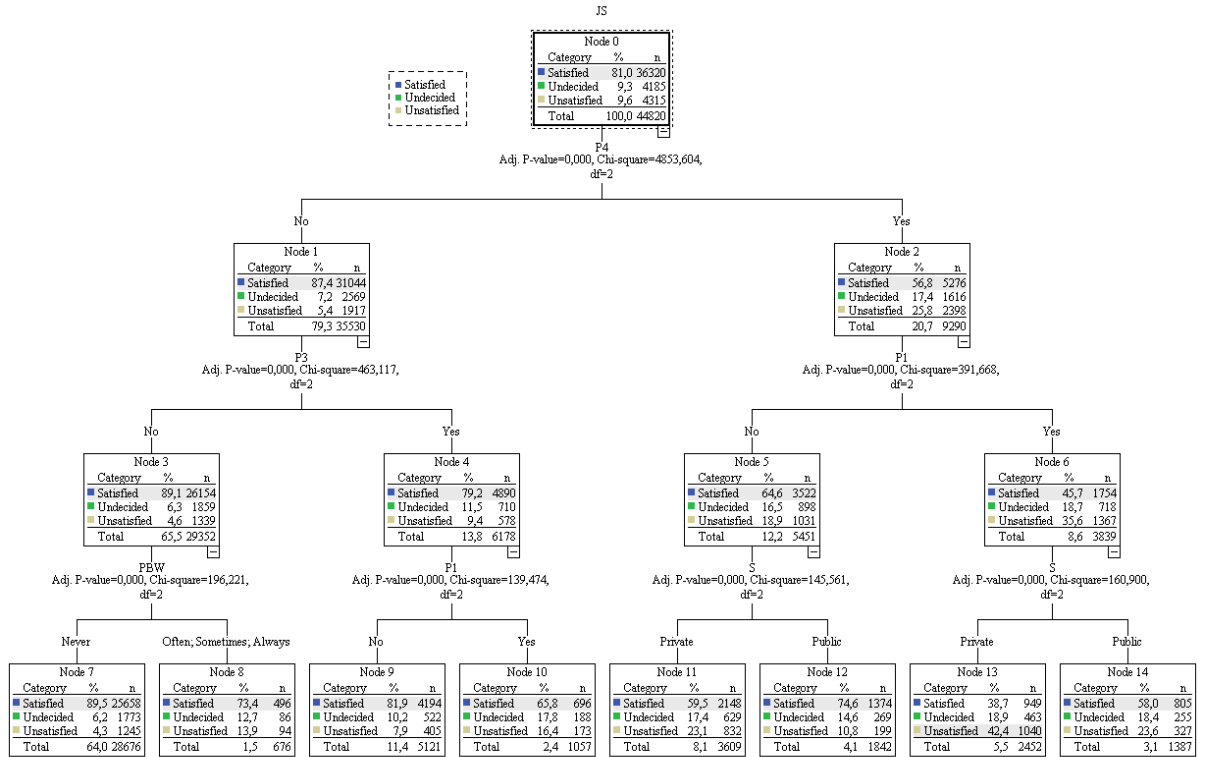
Figure 3.

Decision tree for the variables affecting JS

Table: 1
Selected Attributes

Attribute Evaluator	Search Method	Selection Mode	Selected Attributes
CfsSubsetEval	BestFirst	Full Training	P1, P3, P4, P5, E, PBAI
		Folds n=10	P1, P3, P4, E, P5, PBAI, P, PBW, P6
		Folds n=5	P1, P3, P4, E, P5, PBAI, P, PBW, P6
		Folds n=3	P1, P3, P4, E, P5, PBAI, P, PBW, P6
	GreedyStepwise	Full Training	P1, P3, P4, P5, E, PBAI
		Folds n=10	P1, P3, P4, E, P5, PBAI, P, PBW, P6
		Folds n=5	P1, P3, P4, E, P5, PBAI, P, PBW, P6
		Folds n=3	P1, P3, P4, E, P5, PBAI, P, PBW, P6
	ExhaustiveSearch	Full Training	P1, P3, P4, P5, E, PBAI
		Folds n=10	P1, P3, P4, E, P5, PBAI, P, PBW, P6
		Folds n=5	P1, P3, P4, E, P5, P, PBAI, P6, PBW
		Folds n=3	P1, P3, P4, E, P5, P, PBAI, P6, PBW
InfoGainAttributeEval	Ranker	Full Training	P4, P3, P1, P2, P5, P6, PBW, E, PBAI, S
		Folds n=10	P4, P3, P1, P2, P5, P6, PBW, E, PBAI, S
		Folds n=5	P4, P3, P1, P2, P5, P6, PBW, E, PBAI, S
		Folds n=3	P4, P3, P1, P2, P5, P6, PBW, E, PBAI, S
ChiSquaredAttributeEval	Ranker	Full Training	P4, P1, P3, P5, P6, P2, PBW, E, PBAI, S
		Folds n=10	P4, P1, P3, P5, P6, P2, PBW, PBAI, E, S
		Folds n=5	P4, P1, P3, P5, P6, P2, PBW, PBAI, E, S
		Folds n=3	P4, P1, P3, P5, P6, P2, PBW, E, PBAI, S

Table: 2

Ten best rules for *Job Satisfaction* output variable.

Rule	P1	P2	P3	P4	P5	P6	PBW	PBAI	JS	Conf.
Rule 1	2		2	2	2		1	1	1	0.94
Rule 2	2		2	2			1		1	0.93
Rule 3	2		2	2	2	2	1		1	0.93
Rule 4		2	2	2		2	1	1	1	0.93
Rule 5	2		2	2	2				1	0.92
Rule 6			2	2	2	2		1	1	0.91
Rule 7	2		2	2				1	1	0.91
Rule 8	2		2	2	2				1	0.90
Rule 9	2		2	2	2			1	1	0.90
Rule 10			2	2		2	1		1	0.90