

DETERMINING EFFECTS OF KITCHEN DESIGN RULES ON KITCHEN FUNCTIONALITY IN A COMPARATIVE WAY

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ABSTRACT

One of the most studied areas for increasing interior design performance is kitchen. The reason for this is the expectation of a superior performance from kitchen as regards numerous criteria compared to other areas. When scientific studies conducted on kitchen design performance were examined, it was observed that they are basically divided into two groups. The first group consists of those related to performance of industrial kitchen products. The works carried out in the other group describe the basic design rules to increase kitchen design performance. However, a study examining the effects of any kitchen design rule on kitchen functionality in a comparative way was not found in all the resources obtained. Accordingly, the objective of the study has been described as determining the effect of each design rule utilized for improving the kitchen design performance on the functionality of the kitchen. To this end, a literature research was conducted as the methodology of the study at the first stage and a set of rules was created for kitchen design. Subsequently, effect of each design rule on the functionality of kitchen was determined with designers of a company which has 60 dealers in Turkey and which produces and markets kitchen systems. Personal interview method, which is a statistical data obtaining tool, was conducted with focused groups while this was performed and in-depth interviews were carried out with relevant people.

Keywords: Performance based design, kitchen interior design, designer performance.

INTRODUCTION

The complex cognitive activities forming the basis of design have led people to question a measurable parameter such as "performance". The relation between these two basic components has begun to be examined particularly due to Louis Sullivan's "form follows function" approach. Accordingly, methods have been researched through both scholars and practitioners for enhancing the design performance and various approaches have been proposed (Kalay, 1999; Sullivan, 1934). Furthermore, Design Quality Indicator (DQI) developed through the Construction Industry Council (CIC) in the U.K. has begun to be utilized as a measurement tool to assess design quality (Whyte and Gann, 2003). In this way, it is possible to meet user needs at the optimum level and produce high-quality projects (Oyedele and Thambi, 2007). The concept of "action system" which is called the performance approach in architecture and interior design is an approach aiming to find the most functional and economical solutions by taking into account the relation of the behaviors of the user at different levels within space as regards the usage (building-section-space-action space-one action) of the building (Arcan and Evci, 1992). In this context the real measure of interior quality is user satisfaction and efficiency which is the final result thereof (Power et al., 2000).

One of the most studied areas for increasing interior design performance is kitchen. The reason for this is the expectation of a superior performance therefrom as regards numerous criteria compared to other areas (Yazıcıoğlu and Kanoğlu, 2016). It has been determined in the researchers conducted that average 30% of the works done in the house consist of food preparation and actions related to it (Arcan and Evcı, 1992; Thiersch, 1977). 360 actions different from each other are performed in the kitchen in average during a day and a kitchen is used for 20 years. In this case, 2.6 million actions independent from each other are performed in the same kitchen during the usage period thereof (Blum, 2013). Moreover, the space which is most desired to be renewed in a house has been found to be the kitchen with the rate of 34% as a result of a survey conducted in 2009 as shown in Figure 2 (Harbor, 2009).

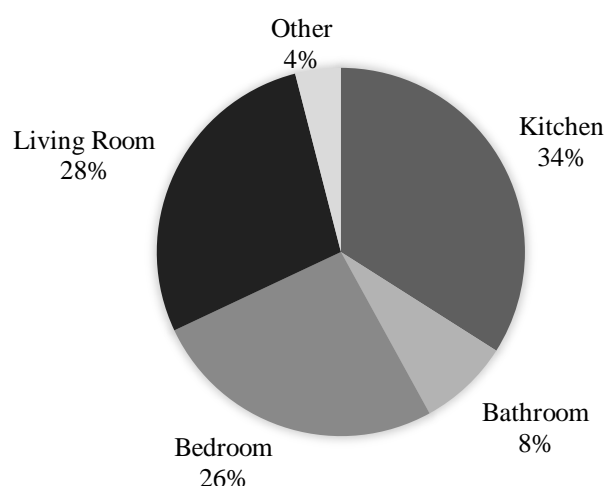


Figure 1. The Rates of Demand As to Renewal of Spaces Within A House (Harbor, 2009)

In addition to all these, kitchen is the area for a designer which has to be resolved almost in all projects. As such, different than other places, researches made for increasing the kitchen interior design performance dates back to much earlier times such as the 18th and 19th centuries. For example, in a research made in 1850 by the U.S. Dept of Agriculture it has been revealed that adapting the bench height according to ergonomic measurements of each user can improve the design performance of kitchen. In 1912, Christine Fredericks conducted a research named "string study" related to the placement of kitchen cabinets and devices. Her works have revealed the fact that creation of correct distance between the kitchen cabinets and devices have great importance both in terms of the energy spent and time. MargareteSchütte-Lihotzky, a Viennese architect, has developed the Frankfurt kitchen in 1926 with a similar approach. Schütte-Lihotzky and architect Ernst May have worked together with an eye to develop an advanced house construction program in order to create alternatives to better design the living spaces in a house. To this end, different actions and movements in the kitchen were assessed by making measurements and the results are used as auxiliary data in the design of kitchens. The kitchen projects obtained in this way were used in more than 10,000 houses. After the Second World War, this kitchen model became an architectural standard both in the U.S. and Europe due to its having high design performance. In 1927, Architect A. Schneck conducted a study for the design of required storage space in the kitchen. According to his opinion preparation of a list of objects of a small house to be stored is the starting point of the right kitchen design (Dynamic Space, 2016). The School of Architecture of the University of Illinois has developed a model in 1940 for increasing the kitchen's design performance. According to this model, the main operating functions in the kitchen take place between the oven, kitchen sink and refrigerator. This triangle formed between these imaginary activity areas was named as "activity triangle". The main idea is that

it will be possible to work in the kitchen in an effective manner if these three points are in optimal proximity to each other. This rule is not applicable geometrically for a kitchen with a single wall. However, also in these types of kitchens it has been proven that the distance between these three areas of activity to each other is the most important factor which affects the functionality of the kitchen (Wikipedia, 2013; Illinois University, 2015).

Numerous researches are carried out to increase kitchen design performance in our day in the light of the researches conducted in the 18th and 19th centuries. For example, the research of Morishita et al.(2003) based on the principles of the U.S. Dept. of Agriculture's research carried out in 1850 to enhance kitchen design performance an electronic system which adjusts automatically the height of kitchen bench according to changing actions according to the cooking actions of the user while has been proposed.

When other scientific studies conducted on kitchen design performance were examined within this context (Pal and Rehman, 2008; DemirkanveOlguntürk, 2013; Cline, 2006; Rivet, 2009; Mak and Francis, 2002; Panwar, 2009; Lamkins, 2011; O'Heir, 2007; Stander et al., 2012; Lyon et al., 2011; Asensio and Ubach, 2003; Baden-Powell, 2005; Beamish et al., 2013; Beazley, 1999; Bouknight, 2004; Cerver, 2006; Conran, 2005; David, 1994; Edic and Edic, 1999; Jankowsk, 2001; King, 2006; Lester and McGuerty, 2010; Lovett, 2006; Maney, 2003; Mielke, 2005; Rand and Perchuk, 1991), it was observed that they are basically divided into two groups. The first group consists of those related to performance of industrial kitchen products. The works carried out in the other group describes the basic design rules to increase kitchen design performance (Yazıcıoğlu, 2014a; Yazıcıoğlu, 2014b; Yazıcıoğlu, 2014c; Yazıcıoğlu and Kanoğlu, 2016). However, a study examining “the effects of any kitchen design rule for enhancing the kitchen design performance on kitchen functionality” was not found in all the resources obtained. However, existence such a comparison will be an important tool showing the way to a designer for enhancing the kitchen design performance during the design process.

PURPOSE AND METHODOLOGY

The objective of the study has been described as determining the effect of each design rule utilized for improving the kitchen design performance on the functionality of the kitchen. In line with this objective, a literature research will be conducted as the methodology of the study at the first stage and a set of rules will be created for kitchen design. Subsequently, effect of each design rule on the functionality of kitchen will be determined with designers of a company which has 57 dealers in Turkey and which produces and markets kitchen systems. Personal interview method, which is a statistical data obtaining tool, will be conducted with focused groups while this is performed and in-depth interviews will be carried out with relevant people.

FORMATION OF SET OF DESIGN RULES FOR INCREASING THE KITCHEN DESIGN SUCCESS

A literature research has been conducted for formation of set of design rules for increasing the kitchen design success (Arcan and Evcı, 1992; Dynamic Space, 2008; Edic and Edic, 1999; Asensio and Ubach, 2003; Baden-Powell, 2005; Beamish et al., 2013; Beazley, 1999; Bouknight, 2004; Cerver, 2006; Conran, 2005; David, 1994; Jankowski, 2001; King, 2006; Lester and McGuerty, 2010; Lovett, 2006; Maney, 2003; Mielke, 2005; Grandjean, 1973; Panero and Zelnik, 1979; Kiran and PolatoğluBaytin, 2006; Afacan and Demirkan, 2010; Anonymous, 2002; Anonymous, 2009; A Handyman's Haven, 2015; Altın, 2008; A Street Builders, 2015; Better Homes and Gardens, 2015; Blum, 2013; Calley, 2007; Cowles et al., 2015; Dynamic Space, 2013; Dynamic space, 2015a; Dynamic space, 2015b; Dynamic space,

2015c; Dynamic space, 2015d; Dynamic space, 2015e; Dynamic space, 2016; Fix, 2015; Häfele, 2009a; Häfele, 2009b; Häfele, 2009c; Häfele, 2009d; Häfele, 2009e; Häfele, 2009f; İçMimarlık, 2009; İnceoğlu, 1982; Kesseböhmer, 2009a; Kesseböhmer, 2009b; Kesseböhmer, 2009c; Kitchens for Cooks, 2008; Korur et al., 2006; NKBA, 2008; NKBA, 2011; NKBA, 2014; NKBA, 2015; Northern Granite and Cabinetry, 2015; Polat, 2005; Yazıcıoğlu, 2010). Similar ones among all design rules obtained from this research were combined and a set containing 130 rules as below (Yazıcıoğlu and Kanoğlu, 2016):

R1. Kitchen entrance must be at least 81cm wide. If there is a counter or divisive element in the entry which creates a corridor, maximum depth of this corridor must be 61cm. If this corridor' depth will be more than 61cm, The width of the kitchen entrance must be at least 91cm.

R2. If there are two kitchen counters opposite to each other located close the kitchen entrance, the distance between the nearest point of these counters must be at least 81cm.

R3. There must be an empty space with a length of 152cm and width of more than 46cm in the opening direction of a standard hinged door or swing door. There must be an empty space with a length of 122cm and in the same width of the width of the door in the opening direction of the door to outside.

R4. The width of the circulation line (in the case of presence of a work counter wider than 61cm perpendicular to the circulation line or if there is more than one work counter or a device) must be at least 91cm.

R5. If there are circulation lines perpendicular to each other the width of one of them must be at least 107cm.

R6. The width of the corridor must be at least 107cm in a kitchen where there is a single-user work triangle or devices and where the counters are perpendicular to each other. If the number of users is more than two this distance must be at least 122cm.

R7. Kitchen work triangle must be planned clockwise for right-handers and in the opposite direction for left-handers.

R8. Refrigerator, kitchen sink and stove order must be respected in one-wall kitchens.

R9. The total length of the legs of the kitchen work triangle should be maximum 793cm. Length of one leg of this triangle must be minimum 122cm and max. 274cm. Each leg of the kitchen work triangle is measured from the center of the front face of the kitchen sink and the devices at home.

R10. If the kitchen work triangle intersects an island or peninsula this intersection must be no more than 31cm.

R11. When the number of legs of the kitchen work triangle is more than three, length of each additional leg must not be more than 274cm and less than 122cm.

R12. If two or more persons are preparing meal at the same time in the kitchen, a kitchen work triangle must be created for each person. However, these work triangles must not intersect each other in any way. In such cases, primary or secondary leg of the work triangles can be shared.

R13. Main circulation line must not pass through the work triangle.

- R14. Entrance, cabinet or device doors should be placed in a way not to interfere each other when opening.
- R15. There must be space to maneuver for each position when entrance, cabinet or device doors are opened.
- R16. If the kitchen is narrow, cupboard doors which can be opened 170o must be used. Such doors will create larger areas while passing.
- R17. If there will not be a circulation line behind the sitting person in the sitting space there must be an 81cm distance between the side of the table and the separating unit. If some other persons will pass behind the sitting person and sit this distance is increased to 91cm. If a circulation line will pass behind the sitting person this distance must be 112cm. If this circulation line will be used by a person with wheelchair this distance must be increased to 152cm.
- R18. There must be enough spaces at least on three sides of the table where meals will be eaten.
- R19. There must be top cabinets at least with 31cm depth and 366m length and adjustable shelves with 76cm height in small kitchens (with an area less than 13,95m²).
- R20. There must be top cabinets at least with 31cm depth and 472m length and adjustable shelves with 76cm height in large kitchens (with an area greater than 13,95m²).
- R21. There must be a top cabinet at least with 31cm depth and 152cm front side length in the place where the primary kitchen sink to be between a distance of 183cm to both sides from the central axis of the kitchen sink.
- R22. A cabinet with legs can be placed at least with 31cm depth and 152cm front side length instead of the top cabinet in the place where the primary kitchen sink to be between a distance of 183cm to both sides from the central axis of the kitchen sink.
- R23. The basic rules to be followed regarding the storage areas to prevent unnecessary movements in the kitchen: storage must be planned in 5 basic areas; capacity of drawers in each place must be identified correctly and width/depth of the objects to be stored must be identified correctly for each area; the drawers must have divider systems and interior roll-outs.
- R24. There must be lower cabinets with at least 53cm length and at least 396m depth in kitchenettes (with an area less than 13,95m²).
- R25. There must be lower cabinets with at least 53cm length and at least 488m depth in large kitchens (with an area greater than 13,95m²).
- R26. Total shelf or drawer length must be 3556m, 4318m and 5080m for small kitchens (with an area less than 13,95 m²), medium sized kitchens (with an area between 14,04m² and 32,55m²) and large kitchens (with an area larger than 32,55m²) respectively. The recommended distribution amount of cabinet types is as indicated in the table:
- R27. Cabinet type in the "other cabinets" category must be no more than 102cm, 241cm and 368cm for small kitchens, for medium sized kitchens and large kitchens respectively to ensure the total cabinet length.
- R28. The cabinets containing condiments and sauces must be placed in the cooking section and near the stove if possible.

- R29. Adjustability of inner parts of drawers with divider units increases the functionality thereof.
- R30. More storage space can be gained by using drawers with more height. This is particularly advantageous for the storage of tools in the dry foods storage section.
- R31. Storage systems used at cabinet doors increase functionality.
- R32. Adjustability of the heights of the shelves in cabinets increases functionality.
- R33. Most comfortable access distance is between 64cm-115cm vertically. The user can access the objects without need to lean or to reach out. In this way, the open shelves between counter provide quick and one-handed access and increase functionality.
- R34. The drawers which can be fully pulled outside provide easier access compared to those which can be opened 2/3.
- R35. Cabinets in which large and heavy pots will be placed must be positioned immediately below the counter and near the work surface.
- R36. Base drawer enhances functionality.
- R37. Drawers at the bottom of oven increase functionality.
- R38. Shelves, rail cupboards and drawers which can be drawn at the bottom allow easy viewing of objects and provide quick access. Additionally, rail cabinets provide 55% more storage space compared to normal cabinets as well as more space to move in the place compared to the ones with doors when they are opened.
- R39. Access to cabinets must be easy.
- R40. Access to the bottom of the lower cabinets must be easy.
- R41. Access to the upper parts of the top cabinets must be easy.
- R42. Access to the rear part of the lower cabinets must be easy.
- R43. Access to the rear part of the top cabinets must be easy.
- R44. More frequently used objects must be planned in a way that they are stored in the top drawers of the lower cabinets and the lower shelves of the top cabinets. Less frequently used objects can be stored on or under these sections. The least used objects should be stored by placing them in the upper part of the top cabinets. Accordingly, the selection of storage units provide saving on time while working in the kitchen.
- R45. Dry food cupboards turning left and right after opening increase functionality.
- R46. Dry food systems which can be pulled out used in cupboards or top cabinets consist of wooden based baskets with adjustable heights and coated with steel wire or non-slip flooring material and in this way create storage space for foods and increase functionality.
- R47. Undercounter dry food systems must be used for cases with spatial limitations where dry food cupboard systems cannot be used.
- R48. Total facing length of wall and lower counter cabinets, drawers and dry food shelves/drawers must be 183cm at two sides from the central axis of the total primary kitchen sink. Front length of storage areas must be at least 1016cm, 1219cm and 1422cm for small kitchens, medium sized kitchens and large kitchens respectively. Storage areas must be intensively between 38cm-122cm vertically.

- R49. There must be a drawer or sliding shelf with at least 305cm of front face length in small kitchens (with an area less than 13,95m²). There must be a drawer or sliding shelf with at least 419cm of front face length in large kitchens (with an area larger than 13,95m²).
- R50. Removability of cabinet doors increases functionality.
- R51. All devices must be placed at a height 38cm and 122cm.
- R52. The maximum height for someone sitting in a wheelchair in front of a counter with 51cm-64cm depth to be accessed is 112cm. If there is not such a counter the access distance is between 38cm and 122cm.
- R53. At least 5 pieces of storage units, between 38 cm and 122cm from the kitchen floor height must be positioned to increase the functionality.
- R54. There must be a functional interior corner system within at least one of the corner cupboards in the kitchen.
- R55. The trashes used for wastes for recycling must be near the kitchen sink. The trashes used for wastes which cannot be recycled can be placed anywhere in the kitchen.
- R56. There must be at least two trashes in the kitchen for wastes for recycling and for wastes which cannot be recycled.
- R57. The upper surface of the trash must not be higher than 91cm. The trash must be easily accessible and removable without need for lifting upward. A trash which can be removable from the side is the most preferred option.
- R58. The knee space must be spared in every possible part of the kitchen sink, oven and range such as the bottom part or immediately next to it. The knee space must be at least 69cm high, 76cm wide and 48cm deep. Height of 69cm can be reduced depending on the increasing of the depth.
- R59. The kitchen sink must be fixed lower than 86cm or its height must be adjustable between 74cm and 91cm. The hole of the kitchen sink must not be deeper than 17cm. There must not be a surface with sharp or rough end under the kitchen sink. A knee space must be planned for wheelchair users under the kitchen sink. This knee space must be 91cm in width, 69cm in height and with 20cm depth. If the distance is 43cm in depth, a space with 23cm height from the ground must be left for the toes.
- R60. There must be an empty floor space of 76cmx122cm in front of all devices. These areas may overlap and maximum 48cm of the knee space (at the bottom of a device, counter, cabinets etc.) may be part of the total 76cm and/or 122cm clean floor space.
- R61. Devices must be easily accessed.
- R62. All the necessary components of the devices must be easily accessed in the correct positions.
- R63. At least an area with 152cm diameter including knees and toe space must be allocated so that the wheelchair can rotate.
- R64. There must be a T-shaped empty floor space floor space with a body length of minimum of 91cm and with arms with a total length of 152cm on both sides of the body in equal length so that a wheelchair rotation area is functional.

- R65. The distance between the side of a dishwasher and a counter, another device or the side of cabinet placed upright to that must be 53cm. The 53cm distance in diagonal placement is the distance from the middle of the side of the kitchen sink to the side of the open door of the dishwasher.
- R66. If it is possible to allocate enough free space for counter near the kitchen sink, rising the dishwasher for 15cm-31cm increases functionality.
- R67. Max.distance between the primary dishwasher and the side of the kitchen sink must be 91cm.
- R68. The dishwasher must be positioned in a way to be accessed by more than one person when it is open. For this purpose, a free floor space of at least 76cmx122cm must be left on either side of the dishwasher when its door is open. The dishwasher must not prevent access to this free space allocated for dishwasher or the kitchen sink when the dishwasher is open.
- R69. If there will be a kitchen sink in the kitchen, it must be placed between the cooking and preparation area and the refrigerator or across them.
- R70. The distance between the oven and the fire-resistant surface above it must be at least 6cm. If this surface is unprotected then the distance must be at least 76cm.
- R71. If there will be an obstacle with 51cm-64cm depth in front of the ventilation controls, these controllers should be placed with a height of 38cm-112cm from the ground. If there is not such an obstacle, the placement height must be between 38cm-122cm. Ventilation controllers must be able to be operated with minimal effort, easy to read and with least noise.
- R72. If the cooking surface does not have a distance of at least 8cm horizontally and 61cm vertically it must not be placed in front of a window. Flammable curtains must not be placed to the window in the place where there is the cooking surface.
- R73. The ideal placement height of the microwave oven must be max.137cm from the floor and must be 8cm below the shoulder height.
- R74. If the microwave oven will be placed under the counter, height of the microwave oven must be maximum at least 38cm from the floor.
- R75. The height of the microwave oven from the floor is calculated to be 15cm. below the elbow height or 8cm below the shoulder height when the microwave oven is placed.
- R76. Counters at least with two different heights are proposed to be designed for the kitchen. One must be constructed to be between 71cm and 91cm above the floor and the other must be constructed to be between 91cm and 114cm. above the floor.
- R77. There must be an empty counter surface at least 335cm long in small kitchens (with an area less than 13,95m²). Furthermore, 61cm counter depth and min. 38cm gap between the counter are required.
- R78. There must be an empty counter surface at least 503cm long in large kitchens (with an area larger than 13,95m²). Furthermore, 61cm counter depth and min. 38cm gap between the counter are required.
- R79. Counter must be accessed easily.
- R80. The entire surface of the counter must be used easily.

- R81. The counter surfaces must come out when they are pulled.
- R82. There must be a counter with length of at least 61cm on one side and with length of at least 46cm on the other side in secondary sinks (the same rule applies in the corner sinks) in the same height with the kitchen sink.
- R83. In case of counters intersecting each other perpendicularly, if the distance of the kitchen sink to the corner in front of the counter is 8cm, there must be an empty counter space for the other counter at least with a distance of 53cm from the same corner.
- R84. The distance between the nearest sides of primary dishwasher and the kitchen sink must be not more than 91cm.
- R85. If the counter height in the area where the kitchen sink does not continue always the same height there must be a counter with length of at least 61cm on one side and with length of at least 8cm on the other side.
- R86. There must be a counter with length of at least 8cm on one side and with length of at least 46cm on the other side in secondary sinks (the same rule applies in the corner sinks) in the same height with the kitchen sink.
- R87. If the medicine cabinet is a need for the user it must be planned in washing work area.
- R88. Detergents should be stored under the kitchen sink. If the rail cleaning materials basket to be mounted to the kitchen sink cabinet can be removed and carried at any time it will increase functionality.
- R89. There must be a counter space at least 38cm in length and 41cm in depth on, under or near the microwave oven.
- R90. If the height of the cooking surface is different from the height of the counter there must be a counter space with 31cm length on one side and 38cm on the other side of the cooking surface in the same height with the cooking surface.
- R91. A knee space must be created at the bottom of a device oven upper surface of which is 86cm-71cm height above the floor.
- R92. There will be a counter in the same height with the cooking surface with length of at least 23cm on one side and at least 38cm on the other side.
- R93. There must be a counter depth of at least 23cm at the back of the device if there is not a blockage at the back of the cooking surface on the island or the peninsula in the same height with the device.
- R94. Length of the counter from the corner to the oven in angled counters must be at least 23cm to one side and at least 38cm to the other side. This counter should be the same height with the oven.
- R95. There must be a counter space of at least 38cm long on the side where the handle of the refrigerator is. If the refrigerator has two doors this counter space must be on the side where the fresh foods in the refrigerator are stored. If it is not possible to allocate a counter space immediately near the refrigerator this counter space with the same size must be max. 122cm away from the refrigerator and across the refrigerator. The depth of this counter space must be at least 41cm.
- R96. If the oven and the refrigerator shall be positioned side by side the refrigerator must be close to the counter. In such a case the place of fridge can be changed with the oven for security purposes if a service area cannot be placed the oven.

R97. The refrigerator must be near the entrance of the kitchen and at the beginning of the counter array.

R98. There must be a counter space on the refrigerator under the counter or adjacent to it at least 38cm in length and 41cm in depth.

R99. Dry foods storage cupboard should be placed immediately next to the refrigerator.

R100. There must be a floor space with 76cmx122cm side lengths which can shift max.61cm from the central axis of the refrigerator or freezer.

R101. The counter space must be on the side of the handle in the ovens door of which are opened to sides.

R102. If the oven door is opening to the main circulation line there must be a counter space next to it or on top of it with at least 38cm in length and 41cm in depth. If the oven door is not opening to the main circulation line this counter space can be maximum 122cm away from the oven or across the oven.

R103. If the counter space will be against the oven, it must be positioned 122cm away from the front and middle of the oven.

R104. There must be a continuous counter space in the preparation section with at least 61cm of depth and 91cm of length. This counter space should be right next to the kitchen sink.

R105. The drawers in which cutlery will be placed must be positioned close to the dishwasher not to be very far away from the oven furnace in the preparation section.

R106. Kitchen utensils consist of 1/3 of all the stored objects. Easy access to them is very important whether they are stored in lower cupboards or upper cupboards. In addition, when the actions in the kitchen were examined, it was observed that 20% of these actions took place in the places where such objects were stored or in the cleaning activity area. Therefore, such storage areas must be close to the kitchen sink and dishwasher.

R107. If two or more persons are working in the kitchen at the same time, a counter area for each person with at least 91cm in length and with 41cm in depth for preparation is needed. If two people will stand side by side the total length of the counter must be at least 182cm.

R108. Counter space of the preparation section can be placed, between the cooking surface and the primary kitchen sink; between the fridge and the primary kitchen sink; next to a cupboard section or next to a secondary kitchen sink.

R109. There must be at least one empty counter space in a kitchen in height of max. 86cm or in adjustable height of 73cm-91cm and in length of 76cm.

R110. If the two working centers will be next to each other, the minimum length of the counter between these working centers must be found by adding 31cm to the longest of the counters which are side by side.

R111. There must not be a high and deep cabinet or a second refrigerator between the main activity areas.

R112. High cabinet unit must be at the corner not to cut the workflow and inside and between the primary working center in the case of presence of space for knees on one side.

R113. Sitting areas in the kitchen requires the following minimum distances for each user: 76cm width for a table with 76cm height and, counter or table space with 48cm depth and at least 48 cm space for knee

R114. Sitting areas in the kitchen requires the following minimum distances for each user: 61cm width for a table with 91cm height and, counter or table space with 38cm depth and at least 38cm space for knee

R115. Sitting areas in the kitchen requires the following minimum distances for each user: 61cm width for a counter with 107cm. height 61cm. counter or table space with a depth of 1cm and at least 3cm space for knee

R116. If service, kitchen and dining areas are placed within the kitchen the functionality increases.

R117. If meals are going to be eaten in another place, distance between the cuisine and this place must not be more than 350cm and this place must be directly connected to the entrance hall, living space and outdoor terrace, if any.

R118. The exposed counter corners should be beveled or rounded for security.

R119. Control buttons, knobs and handles must be able to be commanded by one hand, require minimum power and must not cause situations like twist of the wrist or hand's being caught.

R120. All necessary components of fixtures must be in the correct position and easily accessible.

R121. The control buttons of the devices must be easily accessible.

R122. Use of the control buttons of the devices must be simple.

R123. The devices must have alerting features.

R124. Control panels of the equipments must provide preliminary information that will help the user.

R125. All fixtures to be mounted in a wall such as switches, sockets, telephones, thermostats and etc. must have the height of 38cm-122cm from the ground.

R126. Outlets and power switches must be seen easily, must be used without much effort and easily.

R127. The grounding line circuit breakers in the kitchen must be indicated by signs on them.

R128. Fire extinguisher must be placed in a visible place in the kitchen, away from cooking equipments and with a height between 38cm-122cm from the ground. Smoke detectors must placed in a place close to the kitchen.

R129. At least 8% of the total area of an open or closed kitchen or a living room combined with kitchen must be an area allocated for windows/skylights a field.

R130. Surface of each counter must be illuminated adequately by private or public lighting in accordance with the function of the activity areas.

DETERMINATION THE EFFECT OF EACH DESIGN RULE ON KITCHEN'S FUNCTIONALITY

The design rules related to people with disabilities were excluded priorly from the set of all design rules in order to determine the effect of each design rule on functionality of kitchen in a healthy way (Table 1). The reason for doing this is to define design criteria for users who have similar needs in projecting the kitchen correctly in terms of design performance (Demirkan and Olguntürk, 2013).

Table 1. Kitchen Design Rules For Physically Disabled People

<i>No</i>	<i>Design Rules</i>
R52	The maximum height for someone sitting in a wheelchair in front of a counter with 51cm-64cm depth to be accessed is 112cm. If there is not such a counter the access distance is between 38cm and 122cm.
R58	The knee space must be spared in every possible part of the kitchen sink, oven and range such as the bottom part or immediately next to it. The knee space must be at least 69cm high, 76cm wide and 48cm deep. Height of 69cm can be reduced depending on the increasing of the depth.
R59	The kitchen sink must be fixed lower than 86cm or its height must be adjustable between 74cm and 91cm. The hole of the kitchen sink must not be deeper than 17cm. There must not be a surface with sharp or rough end under the kitchen sink. A knee space must be planned for wheelchair users under the kitchen sink. This knee space must be 91cm in width, 69cm in height and with 20cm depth. If the distance is 43cm in depth, a space with 23cm height from the ground must be left for the toes.
R63	At least an area with 152cm diameter including knees and toe space must be allocated so that the wheelchair can rotate.
R64	There must be a T-shaped empty floor space floor space with a body length of minimum of 91cm and with arms with a total length of 152cm on both sides of the body in equal length so that a wheelchair rotation area is functional.
R91	A knee space must be created at the bottom of a device oven upper surface of which is 86cm-71cm height above the floor.

Personal interview method, which is a statistical data obtaining tool, was conducted with focused groups while this was performed and in-depth interviews were carried out with relevant people in order to determine the effect of each design rule (except the rules in Table 1 for physically disabled users) on the functionality of kitchen with designers of a company which has 57 dealers in Turkey and which produces and markets kitchen systems. This tool was preferred due to its being a superior technique in learning the knowledge and ideas of people on the relevant subject and what may be causing the creation of these thoughts. The group method, among the personal interview methods, was selected in this study. Accordingly, the company's design team members answered the questions in a connected way with each other and with interaction with each other. The people listened to the opinions of others while stating their opinions and created new ideas thanks to this

approach (İlkuçar, 2016). The grading of design rules from 1 to 10 were found to be as in Figure 2 in this context.



Figure 2.The Grading of Design Rules From 1 to 10

The groups of design rules prepared according to Figure 2 is as shown in Figure 3.

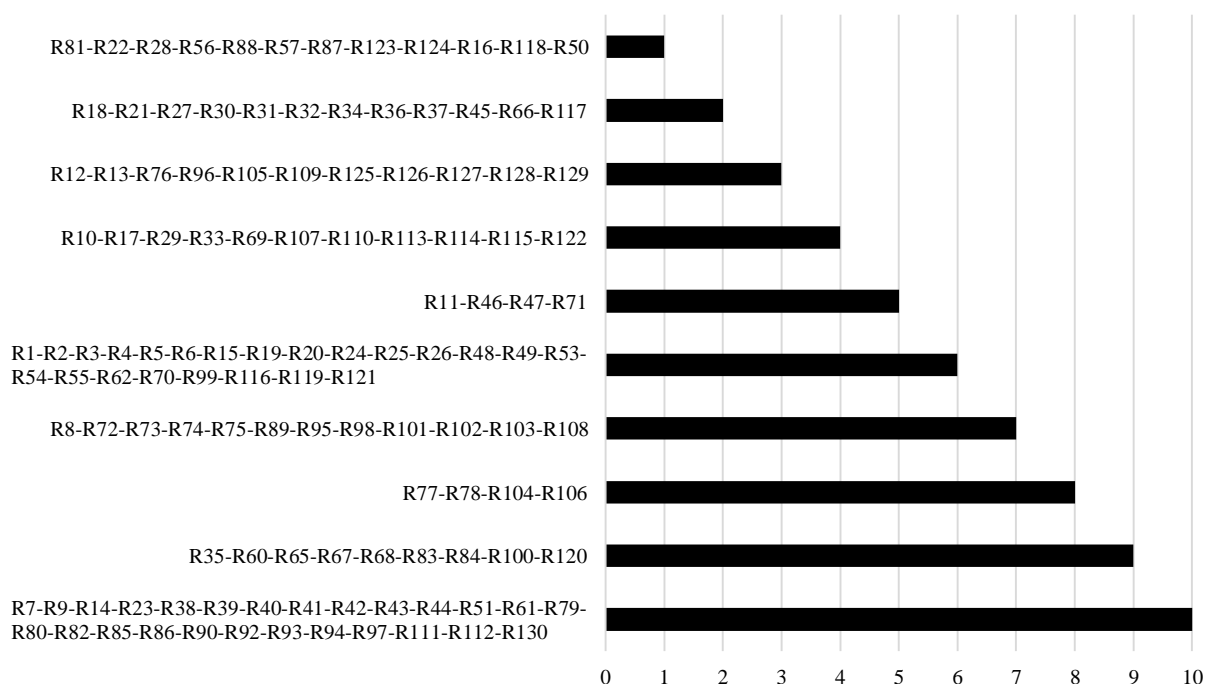


Figure 3. The Groups of Design Rules Prepared According to Grades Received

When the results in Figure 3 were evaluated it was found that creation of the activity triangle correctly, convenient access to storage spaces and devices vertically and horizontally, empty kitchen bench spaces which have to be on both sides of the kitchen sink and the oven and proper lighting of the kitchen according to actions are the first and foremost important design rules affecting the kitchen's design performance. The second equally important design rules are described as empty spaces for circulation which should be left mainly in the front of the devices, positions of the dishwasher and the kitchen sink and their relations with each other. Third degree important design rules include rules as to dimensions of the kitchen bench and storage units in the area of washing activity. The fourth degree important design rules are incident to the service areas which mainly have to be located near the devices. The fifth degree important design rules consist of information regarding the dimensions of the kitchen entrance and circulation areas and how storage areas in the entire kitchen should be designed. Other less important design rules cover mainly issues as to two or more people's being able to cook in the kitchen at the same time, design of the eating and food-service areas and security in the kitchen.

RESULTS

The basic rules to be observed to enhance the kitchen design performance and data analysis chart revealing the degree of impact of these rules on the functionality of the kitchen in a comparative way were prepared in this study. The designer can enhance the kitchen interior kitchen design process in a more conscious way by using the foregoing information which will lead to making the right decisions in accordance with needs of users, producing practical solutions and creating activity areas with "high efficiency".

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