勇健博士论丛

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——博弈论方法

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企业内的员工激励与合作机制：博弈论方法

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蒲勇健教授简介

蒲勇健，1961年11月出生于重庆市渝中区，重庆大学经济与工商管理学院教授、博士、博士生导师；国务院特殊津贴专家、中国百名科技创新优秀青年奖获得者，重庆市首届科技创新十大杰出青年。1983年大学毕业于北京大学数学系；1988年硕士研究生毕业于电子科技大学应用物理所，获激光物理专业硕士学位；1997年博士研究生毕业于重庆大学工商管理学院技术经济专业，获博士学位。近10年来在经济管理方面开展了大量研究工作，在学术杂志和报刊上发表了220余篇论文，出版了《可持续发展经济增长方式的数量刻画与指数构造》、《资源经济学》、《可持续发展与区域经济》、《新经济增长理论》等专著。作为负责人还承担了四项国家自然科学基金项目（其中一项为国际联合资助项目），作为主研还参与了国家杰出青年基金，国家重大科技攻关项目和国家自然科学基金项目的研究，研究成果在国内外学术界甚至社会上都产生了广泛影响。

张 朝 孝 博 士 简 介

　　管理学博士，副教授，1971年9月出生于四川平昌。1996年参加工作，次年考取包头钢铁学院矿业系统工程专业硕士研究生，于2000年毕业，同年考取重庆大学技术经济及管理专业博士研究生，于2003年毕业。获重庆大学2001、2002年度"优秀研究生"称号及重庆大学"优秀毕业研究生"称号。毕业后曾就职于西南财经大学工商管理学院。现任中原工学院经济管理学院副教授，兼河南省新郑市政府顾问。目前，在管理工程学报、管理现代化、重庆大学学报(自然版)等核心期刊及国际会议发表文章8篇。参加加拿大大学–产业联盟与国家自然科学基金项目及教育部博士学科点基金课题两项。主要研究方向为系统方法及博弈论在组织理论、人力资源管理及战略管理等领域的应用。

　　员工激励与团队合作是现代人事管理研究的重要内容。运用博弈论来研究员工激励与团队合作问题并为其构建博弈论基础是人事管理理论研究发展的重要方向。本书所研究的关键问题是现代人力资源管理中两个紧密关联的重要课题,即员工激励和团队合作。员工激励与团队合作是影响人力资源效率发挥程度的两个重要因素,但是激励与合作在一定程度上又是相互矛盾的,要深入研究其中任何一方面都离不开对另一方面的研究。研究员工激励和合作的主要工作被归入管理心理学和组织行为学的研究领域中,而且其研究方法多为实验研究和经验总结。近年来以研究参与人之间的相互作用相互影响及其最优策略为主要内容的一门新兴的经济学分支——博弈论逐渐成为倍受欢迎的研究人力资源管理的重要工具。因为在既定的制度环境中员工之间在工作中表现的竞争合作与博弈论研究的问题具有一致的特征。因此运用博弈论来研究员工激励与合作问题,就是从一个新的视角来研究这两个棘手的问题。本书所进行的研究基于严格的数理模型推导为现代人力资源管理中的员工激励与合作问题构建博弈论基础,有助于现代人力资源管理理论的研究向纵深发展,也为实际管理工作中如何解决团队中的不合作问题,以及根据实际情况制定适当的激励结构具有指导作用。

　　全书在介绍这项研究的目的、意义、内容及创新、国内外研究的现状以及各种激励理论和激励方法的基础上,从 5 个侧面进行研究。

　　首先,分析了团队合作的博弈机制。针对传统博弈理论在解释参与人合作的局限性及蜈蚣博弈悖论所体现的博弈理论方面

的缺陷，构建了暗恋博弈模型并以此分析了合作博弈的理性基础，分析了从不完全信息到共同知识演进的过程。研究结果认为帕累托最优的团队合作要作为唯一的纳什均衡结果需要两个关键环节。第一是对次优的均衡进行扰动，使其脱离原有的均衡状态。该过程有可能是由外部因素激励的结果，也有可能是由参与人初始财富、融资能力所决定的风险规避度量及贴现系数的差异所引起的。第二个关键环节是学习及信号传递过程。当均衡脱离原有的轨道，参与人从其他参与人的行动中修正对其类型的判断，并选择最佳行动，同时向其他参与人发送合作信号。该研究对现实中的团队合作问题具有较好的解释作用。

其次，分析了团队合作与激励结构的关系。团队合作与激励结构的关系表现为增加计件工资率和晋升奖金差距有利于激励团队员工努力工作，但是也会加剧员工之间相互拆台的问题，减少计件工资率和晋升奖金差距有利于降低团队员工拆台的积极性，但是也会降低员工的努力程度。如果团队员工相互拆台而团队合作又相当重要，则在均衡状态下企业不应当用晋升奖金来激励团队成员努力工作，企业给员工支付相等的固定工资并用计件工资来激励员工努力工作。如果团队不存在拆台问题，为了降低产量衡量的误差对员工的风险成本则在均衡状态下，只应对员工支付固定工资和晋升奖金。不合作型员工愿意到合作型团队中工作，但合作型员工则不欢迎不合作型员工，更不会到不合作型团队中工作。如果合作对于团队很重要，则尽量压缩晋升奖金差距，甚至应当从外部聘请高层管理人员。当产品的市场行情好时，没有必要监督员工是否合作，团队中适度的竞争有利于增强团队的

活力；当市场行情不好时，企业应监督团队成员是否合作，但是如果监督成本太高以至超过了代理成本就是不值得的。

第三，研究员工能力水平与激励结构的关系。研究表明固定工资虽不能激励员工付出额外的努力，但可以为员工提供保险，有利于员工参与企业的工作安排，因而是必不可少的。增加奖金差距，增加计件工资率有利于员工努力工作，但是最佳的奖金差距与工人的能力水平成正比，即对能力强的员工的工资差距应比能力弱的员工的工资差距大，对于能力较弱的员工应当缩小工资差距。最优的计件工资率与奖金差距负相关，与工人的风险厌恶成反比，与其能力水平成正比，与产量的方差成反比，企业应当根据市场行情相应地调整最优的计件工资率。但是在均衡状态下，即只要工人有足够的信誉或财富，没有必要支付计件工资，用相对业绩比较的晋升就可以达到激励目的。企业制定金字塔式陡峭的工资结构是为了激励员工为收回自己的保证金而努力工作，如果员工不努力工作，在极端情况下，他甚至会丧失收回保证金的机会，所以员工也不愿意随意更换工作。在一般情况下不应当将员工的激励完全依赖于保证金机制，为了激励不能得到晋升的员工，他们也应得到适当的固定工资和计件工资。

第四，我们研究了隐性激励机制对长期激励结构的影响。职业观念和显性激励机制对于员工的激励表现为替代关系，所以应当对员工的激励进行总体优化。年轻员工的职业观念较强，因此可以放松对年轻员工的显性激励，临近退休的员工，其职业观念已经大大弱化，应将其报酬更多地建立在当期的绩效水平之上。因此企业在制定员工的长期结构时应将员工的职业观念的强弱

作为一种重要的参考因素而加以优化总体激励水平。

最后，我们运用经济分析方法对精神激励进行了初步探讨。精神激励和经济激励都是企业激励员工的重要的激励手段，在激励员工的效果上是替代的关系，它们分别属于企业的有形资产和无形资产。企业应当综合运用精神激励和经济激励才能达到较好的激励效果。如果员工具有不同的偏好，并且企业能够提供连续的激励组合，则所有的员工都会选择不同的激励组合，并且选择较高(低)精神激励的员工会选择较低(高)的经济激励，即企业不用担心每个员工的偏好，基于自选择的组合激励就可以解决每个员工的激励问题。企业对所有员工激励的结构应当是基于企业包括无形资产和有形资产在内的资产结构。

关键词:激励结构　合作　人力资源管理　博弈论

The employee incentives and team cooperation are very important subjects of modern personnel management researches. In the research, game theory is a major approach to be used to study employee incentives and team cooperation and also to construct the game theory foundation. Incentive and cooperation are two important factors for companies to improve the workers' efficiency. But the two factors are mutually relative and contradictory. In order to study one factor, the other must be studied at the same time. Because a new studying tool, game theory, studies the mutual influence and reciprocity between participants, and the best strategies, and the competition and cooperation between workers is exact what game theory studies, it is used to study the competition and cooperation between workers. With a careful study of previous researches, this dissertation will analyze the team cooperation and incentive structure from five facets.

First, the team cooperation game mechanism without principals is studied. Because of the limitations the traditional game theories in explaining the players' cooperation and Centipede Game Paradox, secret-love game model is constructed to analyze the rational foundation of cooperative game. And the evolving process from incomplete information to mutual knowledge is analyzed. Two key links are needed if Pareto Dominance cooperation is to become the only Nash Equilibrium. The first link is disturbing the second-best equilibrium to make it breaking away from the original equilibrium situation. This process may be resulted from the incentives of exterior factors, also from the risk-

averse measures decided by the initial property and financing abilities of players and the differences of discount coefficient. The second key link is learning and signaling. When equilibrium breaking away from the original orbit, players will modify their type judgments, choose the best behaviors, and send cooperative signals to others. For the second link processing successfully, it is important that players should emphasize long-term benefits while an infinite game term is not necessary.

Then, This article studies the connection between team cooperation and incentive structure, the best incentive structure when there's sabotaging activities in teams. And agent cost is analyzed comparatively with the best incentive structure when no sabotaging activities happen in teams. The significance of competition and cooperation among team workers under special conditions as well as the characters and capability structure of team members and the organization structure of productions in teams based on competition and cooperation are also studied. All these studies show that although an increasing on piece wage rate and the bonus disparity will not only prompt team worker' harder-working, it will bring about the problem of sabotaging among employees. While reducing the piece wage rate and widening bonus disparity help to eliminate the enthusiasm for sabotaging, employees' working diligence will also be lowered. If team members will sabotage and team cooperation is rather important, enterprises should not use promoting bonus to incent team members to work hard in equilibrium. Enterprises should pay fixed wage equally to every one and piece wage should be adopted to

prompt team workers to work hard. If there does not exist sabotaging in team, in order to reduce the productivity measurement error and to reduce employees' risk cost, in equilibrium only fixed wages and bonuses are paid to employees. The non-cooperative workers are willing to work in cooperative teams while cooperative workers tend to reject those workers who are not cooperative and reject working in non-cooperative teams. If cooperation means much to teams, bonus gap should be shortened as much as possible and even top managers should be enrolled from outside. When products markets are favorable, there is no need to guarantee the employees' cooperation since adequate competition does good to teams' vigor and energy. While the market is not favorable, enterprises should supervise employees to be cooperative, but it will not be worthy if supervision costs exceeds agency costs.

Then implicit incentive mechanism based on occupational ideas is studied. Employees' current efforts and capabilities have effects on future performance. Their performance will influence the capability judgment from markets, and then influence their future payment. This is so-called typical implicit incentive mechanism namely occupation ideas. Occupation ideas and explicit incentive mechanisms are demonstrated to be mutually substitutive, so the incentives in all should be optimized. Young stuff tends to have strong occupation ideas so explicit incentives can be relaxed; old stuff who is going to be retired has usually much weaker occupation ideas, so payments should be more attached with current performance. Implicit incentive

mechanisms based on occupation ideas have powerful incentive effects. The strong occupation ideas of young stuff can reduce the dependence of current payment on current performance. And for those stuff who is close to be retired, while the enterprise cannot provide promotion and other compensative opportunities, their current payment should be largely connected with current performance. Therefore, in age-wage structures of enterprises, the occupation ideas of employees should be taken into consideration as an elementary factor to optimize the total incentive level.

Then comprehensive incentive mechanism is studied. The concept of comprehensive incentives is brought forward, economic incentives are divided into fixed wage, piece wage and bonus, and the relations between the three factors are further analyzed. The influences of employees' capabilities, risk-averse, productivity variance and bonus gap on optimal piece rate, also the incentive effect of these factors and market price are studied. And the incentive effects of pyramid wage structure and illuminate the nature of classifying stuff according to their capabilities are analyzed. While fixed payment cannot spur to create additional efforts, it provides stuff guarantee and promotes their participating job arrangements, so it is fundamentally necessary. While increasing bonus disparity, piece rate is beneficial to making workers work hard, the optimal bonus disparity is in positive ratio to their capability level. That is to say, the bonus disparity for the workers with higher capability level should be more significant than that for

the workers with lower capability level. The optimal piece rate is in negative correlation with bonus disparity, in inverse ratio to the workers' risk aversion and product variance, in positive ratio to capability level. An enterprise should also adjust the optimal piece rate according with the product market situation. But in equilibrium, if the workers have enough credit or welfare, there is no need to pay workers piece wage. Promotion based on relative performance can reach the aim of incentives. An enterprise's steep wage structure can be interpreted that in order to incent workers to work hard to take back their bail, and that if they do not work hard in extreme some of them may loss the opportunity to take back their bails. So in general workers are not willing to change their works at will. But in order to incent the workers can't be promoted to work hard, an enterprise should pay them proper fixed wage and piece wage.

Lastly, economic analysis of mental incentives is studied. Mental incentives and economic incentives are all important incentive instruments, which are substitutive in incentive effect, and belong to an enterprise's tangible assets and intangible assets. An enterprise should integrate mental incentives and economic incentives to reach a better incentive effect. If workers have different prejudice, and if the enterprise can provide consecutive incentive combination, all the workers will select different incentive combination, and the workers who select more (less) mental incentives will select less (more) economic incentives. That is to say the enterprise need not worry about every

worker's prejudice, the incentive combination based on self-selection can solve all the incentive problems that every workers faces. The incentive structure should be based on the assets structure, which comprises the enterprise's immaterial assets and material assets.

Key words: incentive structure cooperation manpower management and game theory