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CELL PRODUCTION SYSTEM IN PRODUCTION MANAGEMENT IN RECREATION FACILITIES

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ABSTRACT

Our study presents a holistic method prepared according to the principles of axiomatic design (AD) for designers who want to transform a functionally placed production system into a production system consisting of cells. This method, developed according to the axiom of independence, systematically provides all the steps in the cellular production system transformation process. It also includes the feedback system that enables the evaluation and development of the cellular production system according to the determined performance criteria. The method is specifically designed for a recreation business that produces a trekking product in an indoor/outdoor area. The developments obtained as a result of the application are also shown within the scope of the study.

Keywords: *Axiomatic design, cellular production, recreation business*

INTRODUCTION

The concept of production management is the process of planning, organizing, managing, harmonizing, and controlling production activities. In recreation businesses, it is a basic business function that deals with making the necessary decision to provide recreation services at the desired quality and

standards, at the desired time, and at the lowest cost. The concept of recreation service process management, on the other hand, includes the design and continuation of the production processes of recreational products and continuous evaluation to better meet the consumer requirements. To fulfill the mission of recreational products manufacturing enterprises, all departments of the enterprise must produce products in an effective and coordinated manner. It is "leisure time" that is considered as wastefulness and laziness before industrialization, which is the consumer demand of production management in recreation enterprises. Leisure time has become a basic requirement that provides mental, mental, and physical relaxation for the consumer today. When this situation is evaluated in terms of the consumer; It is the activities that the consumer does in his free time to get rid of the boring, disciplined, and monotonous effect of daily life, to relax, and to satisfy having a pleasant time. These activities must be produced by the recreation establishment in the desired quality, in the desired price, time, and amount, with the principles and methods required by the product. Today, the differentiation of consumer demands has increased the tendency to increase product diversity and workshop-type production (discrete production). For these reasons, interest in "cellular production" has increased. A cell is defined as a group of workstations located close to each other where multiple and consecutive operations are performed on families or families, made up of similar raw materials, parts, or products. The manufacturing cell is referred to as the cell in which physical process and transformation are applied to the materials that make up the products (Hyer; Wemmerlöv, 2002). The purpose of cellular production is to reach efficiency in production by taking advantage of the similarity between parts. In other words, it means getting more output in less time, less cost, and better quality. In a cellular production system, the cell consists of parts families, and machine groups. It is tried to obtain cells in which the parts are processed with a minimum relationship with other cells (Adil et al., 1996). In recreation businesses that adopt consumer-oriented recreation product production, it is one of the basic principles to reduce costs by arranging the production processes in line with the recreational products desired by the consumer. Recreation establishments are businesses that produce recreational products based on the order. The recreation products requested by each consumer are different, which causes the number and variety of recreational products to be produced to be high. While the variety of recreation products increases, it becomes difficult to complete the production of such a variety of recreational products on the date the consumer wants. To alleviate all these difficulties and to produce in a consumer-oriented manner, recreation enterprises should turn to cellular production philosophies.

The cell production system has been applied only in businesses that produce goods so far. Recreation businesses are service-based businesses due to the nature

of the product they produce. Our study is designed to show that service-manufacturing businesses can switch to the cell production system. Therefore, to create a production cell, the recreational product must first be defined and the numbers of the material and human elements used in the production process must be determined. Then, similar recreational product families and material element (outdoor-indoor recreation areas) cells are determined and the recreation products should be assigned to the recreation product (outdoor-indoor recreation areas) cell where they will be produced. In creating a recreational product cell, the material and human elements used in the creation of the product should be determined, and interrelated decisions should be made, such as assigning cells (outdoor-indoor recreation areas) to recreational product families or assigning recreational product families to cells (outdoor-indoor recreation areas).

In our study, trekking was chosen as an exemplary product in the transition to the cell production system in recreation enterprises. In the beginning, nature walks, which started as personal activities of nature lovers to experience natural beauties and to be in nature, have gradually gained an economic dimension under the umbrella of alternative tourism today. Trekking is an important activity within the concept of ecotourism. Today, trekking, which is also known as nature walk, is a sport that is generally performed by those who want to get rid of the stress of the city, on weekends, on tracks close to the city, or in the form of 2-3 weeks' tours in foreign countries, accompanied by a professional guide (Ulusan 2009). Some benefits of trekking can be listed as follows when applied by adhering to certain principles; It regulates the circulatory system, strengthens the body muscles, including the heart muscle, enables them to work more effectively, regulates blood pressure, reduces the risk of obesity, facilitates digestion, increases the oxygen flow to the brain, increases mental sharpness and creative thinking potential, increases respiratory capacity, hardens and strengthens bones Provides the secretion of endorphins, the body's natural happiness hormone (Kiracioğlu 2010). LCP analysis is used to determine the routes and routes in nature walks. LCP analysis is preferred due to its fast and high accuracy results in many areas such as transport (Kumari; Geethanjali.2010), nature conservation (Bagli et al, 2011), geography (Atkinson et al, 2005), wildlife (Larue; Nielsen. 2008), landscape planning (Teng et al, 2011), archeology (Diwan, Doumit, 2017), highway planning (Sari; Sen, 2017). This analysis uses the Dijkstra algorithm, which is defined (Rees, 2004) as a central routing algorithm that keeps information in a central location. The goal is to find the lowest cost path from a particular source node to all other nodes. This algorithm determines the lowest cost routes from a starting point to a destination by optimizing the cost in multiple iterations.

METHOD

The model of the research is experimental research according to the research method performed and used. According to the purpose of the research, it focused on descriptive research as it reveals the current situation and descriptive research model because it includes the comparison of existing and new production systems. Cell type production is the model of the established production system. It was developed as an alternative production system to combine both the variety of workshop production and the efficiency advantage of mass production. While creating the production cells of the recreational product, “principles of form with axioms” are used. The most important concept in the form of axioms is the existence of form axioms.

Axiom₁: “Provides independence between functional requirements”

Axiom₂: “Make information content to a minimum”

The relationship between functional requirements and form parameters is mathematical as follows:

$$\{FR\}=[A]\{DP\}$$

In this relationship; {FR} is the vector of functional requirements, {DP} is the vector of form parameters, and [A] is the matrix that determines the design; Each a_{ij} in matrix R is i. shows the relationship between FR and DP. The type of form of recreation product planned to be produced is defined by the structure of the [A] matrix. The case where all the non-diagonal elements of the matrix [A] are zero satisfies the discrete form matrix. It is very difficult to provide this form in real life. The case where the matrix [A] is triangular, that is, the diagonal elements and all the elements below it is nonzero, provides the separated form matrix. It is the most common form situation in real life. The case that the matrix [A] does not have a special structure, that is, there are non-zero elements on the diagonal, provides the bound form matrix. For a form to satisfy the axiom of independence, the matrix [A] must be a discrete or separated form (Suh, 1990).

FINDINGS

The functioning of this system is as follows. The space that makes up the recreation product is grouped according to different algorithms based on the similarities of the materials and personnel.

Cell Layout

While manufacturing a recreational product in a recreation enterprise, this product must be produced in various tools or areas, using various tools and

following a certain process sequence. Starting from the first process to be made on the reactive product produced in such an environment, the material should be procured according to the duration and difficulty level of the walking route, for example, in nature walks. Water to drink and food to be eaten should be prepared. If there is a chronic disease or regularly used medicines, they should be put in the bag. The leader should be informed about the drugs to be used and the disease. You should not go for a walk with a missing or unsuitable bag and equipment. All these preliminary preparations are made and the procedures are completed to start the nature walk. This piece is thus the deficiency in one or more of the processes to be done in the process of manufacturing the trekking product, starting from the process in one corner of the walking route and instead of the break in the other corner; from there it may have to be moved to the walking process, which performs the same or different procedures in different parts of the walking route. Consumers who will go trekking should make a preliminary preparation about nutrition and clothing. These preparations should choose foods with high-calorie value and low volume. Fatty foods and acidic drinks should not be used. A few thin layers of clothing should be worn instead of very thick clothes. Raincoats, berets, and shoes should be chosen well. Considering every situation, spare parts should be kept in clothes. Trekking is carried out under the leadership of an experienced leader who knows the trekking route and under the auspices of an aftershock who is at least as experienced as the leader. Before each walk, information is given about the walking route and time. Before the walk, materials and food are checked. Clothing checks are made according to the conditions of the weather and route. Cell phone and music listening devices are turned off. They walk behind the leader in a single row or double row with a buddy. People walk without getting ahead of the leader or behind the rearguard. There should be no loud conversations. Cannot leave the group without permission. In this production order, it is seen that the consumers who see the same or very similar processes are gathered between the group leader and the rearguard. Failure to detect the presence of continuous drug users during the production process, the absence of the drugs in assigned personnel, the wrong clothing selection, the lack of tools required by the difficulty of the walking route, and the insufficient knowledge of the consumers about the walking rules are common production process problems. In such an open area reactive production enterprise, problems occur when the nature walk ends where it started. The walking distances increase between the starting and ending route, the responsibility areas of the personnel who produce recreational activities are mixed and problems occur in the use of materials. The personnel spends most of their time searching for suitable tools for the production of trekking and adapting consumers to trekking. Cell technology is a form of layout

developed to eliminate these mentioned disadvantages and complexity in recreation businesses.

A business where cell technology is applied consists of more than one production cell. A production cell operates as a production unit where parts with similar characteristics are produced. Different types of machines with different processing capabilities can be found in each production cell. In other words, production benches that do the same job and are of the same type can be distributed one or more than into different cells. Therefore, GT is an efficient approach used for the development of a batch-type production system in which many different products are produced in low volumes (Won, 2000, 239). We can express cell technology as a management philosophy that groups products with similar characteristics in terms of design, production, or both. The basic element in forming production cells is that parts with similar characteristics are produced within the same production cell. This group of parts consisting of parts with similar features (shapes), which requires a similar production flow and can be defined within the same cell, is called a "part family". Similarities between parts are discussed in terms of geometric, functional, material, and process similarities (Xu & Wang, 1989, 1638).

The main purpose here is to produce the most similar parts in the same cell by grouping them. Group technology has many different aspects. The grouping of parts or products that require a similar production process, which is an aspect of group technology, is the basis for the creation of cells in cellular production systems.

The Effect of Settlement Type on the Reactive Product Cells

The layout of a recreation production cell is very important for efficient operation. The process flow requirement of the recreational activity to be produced (indoor-outdoor area) is the most important factor that determines the optimum location. The layout should be seen as part of the recreation business. The cell indoor-outdoor area) is not a stand-alone area, it must ultimately be connected to another cell, a single process unit. While designing a cell, it will be necessary to pay attention to the following points in terms of layout:

- A recreational product cell should be considered within the whole recreation establishment and its connections with other business units working on it should be considered.
- The layout plan should reflect, as much as possible, the process flow requirements of the recreation product family to ensure an uninterrupted and stable flow of materials/parts associated with the recreational product. The movement of recreational products in the opposite direction of the process flow should be avoided, if it is necessary to use the same area

(closed area-open area) for different operations, the star layout plan should be selected.

- The layout plan should take into account the integration that may be considered in the future.
- The floor plan should be as flexible as possible in terms of the possibility of the need to change.
- Particular tool/tool kit storage should be provided.
- The material must be allowed to come and go.
- Between processes, the activity leader or personnel touching the material should be minimized.
- The personnel should be provided with the opportunity to take part in more than one recreation product to allow flexibility of activity leader and staff.
- Ergonomics and occupational health should be considered in the recreation establishment.

The Importance of Recreation Leader and Personnel in Cellular Recreation Activity Production

Instead of traditional product-oriented service production, which is continuing today, a more advanced service production technology that takes into account the factors of the recreation leader and the perspective of the staff is being placed. The first of these factors is the measure of the different stages of recreational activity production, which defines the degree of cooperation required between the recreation leader and staff that are linked or interrelated. Furthermore, the amount of information processed and the decision of the recreation leader and staff to undertake work during habitual job performance should also be taken into account. Another factor to consider is the business environment, which is the measure of the production environment that is predictable and allows for routine and planned decisions. Psychological factors should also be taken into consideration when a new production technology is introduced, especially due to the increase in the requirements of the recreation leader and staff within the conditions of desire for skills, learning, and development. Production processes in the recreational activity cell arise to have various process characteristics found in continuous-process services, such as a high degree of interdependence between functional jobs in the cell. Task design in process services proceeds around self-supervised groups of members who have the skills, knowledge, and autonomy to control technical and environmental variables that are as close as possible to the recreational activity production process.

Cellular Systems Production Recreation Leader and Staff

The recreation leader and staff are multifunctional and different from the traditional recreation leader and staff who are single-functional and connected to one process. For this reason, the recreation leader and staff should be trained to perform all processes in the recreation product cell (indoor-outdoor recreation product). This is very important in terms of the number of elements in terms of providing flexibility to the recreational product cell. To provide job richness and avoid the problem of uniformity, it should be worked on a rotation basis. This understanding differs from the traditional understanding in which the performance evaluation of the worker is based on individual work. Likewise, while the traditional understanding makes the wage and rewarding policy on an individual basis, in the new system, these should be handled on a group basis, and the recreation leader and staff should be evaluated according to the output of the recreation product cell, its quality and whether it produces just in time. There should be a competence assessment system for the recreation leader and staff, but this group should not affect the understanding of rewarding. An important point is the concept of teamwork. The team should be some kind of autonomous group working within given program charts. The team should measure and discuss the quality of the recreation product, whether the desired production output is made on time or not, bring forward the encountered issues, propose solutions and take measures. Elements of the recreational product cell must be in direct contact with suppliers of materials and recreational product consumers (internal or external) and must be able to directly see their performance. He should report to top management on his performance, and he should be open-hearted and brave in this. The understanding of the management that mistakes and disruptions are natural in working life and that their detection will be necessary steps for improvement is essential for the healthy functioning of this mechanism. As the production management in the recreation enterprise becomes leaner and the cellular system is adopted in the production of the recreational product, the following duties should be transferred to the recreation leaders and staff. These tasks are as follows:

- Consultant in cell (recreation product) placement
- Planning the production of recreation product according to the mission of the recreation establishment
- 3. Control of resources, costs, and performance
- Planning the production process of the recreation product
- Quality planning and production process control
- Development of methods and production site (indoor-outdoor) layout
- Development of time standards
- Programming of commodities used in production activity
- Equipment settings, operation, and preventive maintenance

- Production process and flow management
- Determination of business schedules
- Notification of problems and taking corrective action
- Training of new recreation leader and staff
- Allowing a certain time for the cell staff to evaluate “that day” at the end of the working day.
- Cell personnel should be trained to acquire the techniques and tools necessary to achieve their new role that is different from traditional understanding.

Creating a Cellular Production Line in Recreation Businesses

The personnel who are experts in recreation products to be produced in the production department of the recreation enterprise are divided into groups according to the number of products to be produced. For the cellular recreational product production system form, information and documents are given to the form groups, which are prepared according to the principles of form with axioms and educational quality about regular remedies. These developed resort documents cover all stages in the cellular recreation product system. At the same time, steps on the production line are developed according to the independence axiom. Thus, a cellular recreation product production line is established. Necessary data are collected to evaluate and analyze the performance criteria determined during the production phase of the recreation product. For the cellular recreation product production line to fulfill the targeted performance criteria, a continuous improvement method is created that includes production line system arrangements. Continuous improvement method produces regular solutions for optimal system arrangement in line with axioms and principles of form.

Form of Cell Production System for Outdoor and Indoor Recreation Products

The hierarchy of functional requirements-form parameters and related form matrices determined for cell production style for indoor and outdoor recreation products should be created as follows.

Stage 1: Selecting the functional requirements in the functional information field

The first step of cell production system design is to define the functional requirements of the system at the highest level in the functional information field (FR). To serve as an example, the trekking product was taken into consideration and the highest functional need was determined as follows.

FR = “Provide the trekking production cycle to meet consumer requirements”

In terms of production diversity of the recreation business, it is the preparation of a day-trip, one or more-day trekking package, and the production of other species. The quality level, frequency, low cost, and just-in-time production of the recreation product are determined as the wishes of the consumers. These demands determine the flexibility of the production line structures of the recreation enterprises, the speed of the operations in the production line, and the level of response to changing consumer requirements.

Stage 2: Mapping Functional requirements in the Physical Information Field

With the help of the mapping between the functional information field and the physical information field, the production line format parameters that meet the functional production needs specifying in the previous step are created. If we continue with trekking production.

DP = "Cellular Recreation Product Manufacturing Line System Format"

The method for manufacturing a cellular recreation product that shapes the simplified production line. It is the most efficient production system for the demands of recreational product consumers, to reduce the cost during product production, and to increase the quality of the recreational product.

Stage 3: Separation of FR in Functional Information Fields Zigzag in Knowledge Fields

If the form parameter corresponding to the functional need determined in the first stage cannot be applied without further clarification, returning to the functional field and decomposing the relevant functional need into a lower-level functional requirement set (FR_c) is suggested by axioms and form principles. For this reason, the trekking product was defined in the first step to separate the functional need.

FR₁: Classify and group the trekking service according to its stages for material flow to be used in the walk

FR₁: Increase the productivity of production factors according to the characteristics of a nature walk

FR₁: Determine walking routes to reduce costs

FR₄: Determine the optimal points on the walking route where material and personnel can be procured.

FR₅: Organize the production line of the product according to the demand from the consumers.

Stage 4: Mapping FRcs and Finding Form Parameters that Meet Functional requirements in the Physical Information Field

Form parameters corresponding to each of the lower-level functional requirements determined to differentiate the functional need determined at the highest level are determined at this stage. The shape parameters obtained by passing from the functional field to the physical field were determined in the nature walk example as follows.

DP₁: Method for determining the trekking product range

DP₂: The optimal use method of trekking production factors

DP₃: Standardization of trekking routes for the production

DP₄: Preparing control points for production on trekking routes

DP₅: Consumer-oriented production control system

Stage 5: Determining the Shape Matrix

In the 3rd and 4th stages, after the functional requirements and form parameters are determined, the form matrix showing the relationships between functional requirements and form parameters is determined. The formed matrix created by the production management must satisfy the axiom of independence. The equation regarding the functional requirements and form parameters determined in the 3rd and 4th stages is as follows.

$$\begin{array}{|c|} \hline FR_1 \\ \hline FR_2 \\ \hline FR_3 \\ \hline FR_4 \\ \hline FR_5 \\ \hline \end{array} = \begin{array}{|c|} \hline X \\ \hline X X \\ \hline X X X \\ \hline X X X X \\ \hline X X X X X \\ \hline \end{array} * \begin{array}{|c|} \hline DP_1 \\ \hline DP_2 \\ \hline DP_3 \\ \hline DP_4 \\ \hline DP_5 \\ \hline \end{array}$$

This form is a parsed form and provides the axiom of independence. The symbol X used in the shape matrix indicates the strong relationship between the FR-DP pair.

Stage 6: Relocating from the Physical Site to the Functional Area, separating the FR₁, FR₂, FR₃, FR₄, and FR₅, and determining the corresponding DPs

FR₁: Classify the trekking service according to its stages for the material flow to be used in the walk, and the functional need expressed in groups and DP₁: The method of determining the types of trekking products corresponding to this functional need were evaluated together and separated as follows.

FR₁₁: Preparation for the march

FR₁₂: Nutrition and clothing

FR₁₃: Walking rules

FR₁₄: Walking

The form parameters corresponding to the functional needs are also designed as follows.

DP₁₁: Material supply according to the duration and difficulty of the walking route to be made the day before

DP₁₂: Water to drink and food to eat and the amount to be prepared

DP₁₃: A chronic disease or putting regularly used medicines in the bag

DP₁₄: Not using incomplete and not suitable for weather conditions.

DP₂₁: Choosing low-volume food with high-calorie value

DP₂₂: Avoiding excessively fatty foods and acidic beverages

DP₂₃: Choosing raincoats, berets, and shoes well

DP₂₄: Keeping food and clothing spare for every occasion

DP₃₁: Informing the consumer about the walking route and time before each walk

DP₃₂: Checking material and food before the walk

DP₃₃: Clothing control according to weather conditions and walking route conditions

DP₄₁: Walking behind the leader in a single row or double row with the bodysuit

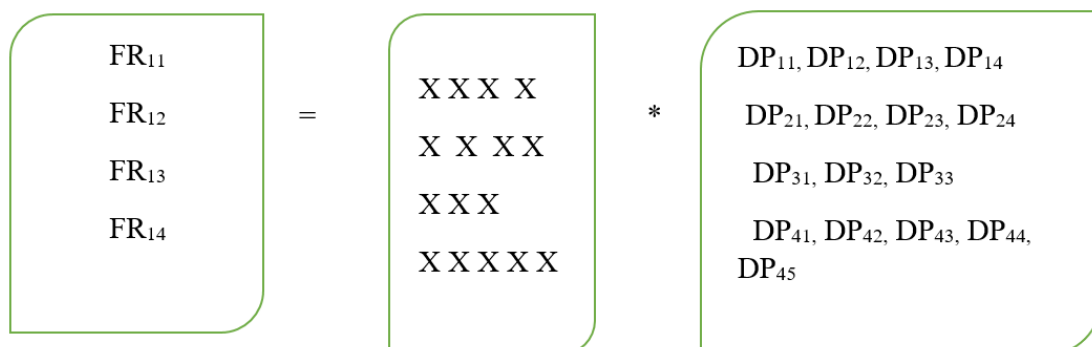
DP₄₂: Walking without getting ahead of the leader and behind the aftershocks

DP₄₃: Switching off mobile phones and music devices while walking

DP₄₄: Loud chat and not leaving the group without permission

DP₄₅: Ending the walk where it started, ensuring that the wastes are not left to nature, and thrown into the recycling box at the destination

FR₁: For the material flow to be used in the walk, classify the trekking service according to its stages and the equality of form regarding the group is stated below. The form is a detached shape and meets the axiom of independence.



We divided the production line, which enables the production of the trekking product, into the activity needs section in five stages. These stages are; classification of trekking services according to its stages for material flow to be

used for walking, increasing the efficiency of production factors according to the characteristics of trekking with the group, determining walking routes that will reduce costs, determining the optimal points where material and personnel can be supplied on the walking route, and arranging the production line of the product according to the demand from the consumers. The first step is to determine the parts that play a high role in a production by product-quantity Pareto analysis (Irani, 1999). The relationship developed to collect the process-like stages in a cell is mostly seen as a trekking product for material flow to be used in the walk. Potential cells are determined depending on the production line created using this matrix. Then, the production line cells are determined according to the principles of cost analysis and economic suitability.

FR₂: According to the characteristics of a nature walk, the functional need expressed as increase the productivity of production factors and the

DP₂: The optimal use method of trekking production factors has been evaluated together and separated as follows.

FR₂₁: Clothing

FR₂₂: Equipment

FR₂₃: Nutrition

Trekking has its materials. These materials should be selected as the materials that will change according to the season and place, without separating the season and walking space. The point to be considered in material selection; The suitability of the materials for the purpose, their versatility, strength, and lightness are taken into consideration. It is necessary to choose rationally as well as to use the right one in materials. The primary material for trekking is clothing. This is because the most important thing in walking is body health. Clothing materials that are comfortable and spacious are required that will not harm body health.

The form parameters corresponding to the functional requirements are also designed as follows.

DP₂₁₁₁: Boot; seasonal walking boots that hold the feet and ground well. Features; Gore-Tex boots in winter are produced in Cordura fabric and suede leather in summer. Other boots should be made waterproof by using wax.

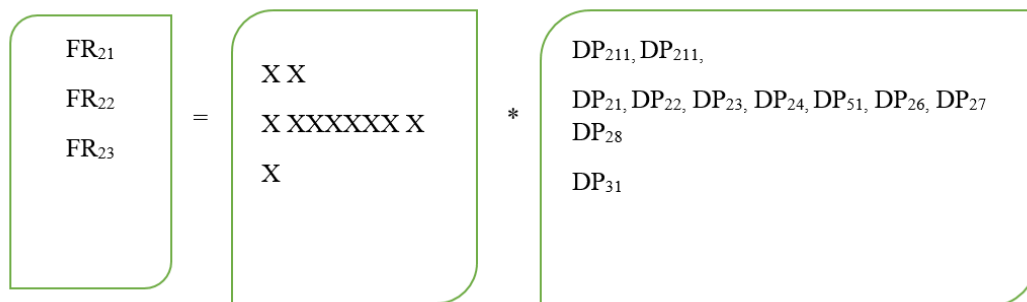
DP₂₁₁₂: Windbreaker or Raincoat; Features: raincoat, poncho. Underwear, mid-wear, and outerwear

DP₂₁₂₁: Water bottle and flask; Features: It must be aluminum; flasks are made of Lexan plastic resistant to temperature differences and have a wide mouth.

DP₂₁₂₂: Whistle; Features: It should have a thermometer and a compass; it should be able to hang on the neck with a rope.

DP₂₁₂₃: Pocket knife; Features: It must be a hunting knife or multi-purpose pliers specially made for nature sportsmen.

- DP₂₁₂₄: Compass; Features: Must be Silva type or military compass with lens
 DP₂₁₂₅: Hat; Features: must be wide edged
 DP₂₁₂₆: Fire Starter; Features: should be matching, lighter or magnesium rod
 DP₂₁₂₇: Backpack; Features: There should be a water bottle, flask pocket in size starting from 35-lt in summer and 40-lt in winter.
 DP₂₁₂₈: first aid kit; Features: must be basic first aid supplies.
 DP₂₁₃₁: Supplementary food, features: Food should be high in calories, low in volume.



FR₃: The functional requirement expressed in the form of determining walking routes to reduce costs and the corresponding functional need

DP₃: The standardization of trekking routes suitable for production has been evaluated together and separated as follows.

- FR₃₁: Equipment
 FR₃₂: Selection of Trekking Route
 R₃₃: Completion of Trekking Route.
 DP₃₁: Camera and camera device for collecting visual data.
 DP₃₁₁: GPS (global positioning device), recording of routes on land.
 DP₃₁₂: Equipment suitable for field walking.
 DP₃₁₄: Binoculars.
 DP₃₁₅: Radio.
 DP₃₁₆: Portable computer.
 DP₃₁₇: 25.000 scale topographic maps.
 DP₃₂: Walking routes are intertwined with nature.
 DP₃₂₁: Traditional village life and its combination with historical texture.
 DP₃₂₂: The participation of the guide who knows the region.
 DP₃₂₃: Preliminary exploratory study.
 DP₃₂₄: Complete review and recording of rural areas that are accessible and not reached by vehicle in land exploration studies.
 DP₃₂₅: Obtaining information about ancient trekking routes from a guide who knows the region during exploration work and recording these routes.
 DP₃₂₆: Determination of transit walking routes.

DP₃₂₇: GPS data obtained from land exploration studies are overlapped with 25.000 scaled topographic maps in the Google Earth environment, preparing plans for where the walking routes will start and where they will continue.

DP₃₂₈: Marking the obtained trekking routes according to Grande Randonnee, which is the international marking method. In this way, making the trekking route ready for service in terms of direction-finding. Making the markings with red and white oil paint, placing them in visible and sheltered places

DP₃₃₁: Specifying the names of the places on the route.

DP₃₃₂: Identification of the fauna on the route.

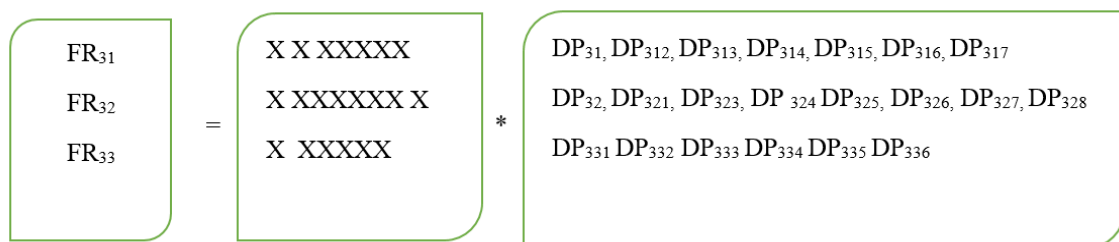
DP₃₃₃: Names and characteristics of historical ruins on the route.

DP₃₃₃: Lake, stream, waterfall, mountain, valley, etc. on the route. names and characteristics.

DP₃₃₄: Description of the climate structure of the route according to the seasons.

DP₃₃₅: Walking distance of the route.

DP₃₃₆: Elevation gain of the route.

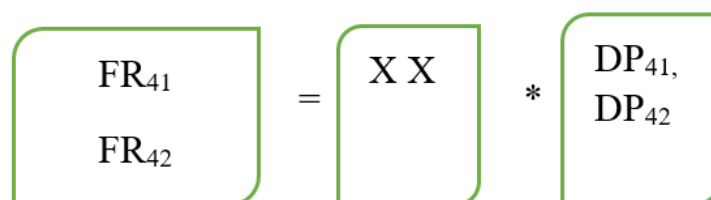


FR₄: Determine the optimal points on the walking route where material and personnel can be procured.

DP₄: Optimal points on the walking route where material and personnel can be supplied are evaluated together with the optimal method of use and separated as follows.

FR₄₁: Leaving necessary materials at the designated points of the walking route

FR₄₂: placing reserve personnel at designated points of the walking route



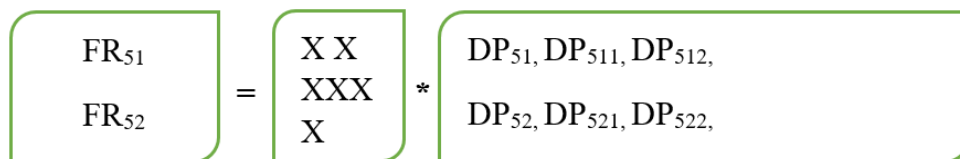
The form parameters corresponding to the functional needs are also designed as follows.

DP₄₁: Determining the strategic points of the walking route and leaving the necessary materials to the relevant places during the walk.

DP₄₂: The strategic points of the walking route are determined and the deployment of reserve personnel who can participate in product production when needed during the walk.

FR₅: Organize the production line of the product according to the demand from the consumers.

DP₅: According to the demand from the consumers, the optimal usage method for the arrangement of the production line of the product has been evaluated together and separated as follows.



The form parameters corresponding to the functional needs are also designed as follows.

DP₅₁: Creating alternative curved routes on the slope map

DP₅₁₁: Determining routes with the lowest slope and finding the shortest path between two points and preparing alternatives according to consumer preferences

DP₅₁₂: determining the lowest cost routes from a starting point to a destination

DP₅₂: View of the route,

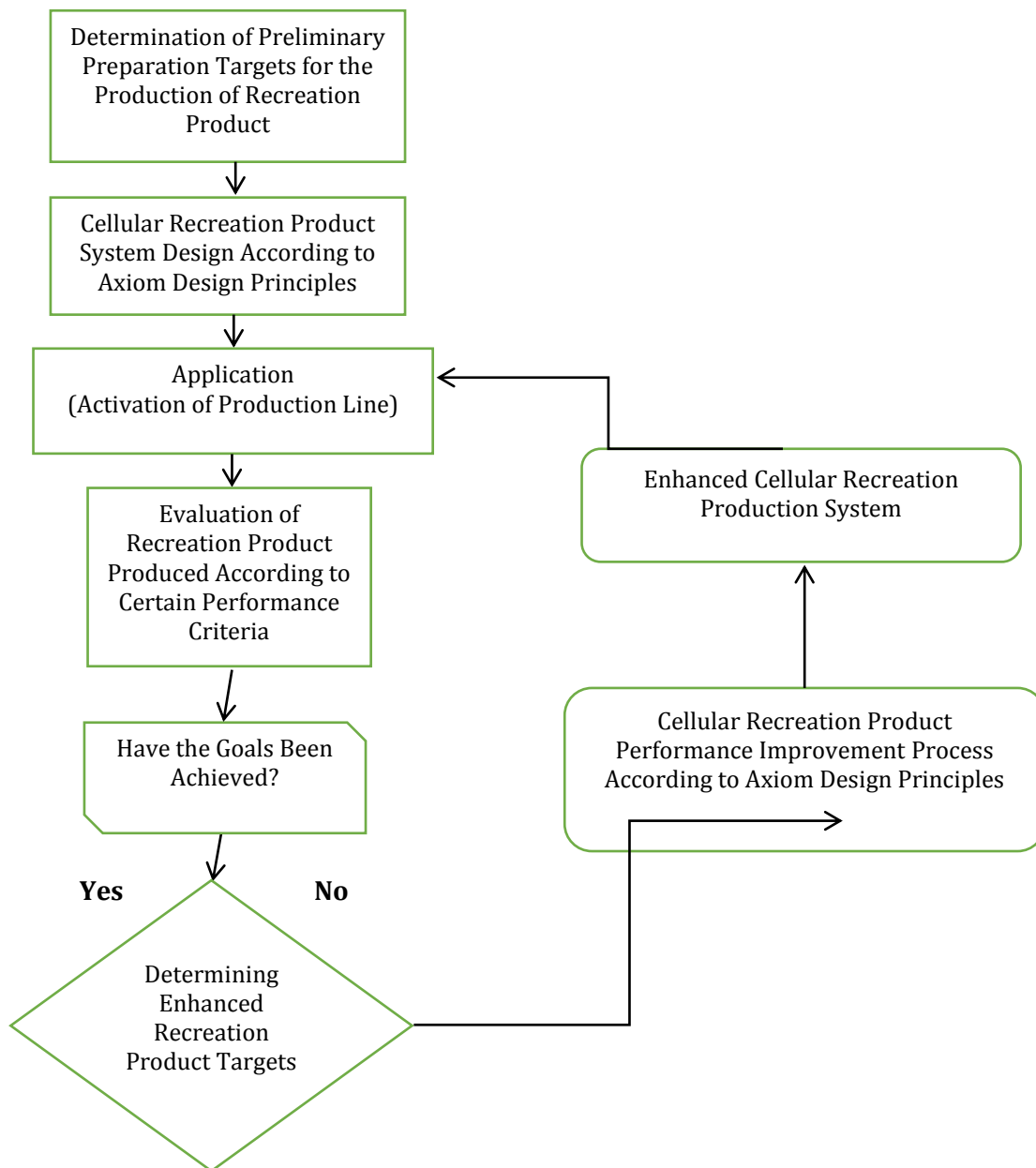
DP₅₂₁: Risks of the route

DP₅₂₂: Habitats of the route

Feedback Cellular Recreation Product System Design

The recreational product transformation process ends with the successful completion of the cell production design steps. From this point on, recreation product production takes place in the cell production system. During cellular manufacturing, necessary data are collected to evaluate and compare the determined performance criteria. For the cellular production system to achieve the target performance criteria, a continuous improvement procedure including system arrangements has now been established. From now on, the continuous improvement procedure produces systematic solutions for the most appropriate system arrangement in line with axioms and design principles.

Feedback Cellular Recreation Product System Design Diagram



RESULT

The proposed design method for the cellular production system was carried out for a recreation business that produces a trekking product. Because the product produced in the production system is trekking and it has been seen that consumers have increased their interest in this product recently, it will guide the enterprises that will switch to this production system. The production resources

must be placed according to their functions in the production system before the recreation establishment starts the cellular production project. Production resources should be arranged according to their functions on the production line. As a result of the realization of all the activities we propose in the cellular production system design method based on axiomatic design principles, the recreation enterprise will be able to produce recreation products (indoor-outdoor recreation products) efficiently and rationally. This will provide recreational businesses with a competitive advantage in the market.

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